Department of Engineering

Chair of the Department: Jankowski
Professor: Guvench; Associate Professors: Jankowski, Lück, Smith; Assistant Professors: Ghorashi, Lin; Adjunct Professors: Kurkjian, Masi, Most.

Engineering is a challenging profession concerned with the design, development, fabrication, and control of physical devices and systems.

The mission of the Engineering Department is to provide a solid and complete engineering education built upon a foundation of mathematics, science, and liberal arts. Our undergraduate programs are calculus-based, but there are opportunities to specialize. Computer usage is integrated throughout the curriculum. Internships and co-ops with our industrial partners are available to students at all levels.

The Department serves both traditional and nontraditional students who are diverse in academic background, age, and life experience. The Department also provides a technical resource to the community by linking the teaching, research, and public service capabilities of the Department with the needs of the industries, organizations, and institutions of southern Maine.

Graduates of the program are prepared to:
- function as engineers in technologically intensive firms;
- succeed in post-baccalaureate study;
- transfer their engineering skills to different environments; and
- contribute to society as broadly educated, articulate, and ethical professionals and citizens.

These objectives are complementary to and in addition to the general education objectives of the University.

Engineering programs include bachelor of science degree programs in electrical engineering and in mechanical engineering, a concentration in computer engineering, minors in electrical and mechanical engineering, and a transfer program that delivers the first year or more for several other engineering specialties.

The Engineering Department is committed to maximizing the student’s potential to achieve his or her academic goals. Upon admission, the student is assigned an advisor from the engineering faculty and staff. The student is then expected to meet with the advisor every semester before registering for classes. Regular contact with an advisor provides assistance for course selection and satisfactory progress toward meeting academic goals, but the primary responsibility for satisfying program requirements rests with the student. Courses are scheduled and rotated to provide maximum access to the breadth of technical electives and to make it possible for a full-time student to graduate in four years. Students are encouraged to pursue double majors, minors, concentrations, additional courses and co-ops to increase access and opportunities for a diverse and productive engineering career.

Please visit our Web site at www.usm.maine.edu/engineering for additional and more recent information about the Department and its programs.

Admission Requirements

Preparation for an undergraduate engineering program should include a high school degree with 4 units of English, 2 units of social science, 1 unit of chemistry with lab, 1 unit of physics with lab, and 4 units of mathematics including algebra II and trigonometry. Incoming students who do not satisfy the admission requirements may enroll in remedial courses provided by the University. Transfer students require a transfer GPA of 2.25.

Programs and Requirements

General Requirements for Bachelor of Science in Engineering Degrees (both electrical and mechanical)

Mathematics

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MAT 152</td>
<td>Calculus A</td>
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<tr>
<td>MAT 153</td>
<td>Calculus B</td>
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<td>MAT 252</td>
<td>Calculus C</td>
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<tr>
<td>MAT 350</td>
<td>Differential Equations</td>
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<tr>
<td>MAT 380</td>
<td>Probability and Statistics</td>
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Computer Science

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<tr>
<th>Course</th>
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<tr>
<td>COS 160</td>
<td>Structured Problem Solving: Java</td>
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<tr>
<td>COS 170</td>
<td>Structured Programming Laboratory</td>
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Basic Science

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<th>Course</th>
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<tr>
<td>CHY 113</td>
<td>Principles of Chemistry I</td>
</tr>
<tr>
<td>CHY 114</td>
<td>Laboratory Techniques I</td>
</tr>
<tr>
<td>PHY 121</td>
<td>General Physics I</td>
</tr>
<tr>
<td>PHY 114</td>
<td>Introductory Physics Laboratory I</td>
</tr>
<tr>
<td>PHY 123</td>
<td>General Physics II</td>
</tr>
<tr>
<td>PHY 116</td>
<td>Introductory Physics Laboratory II</td>
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Engineering

Several engineering courses are common to both majors, referred to as part of the Engineering Core. Due to the subject nature of those courses, they are listed in the degree requirements of each major instead of under the general requirements.

