of Courses

888. Partial Differential Equations III
Spring. 3(3-0) MTH 887.
Continuation of hyperbolic equations; application of functional analysis to existence theorems, theory of Leray and Schauder.

890. Reading in Mathematics
Fall, Winter, Spring, Summer.
Variable credit. Approval of department.

899. Master's Thesis Research
Fall, Winter, Spring, Summer.
Variable credit. Approval of department.

920. Harmonic Analysis I
Fall of even-numbered years. 3(3-0) MTH 823.
MTH 862 or approval of department.
Continuation of hyperbolic equations; application of functional analysis to existence theorems, theory of Leray and Schauder.

924. Functional Analysis I
Fall of odd-numbered years. 3(3-0) MTH 823.
MTH 862 or approval of department.

925. Functional Analysis II
Winter of even-numbered years. 3(3-0) MTH 924.
Continuation of MTH 924.

926. Functional Analysis III
Spring of even-numbered years. 3(3-0) MTH 925.
Continuation of MTH 925.

927. Theory of Measure and Integration
Spring. 3(3-0) MTH 922.
Interdepartmental with the Department of Statistics and Probability.

928. Harmonic Analysis II
Winter of odd-numbered years. 3(3-0) MTH 920.

929. Harmonic Analysis III
Spring of odd-numbered years. 3(3-0) MTH 928.
Continuation of MTH 928.
Selected topics from Fourier analysis on compact groups, singular integrals, harmonic analysis in Rn, Lp theory in one and several variables or differentiation of integrals.

934. Advanced Group Theory I
Fall. 3(3-0) MTH 836.
Permutation groups, characters, properties, automorphisms, lattices of subgroups, classes of infinite groups, linear groups, recent literature.

935. Advanced Group Theory II
Winter. 3(3-0) MTH 934.
Continuation of MTH 934.

936. Advanced Group Theory III
Spring. 3(3-0) MTH 935.
Continuation of MTH 935.

948. Fluid Dynamics III
Spring of odd-numbered years. 3(3-0) MTH 885.
General theory of perfect fluids including motion of incompressible fluids in two and three dimensions and applications to problems of wing profiles, viscous and compressible fluids discussed briefly.

951. Approximation Theory I
Fall of odd-numbered years. 3(3-0) MTH 823.
General methods of approximating functions; degree of approximation; methods of approximation; solutions of integral equations; approximation with polynomials, rational functions and general linear families; the Uniform problem; degree of approximation; approximations with polynomials; rational functions and general linear families; the Uniform problem; degree of approximation; approximations with polynomials; rational functions and general linear families.

952. Approximation Theory II
Winter of even-numbered years. 3(3-0) MTH 951.
Continuation of MTH 951.
General methods of measuring error: Approximation in L1 and Lp norms, least-square approximation and orthogonal expansions, approximation in normed linear spaces.

953. Approximation Theory III
Spring of even-numbered years. 3(3-0) MTH 952.
Continuation of MTH 952.

961. Topological Groups
Winter of even-numbered years. 3(3-0) MTH 862.
General properties of topological groups, classical groups and Lie groups.

962. Point Set Topology
Fall of odd-numbered years. 3(3-0) MTH 823.
MTH 861.
Hausdorff continua, Hahn-Mazurkiewicz cyclic element theory, monotonous decompositions, indecomposable continua, homogeneity.

964. Algebraic Topology I
Fall. 3(3-0) MTH 834, MTH 862.
Simplicial and singular homotopy theory, Eilenberg-Serre axioms, chain complexes, cell complexes, applications to Euclidean spaces.

965. Algebraic Topology II
Winter. 3(3-0) MTH 864.
Continuation of MTH 964 including category and functor theory, general coefficient and cohomology theory.

966. Algebraic Topology III
Spring. 3(3-0) MTH 965.
Continuation of MTH 965 including homology groups of products, Eilenberg-Zilber theorems, cohomology products, differential topology.

991. Advanced Topics in Geometry
Fall, Winter, Spring, Summer.
Variable credit.

992. Advanced Topics in Analysis
Fall, Winter, Spring, Summer.
Variable credit.

993. Advanced Topics in Algebra
Fall, Winter, Spring, Summer.
Variable credit. Approval of department.
Structure of rings and algebras, Lie algebras, Jordan algebras, advanced algebraic number theory, advanced linear algebra, advanced topics in group theory, lattice theory.

