3510. Introduction to Abstract Algebra I. 3 hours. Groups, rings, integral domains, polynomial rings and fields. Prerequisite(s): MATH 2510.

3520. Abstract Algebra II. 3 hours. Topics from coding theory, quadratic forms, Galois theory, multilinear algebra, advanced group theory, and advanced ring theory. Prerequisite(s): MATH 3510.

3610. Real Analysis II. 3 hours. Continuation of 2510. Topics include derivatives, integrals, limits of sequences of functions, Fourier series; and an introduction to multivariable analysis. Prerequisite(s): MATH 2510; and 2700 (may be taken concurrently).

3680. Applied Statistics. 3 hours. Descriptive statistics, elements of probability, random variables, confidence intervals, hypothesis testing, regression, contingency tables. Prerequisite(s): MATH 1710; MATH 1720 (may be taken concurrently).

3740. Vector Calculus. 3 hours. Theory of vector-valued functions on Euclidean space. Derivative as best linear-transformation approximation to a function. Divergence, gradient, curl. Vector fields, path integrals, surface integrals. Constrained extrema and Lagrange multipliers. Implicit function theorem. Jacobian matrices. Green's, Stokes', and Gauss' (divergence) theorems in Euclidean space. Differential forms and an introduction to differential geometry. Prerequisite(s): MATH 2700 and 2730.

4050. Advanced Study of the Secondary Mathematics Curriculum. 3 hours. Study of mathematical topics in the secondary curriculum from an advanced viewpoint. Discussion of the relationship between the secondary and collegiate curricula. As each of the mathematical topics is studied, related issues involving cognitive development, pedagogical methods and the philosophy of teaching and learning are considered. Prerequisite(s): MATH 3510 and 4060, EDSE 3830, and acceptance into the secondary teacher education program.

4060. Foundations of Geometry. 3 hours. Selections from synthetic, analytic, projective, Euclidean and non-Euclidean geometry. Prerequisite(s): MATH 2510. Prior or concurrent enrollment in MATH 3510 or MATH 3610 is strongly recommended.

4100. Fourier Analysis. 3 hours. Application-oriented introduction to Fourier analysis, including Fourier series, Fourier transforms, discrete Fourier transforms, wavelets, orthogonal polynomials and the Fast Fourier Transform (FFT) algorithm. The theoretical portions of the course emphasize interconnections and operator algebraic formalism. Applications are chosen from among differential equations, signal processing, probability and high precision arithmetic. Prerequisite(s): MATH 1720 and 2700; MATH 2730 and 3410 are recommended (may be taken concurrently).

4200. Dynamical Systems. 3 hours. One-dimensional dynamics. Sarkovskii's theory, routes to chaos, symbolic dynamics, higher-dimensional dynamics, attractors, bifurcations, quadratic maps, Julia and Mandelbrot sets. Prerequisite(s): MATH 3610.

4430. Introduction to Graph Theory. 3 hours. Introduction to combinatorics through graph theory. Topics introduced include connectedness, factorization, Hamiltonian graphs, network flows, Ramsey numbers, graph coloring, automorphisms of graphs and Polya's Enumeration Theorem. Connections with computer science are emphasized. Prerequisite(s): MATH 2510 or 2770.

4450. Introduction to the Theory of Matrices. 3 hours. Congruence (Hermitian); similarity; orthogonality, matrices with polynomial elements and minimal polynomials; Cayley-Hamilton theorem; bilinear and quadratic forms; eigenvalues. Prerequisite(s): MATH 2700.

4500. Introduction to Topology. 3 hours. Point set topology; connectedness, compactness, continuous functions and metric spaces. Prerequisite(s): MATH 3610.

4520. Introduction to Functions of a Complex Variable. 3 hours. Algebra of complex numbers and geometric representation; analytic functions; elementary functions and mapping; real-line integrals; complex integration; power series; residues, poles, conformal mapping and applications. Prerequisite(s): MATH 2730.

4610. Probability. 3 hours. Combinatorial analysis, probability, conditional probability, independence, random variables, expectation, generating functions and limit theorems. Prerequisite(s): MATH 2730.