Technical Electives

A technical elective is a course with 3 or more credits, at or above the 300 level, that is not a required course of the major. Five technical electives are required for all bachelor of science in engineering degrees, with at least 2 in the major, and at least 4 in engineering disciplines. EGN electives are general engineering courses that contain both electrical and mechanical elements; they are applicable to both majors. The fifth required technical elective may be chosen from physics, chemistry, mathematics, computer science, electrical engineering, mechanical engineering, general engineering
or other technical disciplines. Permission from the student’s advisor is required for any course outside engineering to be counted as a technical elective.

For graduation, engineering majors must maintain an overall grade point average of 2.0 and a cumulative grade point average of 2.0 in engineering courses. Permission from the student’s advisor is required before taking any course outside USM to satisfy a requirement of the major.

University Core Curriculum requirements are outlined elsewhere in this catalog. Some requirements of the engineering degrees also satisfy Core Curriculum requirements.

I. Bachelor of Science in Electrical Engineering
The electrical engineering program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Requirements for the degree, in addition to the general requirements described earlier, include the following:

Engineering Core
- EYE 112 Built Environment: Energy
- ELE 216 Circuits I: Steady-State Analysis
- ELE 217 Circuits II: System Dynamics
- EGN 260 Materials Science for Engineers
- EGN 301 Junior Design Project and the Engineering Profession
- EGN 304 Engineering Economics
- ELE 323 Electromechanical Energy Conversion
- EGN 402 Senior Design Project

Electrical Engineering
- ELE 172 Digital Logic
- ELE 243 Electronic Devices and Circuits
- ELE 271 Microprocessor Systems
- ELE 314 Linear Signals and Systems
- ELE 346 Advanced Electronics
- ELE 351 Electromagnetic Fields

Technical Electives
- 2 Electrical Engineering Electives (ELE or EGN)
- 2 Engineering Electives (ELE, EGN or MEE)
- 1 General Technical Elective (ELE, EGN, MEE or other as approved by the advisor)

Credits to graduate: 123

Computer Engineering Concentration
Students with a particular interest in the design and application of computer hardware and software systems may choose the computer engineering concentration. The requirements for the Bachelor of Science degree in electrical engineering with a concentration in computer engineering differ from the standard electrical engineering degree as follows: Students in the concentration are not required to take ELE 323 or ELE 351. Instead, they are required to take COS 161, COS 285 and COS 350. In addition, a computer science elective at or above the 300-level must be taken to satisfy the general technical elective requirement, as approved by the student’s advisor.

For graduation, majors of electrical engineering with a concentration in computer engineering must maintain an overall grade point average of 2.0 and a cumulative grade point average of 2.0 in engineering and computer science courses.

Credits to graduate: 125

Minor in Electrical Engineering
A minor in electrical engineering may be obtained by successfully completing the following courses with a cumulative grade point average of 2.0: ELE 172, ELE 243, all of their prerequisites, and two additional electrical engineering courses, as approved by the student’s engineering advisor.

II. Bachelor of Science in Mechanical Engineering
The mechanical engineering program officially began in the fall of 2006. Pursuant to ABET guidelines, accreditation will be pursued after the first graduating class.

Requirements for the degree, in addition to the general requirements described earlier, include the following:

Engineering Core
- EYE 112 Built Environment: Energy
- ELE 216 Circuits I: Steady-State Analysis
- ELE 217 Circuits II: System Dynamics
- EGN 260 Materials Science for Engineers
- EGN 301 Junior Design Project and the Engineering Profession
- EGN 304 Engineering Economics
- ELE 323 Electromechanical Energy Conversion
- EGN 402 Senior Design Project

Mechanical Engineering
- MEE 150 Applied Mechanics: Statics
- MEE 230 Thermodynamics I
- MEE 251 Strength of Materials
- MEE 270 Applied Mechanics: Dynamics
MEE 366  Fluid and Thermal Systems
MEE 372  Computer-Aided Design of Machine Elements
MEE 373  Dynamics of Machines and Mechanisms

Technical Electives
2 Mechanical Engineering Electives (MEE or EGN)
2 Engineering Electives (MEE, EGN or ELE)
1 General Technical Elective (MEE, EGN, ELE or other as approved by the advisor)

Credits to graduate: 124

Minor in Mechanical Engineering
A minor in mechanical engineering may be obtained by successfully completing the following courses with a cumulative grade point average of 2.0: MEE 230, MEE 251, MEE 270, all of their prerequisites, and two additional mechanical engineering courses, as approved by the student’s engineering advisor.