994. Advanced Topics in Applied Mathematics
Fall, Winter, Spring, Summer.
Variable credit. Approval of department.

996. Advanced Topics in Topology
Fall, Winter, Spring, Summer.
Variable credit. Approval of department.
Topological groups, topology of Euclidean spaces, axiomatic homology theory, homotopy theory, function spaces.

999. Doctoral Dissertations Research
Fall, Winter, Spring, Summer.
Variable credit. Approval of department.

MECHANICAL ENGINEERING

College of Engineering

201. The Science of Sound I: Rock, Bach and Oscillators
Winter. 3(3-0) or 4(4-0)
Interdepartmental with and administered by the Department of Physics.

202. The Science of Sound II
Spring. 3(3-0) or 4(4-0) PHY 201.
Interdepartmental with the Department of Physics.

300. Technology and Utilization of Energy
Winter. 3(3-0)
Initial course in any sequence of courses in the Department of Natural Science. Interdepartmental with the Department of Engineering.
Problems of energy technology and its impact: energy sources, conversions, waste and environmental effects, future outlook for mankind.

303. Thermal-Fluid Phenomena
Spring. 3(3-0) MMB 201 or approval of department.
Concepts and principles used to describe, predict, or explain thermal and fluid flow phenomena. Constraints, approximations, engineering problem solving. Application to socio-technical questions.
311. Thermodynamics I
Fall, Winter, Spring. 3(3-0) MTH 215 or concurrently.
Analysis, second and first laws of thermodynamics. General energy equation. Process relations. Concepts of equilibrium, reversibility, and irreversibility. Applications of these to systems describable by two independent properties.

312. Thermodynamics II
Winter, Spring. 3(3-0) M E 311.
Continuation of M E 311. Gas and vapor relations, reactive and non-reactive mixtures. Thermodynamic principle as applied to gas and vapor power and refrigeration cycles for reciprocating and turbo machinery.

315. Thermodynamics Laboratory
Fall, Winter, Spring. 1(0-3) M E 311 concurrently.
Laboratory experiments applying the basic laws of thermodynamics. Approved through Spring 1981.

316. Thermodynamics Laboratory II
Winter, Spring. 1(0-3) M E 312 concurrently.
Laboratory experiments investigating gases and liquid behavior and combustion from a thermodynamic viewpoint. Approved through Spring 1981.

320. Kinematics of Machines I
Fall, Spring, Summer. 4(3-3) EGR 260; M MM 306 or concurrently.
Analysis of displacement, velocity, and acceleration in mechanical linkages; cam analysis and design; analysis of spur, helical, bevel, and worm gears, including planetary systems.

333. Fluid Mechanics II
Fall, Spring, Summer. 4(3-3) M E 332.
Fluid flow phenomena; laminar flow; turbulent flow, pipe flow, inviscid flows; boundary layers; external flow; an introduction to compressible flow.

341. Computer-Aided Manufacturing
Spring. 4(3-2) CPS 110 or CPS 120.
Interdepartmental with the Department of Computer Science.
Numerical control, Computer-Aided Numerical Control, Direct Numerical Control, and adaptive control applied in present day manufacturing. Use of the APL language to control NC machines.

346. Mechanical Engineering Measurements Laboratory
Winter, Spring. 2(1-3) E E 345.
Mechanical engineering experiments including accuracy, data reduction, and the measurement of pressure, velocity, temperature, heat flow and vibration.

347. Thermoscience and Energy Systems Laboratory
Fall, Summer. 2(1-3) M E 311.
Thermosciences and Energy Systems Laboratory.

351. Mechanical Engineering Analysis
Fall, Winter, Spring. 4(4-0) CPS 120 or concurrently.
Application of analytical and numerical methods to the solution of problems encountered in mechanical engineering.

352. Introduction to Systems and Control
Winter, Spring. 4(4-0) PHY 288, MTH 310.
Modeling of a variety of physical systems, using state-variable concepts. Time and frequency response of low-order linear systems. Primary applications to mechanics and hydraulics.

406. Automotive Engines
Spring. 3(2-3) M E 312.
Analysis of internal combustion engines for vehicular propulsion.

407. Automotive Vehicles
Fall. 3(3-0) M MM 306.
Analysis of the propulsion, braking, steering, and suspension requirements.

410. Thermomechanical Continua
Fall, Spring. 3(3-0) M M 211.
Reexamination of the continuum concept in the modeling of the deformation of solids and the flow of fluids; Cartesian tensor formulation of the basic physical laws involving stress and strain.

411. Heat Transfer I
Fall, Summer. 3(3-0) M E 311.

412. Heat Transfer II
Winter, Spring. 3(3-0) M E 333.
Natural and forced convection based on boundary layer theory. Heat transfer in fluids with phase change. Heat exchangers, mass transfer.