4650. Statistics. 3 hours. Sampling distributions, point estimation, interval estimation, hypothesis testing, goodness of fit tests, regression and correlation, analysis of variance, and non-parametric methods. Prerequisite(s): MATH 3680 and 4610.

4900-4910. Special Problems. 1–3 hours each.

4951. Honors College Capstone Thesis. 3 hours. Major research project prepared by the student under the supervision of a faculty member and presented in standard thesis format. An oral defense is required of each student for successful completion of the thesis. Prerequisite(s): completion of at least 6 hours in honors courses; completion of at least 12 hours in the major department in which the thesis is prepared; approval of the department chair and the dean of the school or college in which the thesis is prepared; approval of the dean of the Honors College. May be substituted for HNRS 4000.

Mechanical and Energy Engineering

Mechanical and Energy Engineering, MEEN

1110. Mechanical and Energy Engineering Practice I. 1 hour. Introduction to the practice of Mechanical and Energy Engineering, applications of the subject, presentation of the work of the faculty and practicing engineers, seminars on "real world" projects, ethics and professional orientation.

1210. Mechanical and Energy Engineering Practice II. 1 hour. Continuation of MEEN 1110. Applications of Mechanical and Energy Engineering, presentations by faculty and practicing engineers, professional orientation, professional ethics.

2130. Statics and Dynamics. 4 hours. Statics of particles and rigid bodies. Concepts of force, moments, free body diagrams, equilibrium and friction with engineering applications. Kinematics and kinetics of particles and rigid bodies. Energy and impulse momentum methods applied to particles and rigid bodies. Plane motion of rigid bodies and force analysis of linkages. Prerequisite(s): MATH 1720, PHYS 1710 and 1730.

2210. Thermodynamics. 3 hours. Zeroth, first and second laws of thermodynamics with applications to engineering and energy conversion, open and closed systems, thermodynamic properties of simple substances, equations of state, thermodynamic properties of mixtures, psychrometrics and psychrometric charts. Prerequisite(s): MATH 2730.

2250. Computer Aided Engineering. 3 hours. (2;0;2) Computational techniques applied to engineering analysis and design. Computer aided design (CAD) techniques, constrained and unconstrained optimization, simulation and solution of simple differential equations, symbolic manipulation, application of finite element analysis. Prerequisite(s): MATH 2700. Corequisite(s): ENGR 2332 and MATH 3310.

2900-2910. Special Problems in Mechanical and Energy Engineering. 1–3 hours each. Individual instruction in theoretical, experimental or research problems. Prerequisite(s): consent of instructor. Each course may be repeated for 6 credit hours. For elective credit only; may not be substituted for required MEEN courses.

3110. Applied Thermodynamics II. 3 hours. Introduction to steam and gas cycles, improvements on cycles, advanced thermodynamics cycles, psychrometrics and psychrometric charts, chemical reactions and chemical equilibria, combustion, flame temperature. Prerequisite(s): CHEM 1415/1435, or CHEM 1410/1430 and 1420/1440; MATH 2730; MEEN 2210.

3120. Fluid Mechanics and Convection. 3 hours. Fundamental concepts and properties of fluids, hydrostatics, basic equations of fluid and heat flow in differential and integral form, dimensional analysis and similitude, potential flow, viscous flow, viscous and thermal boundary layers, pipe flow and heat transfer, turbulence, heat and fluid flow correlations for objects of simple shape. Prerequisite(s): MATH 3310, MEEN 2210.

3125. Thermal Engineering Projects. 2 hours. (0;6) Project component of the thermal science courses in the curriculum. Students work in teams to complete engineering practice projects. The theoretical aspects of this course are given in MEEN 2210, 3110 and 3120. Prerequisite(s): MEEN 2210. Corequisite(s): MEEN 3110, 3120.

3130. Machine Elements. 3 hours. Applications of the principles of mechanics and mechanics of materials to machine design. The elements of machines are analyzed in terms of their dynamic behavior. Selection and sizing of machine elements. Students use the finite element technique for the analysis of machines and their components. Prerequisite(s): ENGR 2332, MEEN 2220.

3210. Conduction and Radiation. 2 hours. Basic concepts of steady and unsteady conduction, elements of radiation, black and gray body radiation, f-factor analysis, combined modes of heat transfer, simple heat exchange devices and systems. Prerequisite(s): MEEN 3110, 3120.