III. Transfer Program for Other Engineering Disciplines
The engineering transfer program prepares students to begin engineering studies at USM and then complete engineering degrees at the University of Maine or elsewhere. All University of Southern Maine students in this program are eligible to transfer to any accredited engineering program in the country for the completion of the program.

Course Fees
Course fees to cover the cost of materials and supplies are assessed in some engineering courses. Consult the department for a current list of fees associated with each course.
EYE 112 Built Environment: Energy
Engineers use mathematics and apply scientific principles to design, create, modify, and control physical systems. They communicate effectively in both written and oral forms, and work in teams as well as alone. This course introduces students to the tools, tasks, and culture of engineering. Students use spreadsheets to solve problems and graph the results. Through class work, laboratory exercises, and independent research, students learn fundamental concepts of devices such as batteries and motors. The course culminates with a project in which student teams design, build, test, demonstrate, and document a device, utilizing the knowledge and skills acquired in the early part of the course. This course is not required for transfer students with more than 24 credits applied toward one of our engineering degree programs. Replaces EGN 100. Lecture 1 hr., Lab 3 hrs. (Fall, Spring.) Cr 3.

EGN 180 Programming with Mathematica
Introduction to programming with Mathematica. The Mathematica language, its rules, syntax and supported programming styles. Includes many practical examples and hands-on exercises. Prerequisite: Quantitative Reasoning or instructor permission. Lecture 1 hr. Cr 1.

EGN 181 Computing with Mathematica
Introduction to computing with Mathematica. to help mathematicians, science and engineering students solve typical computational problems encountered in their disciplines effectively and efficiently. Mathematica programming language and programming styles, symbolic and numerical computations, visualization and graphics. The course includes many practical examples and hands-on exercises. Prerequisite: Quantitative Reasoning or instructor permission. Lecture 1 hr. Cr 1.

EGN 260 Materials Science for Engineers
Concepts and relationships between structure, composition, and thermal, optical, magnetic, electrical and mechanical properties of technologically important materials. Replaces EGN 362 and ELE 262. Prerequisites: PHY 123, MAT 153, CHY 113. Lecture 3 hrs., Lab 1 hr. (Fall.) Cr 3.

EGN 301 Junior Design Project and the Engineering Profession
The fundamental mission of engineering is design. Students, working in teams, learn the fundamentals of developing a specific problem statement, flowcharting, researching, project management, and design actualization, incorporating appropriate engineering standards and multiple realistic constraints. Professional issues such as ethics, intellectual property, interview skills, and resume preparation are explored. The student is challenged to consider the work of the engineer in the broader context of societal, personal, and professional responsibility. Prerequisite: advisor permission. Lecture 3 hrs. (Spring.) Cr 3.

EGN 304 Engineering Economics
Investment, cost, cash flow, the present value of a cash flow, rate of return of a project, cost-benefit study, breakeven analysis, evaluation of alternatives under budget constraint, sensitivity analysis of economic decisions with respect to changes in economic factors, expected value and economic decision-making under uncertainty, supply, demand and equilibrium in economics, Pareto efficiency, effects of taxes, subsidies and rationing on economics, computer-aided engineering economics using spreadsheets. This course is a requirement for engineering majors, and may also contribute to a Thematic Cluster. Prerequisite: Quantitative Reasoning or instructor permission. Lecture 3 hrs. (Spring, 2-yr rotation.) Cr 3.

EGN 317 Introduction to Robotics

EGN 325 Control Systems
Laplace transform, transfer function, modeling control systems by block diagrams, transient and steady-state responses, control systems error analysis, root-locus and Roboth’s stability methods, analysis and design of control systems using root-locus analysis, operational amplifiers, frequency-response analysis using Bode and Nyquist diagrams, compensation and design of feedback control systems using lead-lag compensators and PID controllers. Includes experiments and computer simulations for analysis and design of control systems. Electrical or mechanical engineering elective. Prerequisite: ELE 217. Lecture 3 hrs., Lab 1 hr. Cr 3.

EGN 368 Advanced Engineering Materials
Properties of conductive, dielectric, polar, magnetic, and other technologically important materials with a view toward understanding their behavior and application in electronic devices. Measurement techniques and production technology will be considered. Part of the course will deal with reading and interpreting published articles in technical journals. Electrical or mechanical engineering elective. Prerequisite: EGN 260. Lecture 3 hrs. Cr 3.