414. Energy Conversion
Winter. 3(3-0) M E 312.
Fundamental principles of energy conversion systems. Direct energy conversion. Thermoelectric, thermionic, nuclear, fuel cells, magnetohydrodynamic, and other methods of power generation.

415. Solar Energy Conversion
Fall. 4(4-0) M E 311 or approval of department.

416. Statistical Thermodynamics
Spring. 3(3-0) M E 311.
Kinetic theory, classical statistical mechanics, and quantum statistical mechanics. Derivation of transport coefficients; applications of statistical mechanics.

436. Cooling Processes
Winter. 3(3-0) M E 312.
Fundamentals of fluid mechanics, potential flows about bodies and airfoils, compressible flow, perturbation methods, viscous flow, boundary layers on airfoils, transition, turbulence, separation, aerodynamics of wings and bodies.

442. Industrial Engineering
Spring. 4(3-2) M MM 280.
Theory and techniques used by industry in planning for manufacturing. Process selection and design, work measurement, scheduling, production time standards, materials handling, and plant layout planning.

455. Mechanical Vibrations
Fall, Winter. 4(4-0) M MM 306.
Oscillatory phenomena for linear systems with one and two degrees of freedom, nonlinear systems, time varying systems with deterministic excitation, and time invariant systems with non-deterministic excitations.

458. Control Theory
Winter, Spring. 4(4-0) M E 352.
Closed-loop control systems; application of transfer function analysis; design for a definite degree of stability; on-and-off controllers.

463. Computer-Assisted Design I
Winter. 3(2-2) E E 435.
Multi-variable systems; computer aided design; three-dimensional transformations, perspectives, contour surface layout for design and manufacturing, an introduction to finite element applications.

464. Computer-Assisted Design II
Spring. 3(2-2) E E 455, M E 463 and approval of department.
Modal analysis of dynamic systems; identification of modal characteristics from input-output data; computer techniques including graphics, eigenvalue and Fourier transform computations.
471. Flight Dynamics
Fall, 3(3-0) MMM 306.
Particle and rigid body dynamics; orbit theory; aerodynamic forces; propulsion; longitudinal, directional, and lateral stability and control; range; payload; a specific vehicle will be designed.

490. Special Topis
Fall, Winter, Spring. Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits. Approval of department. Special topics in mechanical engineering of current interest and importance.

499. Independent Study
Fall, Winter, Spring. 1 to 6 credits. May reenroll for a maximum of 9 credits. Approval of department.

810. Intermediate Heat/Mass Transfer
Fall. 4(4-0) Approval of department.

813. Convective Heat Transfer
Winter. 3(3-0) M E 412; MTH 421.
Analysis of convective transfer of heat, mass and momentum in boundary layers and induced flows. Heat transfer with phase change of fluids.

814. Radiative Heat Transfer
Spring. 3(3-0) Approval of department. Statistical mechanics and thermodynamics of radiation. Study of spectral properties. Radiative transfer in media. Selected applications.

815. Advanced Classical Thermodynamics
Fall of odd-numbered years. 3(3-0) M E 416; MTH 432 or MTH 442 or concurrently. Postgraduate treatment of the laws of thermodynamics. Equilibrium and maximum entropy postulates. Development of formal relationships. Principles for general systems. Applications to chemical, magnetic, electric, and elastic systems.

817. Conductive Heat Transfer
Fall. 3(3-0) M E 411. M E 351.

282. Interdepartmental with the Department of Metallurgy, Mechanics and Materials Science.
Discrete and continuous parameter systems with linear and nonlinear characteristics. Variational principles; equations of motion. Matrices, quadratic forms, self-adjoint operators; eigenvalues and transcendental equations. Theory developed through physical problems.

826. Kinematics of Machines II
Fall. 3(3-0) M E 320.

827. Machine Design III
Spring. Summer. 3(3-0) M E 421.
Strain energy method for analyzing statically indeterminate machine members; theories of failure; fatigue; use of statistics in selection of tolerances for parts in mass production. Optimum design.

828. Machine Design IV
Winter. 3(3-0) M E 421.
Application of design theory to the synthesis of complete mechanical and hydraulic systems. Stress waves due to impact loading. Critical speed.

832. Refrigeration
Spring. 3(3-0) M E 436.
Characteristics of refrigerant applications; application of theoretical principles pertaining to comfort cooling, food refrigeration, and ultra-low temperature units; refrigeration controls, and control systems.