3230. Dynamics, Vibrations and Control. 3 hours. Review of basic modeling techniques of the dynamic behavior of mechanical and electrical systems. Linear dynamics. Block diagrams. Feedback and compensation. Computer simulations of steady-state and dynamic behavior. Root locus and frequency response methods. Vibration analysis, control and suppression. Prerequisite(s): MEEN 2130 and MATH 2700.

3240. Mechanical and Energy Engineering Laboratory and Instrumentation. 3 hours. (2;3) Principles of experimentation. Measurement techniques and instruments. Statistical analysis of experimental data and error analysis. Presentation of data and report writing. Students perform a series of experiments in areas of mechanical engineering and undertake a project in which they design an experiment to obtain data. Prerequisite(s): MEEN 2130, MATH 3310.

3242. Mechanical and Energy Engineering Laboratory II. 2 hours (1;3). Continuation of MEEN 3240. Principles of experimentation. Students perform a series of experiments in key areas of mechanical and energy engineering including convection, heat and energy transfer, experimental aerodynamics, thermal cycles, refrigeration, control of thermal systems, and alternative energy technologies (solar energy, fuel cells and wind power). Prerequisite(s): MEEN 3240.

4110. Alternative Energy Sources. 3 hours. Introduction to the physics, systems and methods of energy conversion from non-conventional energy sources, such as solar, geothermal, ocean-thermal, biomass, tidal, hydroelectric, wind and wave energy. Advantages and disadvantages of alternative energy sources and engineering challenges for the harnessing of such forms of energy. Energy storage. Fuel cells. Prerequisite(s): MEEN 3110, 3120 and 3210.

4112. Nuclear Energy. 3 hours. Atomic physics and the structure of the atom. Radioactivity. Interactions of neutrons with matter, nuclear cross-sections. Nuclear fuels and fuel elements. Elements of nuclear reactors. Components and operation of nuclear power plants. Notable accidents of nuclear reactors. Breeder reactors. Prerequisite(s): MEEN 3110, 3120 and 3210.

4150. Mechanical and Energy Engineering Systems Design I. 3 hours. (2;3) Advanced treatment of engineering design principles with an emphasis on product and systems design, development and manufacture. Mimics "real world" environment with students working in teams to prepare product specification, develop several concepts, perform detailed design, and construct prototypes subject to engineering, performance and economic constraints. Prerequisite(s): EENG 2610, MEEN 3130, 3210, 3230.

4250. Mechanical and Energy Engineering Systems Design II. 3 hours. (0;9) Continuation of MEEN 4150, in which the student teams complete their product design, development and manufacturing projects. Patterned on a professional workplace environment in which the teams plan and manage their resources while adhering to an overall project schedule. The teams give weekly oral and written progress reports and obtain feedback from the faculty mentor. Prerequisite(s): MEEN 4150.

4800-4810. Topics in Mechanical and Energy Engineering. 3 hours. Varying topics in mechanical and energy engineering. Prerequisite(s): consent of instructor. May be repeated for credit as topics vary.

4890. Directed Study in Mechanical and Energy Engineering. 1–3 hours. Study by individuals or small groups. Plan of study must be approved by supervising faculty. Written report is required. Prerequisite(s): MEEN 2210. May be repeated for 6 credit hours, but a maximum of 3 credit hours apply to major.

4900-4910. Special Problems in Mechanical and Energy Engineering. 1–3 hours each. Individual instruction in theoretical, experimental or research problems. Prerequisite(s): consent of instructor. May be repeated for 6 credit hours, but a maximum of 3 credit hours from 4900-4910 apply to major. For technical elective credit only.

4951. Honors College Capstone Thesis. 3 hours. Major research project prepared by the student under the supervision of a faculty member and presented in standard thesis format. An oral defense is required of each student for successful completion of the thesis. Prerequisite(s): completion of at least 6 hours in honors courses; completion of at least 12 hours in the major department in which the thesis is prepared; approval of the department chair and the dean of the school or college in which the thesis is prepared; approval of the dean of the Honors College. May be substituted for HNRS 4000.