EGN 394 Engineering Internship
Work experience in engineering. An opportunity for students to obtain credit for a project or study sequence completed while employed. The activity must have both components of design and analysis and be pre-approved by the instructor. Only those who have completed all sophomore engineering classes of the respective major are eligible. May substitute for an electrical or mechanical engineering elective if accumulated 3 or more credits. Prerequisite: instructor permission. (Fall, Spring, Summer.) Cr 1-3.

EGN 402 Senior Design Project
Design and implementation of a device or system to perform an engineering function. May be done individually or in small groups, but the contribution is evaluated on an individual basis. Project outcomes include an oral presentation, a demonstration of the device or system, and a final report. The final report must contain a description of the engineering standards that were investigated and/or applied and how the realistic constraints were observed. Prerequisites: EGN 301, the Core Curriculum
EGN 403 Advanced Design Project
In-depth design and implementation of a device or system to perform an engineering function, or an engineering research project. May be done individually or in small groups, but the contribution is evaluated on an individual basis. Electrical or mechanical engineering elective. Prerequisites: EGN 402 with a grade of B or better, and instructor permission. (Fall, Spring, Summer.) Cr 3.

EGN 417 Robot Modeling

EGN 418 Robot Intelligence
Motion control, trajectory and path planning, actuators and sensors, artificial intelligence, and programming of robotic devices. Case study of multiple platforms in the Robotics and Intelligence Systems Laboratory. Complements EGN 417. Electrical or mechanical engineering elective. Prerequisites: ELE 217 and EGN 260, or instructor permission. Lecture 3 hrs, Lab. 1 hr. Cr 3.

EGN 446 Micro Electromechanical Systems
Topics include microfabrication, principles of electromechanical energy conversion and transduction, sensors and actuators, materials used for MEMS and their thermal, electrical, and mechanical properties. Standard MEMS fabrication processes and MEMS design. Electrical or mechanical engineering elective. Prerequisites: ELE 217, COS 160. Lecture 3 hrs., Lab. 1 hr. Cr 3.

EGN 497 Independent Study
An opportunity for the student to explore topics not covered in available courses or to pursue a topic of interest in-depth. By prearrangement with a faculty member. May substitute for an electrical or mechanical engineering elective if accumulated 3 or more credits. Prerequisite: instructor permission. (Fall, Spring, Summer.) Cr 1-3.

EGN 498 Selected Topics in Engineering
Topics in engineering not regularly covered in other courses. Electrical or mechanical engineering elective. The content can be varied to suit current needs. The course may, with advisor permission, be taken more than once. Consult the Department for current offerings and prerequisites. Cr 3.

ELE 172 Digital Logic
Introduction to the design of binary logic circuits. Combinatorial and sequential logic systems. Design with small and medium scale integrated circuits and programmable logic devices (PLDs). Registers, counters, and random access memories (RAMs). The algorithmic state machine (ASM). Lecture 3 hrs., Lab. 2 hrs. (Spring.) Cr 4.

ELE 216 Circuits I: Steady-State Analysis
An examination of fundamental circuit laws and theorems, network analysis, physical properties and modeling of resistors, inductors, and capacitors, review of engineering standards applicable to circuits and components. Sinusoidal steady-state operation: phasors, and impedance. Frequency domain analysis, transfer functions, poles and zeros, frequency response, and basic filtering. The course also covers the operation of meters, oscilloscopes, power supplies, and signal generators. Prerequisites: MAT 153, PHY 123. Lecture 3 hrs., Lab. 2 hrs. (Fall.) Cr 4.

ELE 217 Circuits II: System Dynamics
Magnetic coupling. Time-domain analysis of first- and second-order systems, based on electric circuits, but drawing analogy to mechanical, fluid, and thermal systems. Study and application of the Laplace transform for the solution of differential equations governing dynamic systems. Resonance, Bode Plots, frequency response design. Principles of control, feedback, and stability. AC power and polyphase circuits. Prerequisite: ELE 216. Lecture 3 hrs., Lab. 2 hrs. (Spring.) Cr 4.