840. Intermediate Fluid Mechanics
Fall. 3(3-0) M E 322 or C E 321.
Deformable control volumes. Navier-Stokes equations, dimensionless variables, vorticity and circulation, turbulent flow, inviscid flow, and boundary layer theory.

841. Advanced Gas Dynamics
Spring. 3(3-0) M E 432; MTH 432 or MTH 425 or MTH 424 or approval of department.
Compressible subsonic and supersonic flow, shock waves, expansion fans, inviscid equations, perturbation theory, similarity rules, methods of measurement, method of characteristics, hodograph methods.

842. Inviscid Fluids
Spring. 3(3-0) MTH 810; MTH 322 or MTH 423.
Kinematics; dynamical equations; potential flows, transformations, Helmholtz flows, added masses, forces and moments; vortex motion, wave motion.

843. Turbulence
Winter, Summer. 4(4-0) MTH 810 or approval of department.
Basic equations of turbulent motions including momentum, kinetic energy, scalar contaminants, correlation and spectrum functions. Basic elements of turbulent shear flows, phenomenological theories and hotwire anemometry.

851. Modeling of Engineering Systems
Fall. 4(4-0) M E 435 or E E 415.
Interdepartmental with Systems Science. Modeling of engineering devices and components; assembly into systems; bond graph representation; prediction of dynamic behavior by linear, nonlinear and simulation methods; applications to mechanical, electrical, fluid, thermal systems.

860. Topics in Parameter Estimation
Spring. 3(4-0) May reenroll for a maximum of 8 credits when different topics are taken. STT 421 or STT 441 recommended.

862. Mechanical and Aerospace Optimization
Winter. 3(3-0) MTH 424.
Elementary fundamentals of calculus of variations, maximum principle. Optimization techniques applied to fluids, gas dynamics, optimization of airfoil shapes, fuel consumption, heat transfer, wave propagation in solids and physical properties in plasmas.

870. Wave Motion in Continuous Media I
Winter. 3(3-0) or approval of department.

899. Master's Thesis Research
Fall, Winter, Spring. Variable credit. Approval of department.

920. Theory of Vibrations II
Winter of odd-numbered years. 4(4-0) MTH 422; MTH 823 or approval of department. Interdepartmental with and administered by the Department of Metallurgy, Mechanics and Materials Science.
Vibrations of one, two, and three-dimensional models of elastic and inelastic continua. Interaction phenomena. Stability, Variational methods. Applications to aeronautics, aerospace and underwater technology.

921. Theory of Vibrations III
Spring of odd-numbered years. Summer. 4(4-0) MTH 920 or approval of department. Interdepartmental with and administered by the Department of Metallurgy, Mechanics and Materials Science. Nonlinear oscillations. Resonance; subharmonics; self-sustained motions; stability. Methods of Poincare, van der Pol, etc. Random vibrations. Parametric excitations; stochastic processes; power spectra. Applications.

925. Mechanical Engineering Problems
Fall, Winter, Spring. Summer. Variable credit. May reenroll for a maximum of 9 credits. Approval of department. Analysis of advanced engineering problems involving design and thermodynamics, fluid dynamics, gas dynamics, space.

942. Viscous Fluids
Fall of even-numbered years. 3(3-0) MMM 810 or CHE 841.
Exact solutions of Navier-Stokes equations, i.e., Oscillatory Motion, Laminar Jet, Converging Channel, etc.; Hydrodynamic Stability including free convection, surface tension, gravitational and free-surface instabilities, and Tollmien-Schlichting waves.
MEDICAL TECHNOLOGY
College of Human Medicine
College of Osteopathic Medicine

201. Medical Technology
Fall. 114 credits. Approval of school.
Relationship of medical technology to medicine and research, and the necessary interaction with other paramedical sciences.

401. Seminar in Medical Technology
Spring. 1 credit. Juniors.
Acquire knowledge of the operation and administration of a hospital, the philosophy and understanding of the entire profession of medical technology.

495. Independent Study
Fall, Winter, Spring, Summer. 1 to 5 credits. Approval of department.
Independent study including assigned reading and reviews of appropriate scientific periodicals.

MEDICINE

College of Human Medicine

512. Infectious Diseases
Fall. 4-5 credits. MPH 511, or approval of department. Interdepartmental with and administered by the Department of Microbiology and Public Health.
Infectious diseases of man, including biology of the causative microorganism, epidemiology, pathogenesis, host-parasite relationships, clinical and laboratory diagnosis, and clinical management.