ELE 243 Electronic Devices and Circuits

ELE 271 Microprocessor Systems

ELE 314 Linear Signals and Systems
Introduction to the theory of linear signals and systems. Linear time-invariant system properties and representations; differential and difference equations; convolution; Fourier analysis; Laplace and Z transforms. Selected topics in sampling, filter design, digital signal processing, and modulation. Prerequisite: ELE 217. Lecture 3 hrs., Lab 2 hrs. (Fall, 2-yr rotation.) Cr 4.

ELE 323 Electromechanical Energy Conversion
Basic concepts of magnetic circuits and transformers. Three-phase system and power transmission. Conversion between electrical and mechanical energy through magnetic fields. Study of direct current motors and generators. Study of alternating current machines: induction motors, synchronous machines, and single-phase motors. Prerequisite: ELE 217. Lecture 3 hrs., Lab. 2 hrs. (Fall.) Cr 4.

ELE 327 Energy and Power Systems
Alternative energy sources for power generation. Polyphase systems, symmetrical components, power transformers, transmission lines, power flow, fault analysis, power system controls. Electrical engineering elective. Corequisite: ELE 323. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 346 Advanced Electronics
Analysis and design of electronic circuits with BJTs, FETs and OpAmps for applications in signal generation, amplification, waveshaping, and power control. Topics include differential, multi-stage, linear and power amplifiers; real operational amplifiers and OpAmp applications, design for frequency response, active filters; feedback, stability and oscillators. Simulation and design verification with SPICE. Replaces ELE 343. Prerequisites: ELE 217, ELE 243. Lecture 3 hrs., Lab. 2 hrs. (Fall, 2-yr rotation.) Cr 4.

ELE 351 Electromagnetic Fields
Static electric and magnetic fields; properties of dielectric and ferromagnetic materials; time varying fields, Faraday’s law, Maxwell’s equations; plane waves in dielectric and conducting media; calculation of the fields and other properties of common transmission lines and other devices. Prerequisites: MAT 252, ELE 217. Lecture 3 hrs. (Spring, 2-yr rotation.) Cr 3.

ELE 363 Solid State Electronic Devices
Theory of selected solid state electronic devices and their fabrication. The devices studied include advanced bipolar, CMOS, and optoelectronic devices. Device characterization, modeling and simulation. An occasional laboratory period may be substituted for equivalent class time. Electrical engineering elective. Prerequisite: ELE 243. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 364 Microelectronic Fabrication

ELE 367 Optoelectronics
Properties and applications of optoelectronic devices and systems. Topics include radiation sources (LEDs and semiconductor lasers), photo detectors and detector circuits, solar cells, fiber optics, and electro-optical system components. Electrical engineering elective. Prerequisite: ELE 243. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 373 Digital System Architecture and Design
Algorithmic approaches to digital system design. Methods of design and testing of multi-input, multi-output logic systems including arithmetic units, logic controllers, and microprocessors. Logic design with PLDs, FPGAs, and VHDL. Electrical engineering elective. Prerequisite: ELE 172. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 412 Power Electronics
Introduction to power electronics and power semiconductor devices. Analysis, performance characterization, and design of power electronics converters such as: rectifiers, DC choppers, AC voltage controllers, and single-phase inverters. Operation of DC motor drives. Electrical engineering elective. Prerequisite: ELE 346. Lecture 3 hrs. Cr 3.

ELE 442 Digital VLSI Circuits and Design
Principles of internal circuit and layout design of digital VLSI circuits. CMOS technology is emphasized. Topics include NMOS and CMOS processes, device physics and SPICE models, logic circuits, electrical and physical design of logic gates, dynamic CMOS circuits, memory, chip layout principles, parasitics, and performance estimation. Simulation, layout, and electronic design automation tools are demonstrated and used. Electrical engineering elective. Prerequisites: ELE 172, ELE 346. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 444 Analog Integrated Circuits and Design
Principles of internal circuit operation and design of analog integrated circuits with emphasis on CMOS technology. Topics include analog CMOS processes, devices and device models, bias and reference sources, differential and high gain amplifiers, OTAs and operational amplifiers, power stages, frequency response, feedback, stability and internal compensation applied to the design of CMOS operational amplifiers and other CMOS analog integrated circuits. SPICE simulation, layout and electronic design automation tools are demonstrated and used in homework and design projects. Electrical engineering elective. Prerequisite: ELE 346. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 445 Special Topics in CMOS Integrated Circuit Design
Special topics such as high performance operational amplifiers, silicon integrated sensors and sensor interface circuits, switched capacitor circuits, oscillators and integrated waveform generators, phase-locked-loop circuits, memory, etc., are covered with emphasis on three chosen topics with instructor guided projects leading to chip level design of these circuits. SPICE simulation verifications, layout and electronic design automation tools are used extensively. Electrical engineering elective. Prerequisite: ELE 346. Lecture 3 hrs., Lab. 1 hr. Cr 3.