520. Biology of Blood Diseases
Spring. 2 credits. Enrollment in a college of medicine or a graduate program in a biological science. Correlates basic science and clinical concepts of hematology.

590. Special Problems in Medicine
Fall, Winter, Spring, Summer. 1 to 6 credits. Human Medicine student or approval of department.
Each student will work under direction of a staff member on an experimental, theoretical, or applied problem.

608. Senior Medical Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 43 credits. Primary clerkship, third year Human Medicine student.
A combined office and hospital experience that will provide the student with an opportunity to learn the concepts of evaluation and management of neurological diseases.

609. Hematology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. M ED 608.
Development of skills in data collection, problem solving and management related to common hematologic disorders of children and adults.

610. Oncology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. M ED 608.
Development of skills in data collection, problem solving, and management of the most prevalent cancers in children and adults.

611. Cardiology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
A clinical clerkship in which students evaluate in depth patients with cardiac diseases. This includes experiences with special diagnostic procedures including cardiac catheterization, phonocardiography, echocardiography and electrocardiography.

612. Nephrology/Urology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits.

613. Dermatology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Office based experience with a dermatologist to learn clinical skills in dermatology and develop observational and diagnostic skills in skin disease.

614. Medical Chest Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
A clerkship covering four aspects of chest diseases: tuberculosis, diagnosis, pulmonary function, and physical therapy. The student will work with medical residents, utilizing outpatient and hospital facilities.

615. Gastroenterology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Referred patients with gastrointestinal problems are seen. Other patients or outpatients. Many long-term problems are followed. Patients with psychosocial problems are seen conjointly with Social Service.

616. Allergy Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. M ED 608 and H M 602 or H D 608.
Office and hospital based experience to learn and develop diagnostic skills in allergy with a review of basic therapeutics as they relate to allergic diseases.

617. Neurology Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
A combined office and hospital experience that will provide the student with an opportunity to learn the concepts of evaluation and management of neurological disease.

618. Infectious Disease Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602 and M ED 608 or H D 608.
Interdepartmental with the Department of Microbiology and Public Health.
The clerkship emphasizes acquisition in depth knowledge and skills essential in solution of clinical problems in infectious and immunologic diseases. Integrated basic science input is afforded through relevant seminars.

619. Clinical Pharmacology Clerkship
Fall, Spring. 4 credits. H M 602; M ED 608 and H D 608.
Understanding and use of drugs; adverse effects; and misuse of drugs.

620. Endocrinology and Metabolism Clerkship
Fall, Winter, Spring. 4 to 8 credits. May reenroll for a maximum of 16 credits.
Clinical and/or clinical-research clerkship to allow the student to work closely with patients having endocrine disorders, abnormalities, endocrine hypertension or diabetes mellitus.

621. Computer Medicine Clerkship
Fall, Winter, Summer. 4 to 16 credits.
May reenroll for a maximum of 16 credits. H M 602.
Learning BASIC computer language; preparing flow chart for elementary management of medical problem.

622. Diabetes and Metabolism Clerkship
Fall, Winter, Spring. 4 credits. H M 602; M ED 608 and H D 608.
Clinical experience with diabetic patients and other related endocrine disorders.

624. Geriatrics Clerkship
Fall, Winter, Spring, Summer. 16 credits. H M 602; M ED 608 and H D 608.
Exposure to a wide variety of geriatric medical problems.

626. Physical Medicine and Rehabilitation Clerkship
Fall, Winter, Spring. 4 to 8 credits. May reenroll for a maximum of 8 credits. H M 602; M ED 608 and H D 608.
Experience in prescription-writing for physical medicine procedures, occupational therapy and rehabilitation skills.

627. Rheumatology Clerkship
Fall, Winter, Spring. 4 credits. H M 602; M ED 608 and H D 608.
Combined office and hospital consultancy clerkship, which develops diagnostic skills in areas of rheumatic diseases.

628. Internal Medicine Clerkship
Fall, Winter, Spring. 4 to 16 credits. May reenroll for a maximum of 16 credits. H M 602; M ED 608 and H D 608.
Elective experiences in internal medicine.

630. Emergency Medicine Clerkship
Fall, Winter, Spring, Summer. 4 to 8 credits. May reenroll for a maximum of 8 credits. M ED 608, H D 608 or SUR 608; H M 602. Interdepartmental with the Department of Surgery.
Pathophysiology and other basic concepts will be used to explain the development of emergent conditions. Clinical diagnosis and treatment of emergencies seen in community emergency departments will be discussed.

MEDICINE - Descriptions of Courses