ELE 483 Communications Engineering

ELE 486 Digital Signal Processing
Basic principles of processing digital signals. Sampling and quantization. Time and frequency domain representation and analysis of discrete-time signals and systems. FIR and IIR systems. Digital filter design; review of classic analog filter design (Butterworth, Chebyshev). Quantization and finite-precision effects. DSP hardware. Computers will be used to design and realize various signal processors. Electrical engineering elective. Prerequisites: ELE 314, COS 160. Lecture 3 hrs. Cr 3.

ELE 489 Digital Image Processing
The theory and practice of digital processing of images by computer. Introduction to two-dimensional signal processing theory: sampling, transforms, and filters. Image acquisition and representation; enhancement methods; image coding; image analysis; and image processing hardware. Electrical engineering elective. Prerequisites: ELE 217, COS 160. Lecture 3 hrs. Lab. 1 hr. Cr 3.

ELE 498 Selected Topics in Electrical Engineering
Topics in electrical engineering not regularly covered in other courses. Electrical engineering elective. The content can be varied to suit current needs. The course may, with advisor permission, be taken more than once. Consult the Department for current offerings and prerequisites. Cr 3.

MEE 150 Applied Mechanics: Statics
A study of force systems and equilibrium, structural models, friction, distributed forces. Designed to develop the ability to analyze and solve engineering problems. Prerequisites: MAT 152, PHY 121. Lecture 3 hrs., Lab. 1 hr. (Spring.) Cr 3.

MEE 154 Statics I and Strength of Materials
Equilibrium of particles, equilibrium of rigid bodies, determination of center of gravity of objects, analyzing trusses and frames, moment of inertia, stress and strain in axial loading. Hooke’s law, torsion of power transmission shafts, design of beams for bending, drawing shear force and bending moment diagrams, shearing stresses in beams under transverse loading, combined stresses, principal stresses, Mohr’s circle for stress and strain transformation, deflection of beams under traverse loading. Includes experiments and computer simulations. Replaces MEE 150 and MEE 251. Prerequisites: MAT 152, PHY 121. Lecture 3 hrs., Lab. 2 hrs. (Spring.) Cr 4.

MEE 230 Thermodynamics I
Energy and energy transformations, the First and Second Laws applied to systems and to control volumes, thermodynamic properties of systems, availability of energy. Prerequisites: MAT 153, PHY 121. Lecture 3 hrs. (Fall.) Cr 3.

MEE 251 Strength of Materials
The principles of solid mechanics and their applications to practical problems, stresses and deflections in axial loading, torsion, beams, columns, combined stresses. Prerequisites: MEE 150, MAT 153. Lecture 3 hrs. (Spring.) Cr 3.

MEE 254 Statics II and Dynamics
Kinematics of particles and system of particles, kinetics of particles and system of particles using Newton’s second law and methods of energy and momentum, static and kinetic friction, wedges, rolling resistance, plane kinematics and kinetics of rigid bodies, application of virtual work in statics and dynamics. Includes experiments and computer simulations. Replaces MEE 270. Prerequisites: MEE 154, MAT 252. Lecture 3 hrs., Lab. 2 hrs. (Spring.) Cr 4.

MEE 270 Applied Mechanics: Dynamics
Motion of particles and rigid bodies, impulse and momentum, work and energy and simple harmonic motion, force, mass, and acceleration. Prerequisites: MEE 150, MAT 252. Lecture 3 hrs. (Spring.) Cr 3.

MEE 352 Analysis and Design of Composite Structures
Advantages and limitations of composite materials, fibers and matrices, anisotropic, orthotropic and transversely isotropic materials, fabrication processes, elastic behavior and strength of a laminaelastic constants of a lamina along an arbitrary direction, sandwich beams, elastic behavior of multidirectional laminate, modes of failure and failure criteria of laminates, joining and assembly, composite materials in aerospace, automobile and naval applications, mechanical test methods, experimental determination of engineering constants of composites, fatigue, impact and environmental effects computer-aided analysis and design of composite structures. Mechanical engineering elective. Prerequisites: MEE251, EGN 260. Lecture 3 hrs., Lab 1 hr. Cr 3.

MEE 361 Physical Metallurgy
Introduction to the current state of metallurgical technology. It builds on basic principles, particularly crystal structure and phase equilibria, to introduce students to contemporary metallurgical literature. Topics such as defect structures and the effect of heat treatment are introduced in a “just in time” fashion. Mechanical engineering elective. Prerequisite: EGN 260. Lecture 3 hrs. Cr 3.

MEE 366 Fluid and Thermal Systems
The principles of fluid mechanics and thermodynamics are used to develop analytic models of mass, momentum, and energy balance in engineering systems. Topics include properties of materials, the Bernoulli equation, fluid statics, kinematics, free-surface flow, viscosity, drag coefficient, dimensional analysis, internal and external flow, and the principles of heat transfer. Replaces MEE 332, MEE 341 and MEE 360. Prerequisites: MEE 230, MEE 270, MAT 350, ELE 217. Lecture 3 hrs., Lab. 2 hrs. (Fall, 2-yr rotation.) Cr 4.
MEE 372 Computer-Aided Design of Machine Elements
Elements of mechanical engineering design, introduction to computer aided drafting, stress analysis, deflection and stiffness analysis, Castigliano’s theorem, Euler buckling, static failure criteria, fatigue failure criteria, design of shafts, limits and fits, critical speed of shafts, detachable and permanent joints and springs. Design is performed by available formulas and standards as well as computer aided design by simulation software. Includes a student design project. Prerequisites: MEE 251, MEE 270, EGN 260. Lecture 3 hrs., Lab. 2 hrs. (Fall, 2-yr rotation.) Cr 4.

MEE 373 Dynamics of Machines and Mechanisms
Mobility and degrees of freedom in mechanisms, review of kinematics, instant centers, cam and follower design, gears, gear trains, interference and undercutting, synthesis of linkages, static and dynamic force analysis, measuring mass moment of inertia, free and forced vibrations, dynamics of reciprocating engines, static and dynamic balancing, Euler’s equations of motions, rolling-contact bearings, journal bearings, flywheels, gyroscopes, governors, clutches and brakes. Design is performed by available formulas and standards as well as computer aided design by simulation software. Includes a student design project. Prerequisite: MEE 372. Lecture 3 hrs., Lab. 2 hrs. (Spring, 2-yr rotation.) Cr 4.

MEE 374 Theory and Applications of Vibrations
Free undamped and damped vibrations of one degree of freedom (DOF) systems, forced vibrations of one DOF systems with harmonic and non-harmonic excitations, resonance, free vibrations of multi DOF systems, mode shapes, forced vibrations of multi DOF systems and dynamic vibration absorber. Includes experiments and computer simulations. Mechanical engineering elective. Prerequisite: ELE 217. Lecture 3 hrs., Lab 1 hr. Cr 3.

MEE 432 Heat Transfer
The fundamental laws of heat transfer by conduction, convection, and radiation, applied to the study of engineering problems via analytical, numerical, and graphical techniques. Mechanical engineering elective. Prerequisite: MEE 366. Lecture 3 hrs. Cr 3.

MEE 435 Advanced Thermal Systems
Apply the principles of thermodynamics, fluid mechanics, and heat transfer to engineering systems. These systems include but are not limited to power generation, heating ventilating and air conditioning (HVAC), internal combustion engines, manufacturing processes. The concept of energy efficiency will be emphasized. Mechanical engineering elective. Prerequisites: MEE 366, MAT 350. Lecture 3 hrs. Cr 3.

MEE 498 Selected Topics in Mechanical Engineering
Topics in mechanical engineering not regularly covered in other courses. Mechanical engineering elective. The content can be varied to suit current needs. The course may, with advisor permission, be taken more than once. Consult the Department for current offerings and prerequisites. Cr 3.