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

829. Fluid Transients
Spring of odd-numbered years. 4(4-0) CE 825 or approval of department. Interdepartmental with Civil Engineering.
Application of unsteady flow concepts and wave mechanics to hydraulic engineering; method of characteristics; surges and waterhammer in piping systems; unsteady open channel flow; oscillatory waves; similarity and models.

830. Intermediate Fluid Mechanics
(840.) Fall. 3(3-0) E 332 or E 321.
Interdepartmental with Civil Engineering. Deformable control volumes, Navier-Stokes equations, dimensionless variables, vorticity and circulation, turbulent flow, inviscid flow, and boundary layer theory.

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

841. Advanced Gas Dynamics
Spring. 3(3-0) E 432; MTH 432 or MTH 422 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) MMM 810; MTH 432 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) MMM 810 or approval of department.
Basic equations of turbulent motions including momentum, kinetic energy, scalar contaminants, correlation and spectrum functions. Basic elements of statistical descriptions, isotropic and shear flows, phenomenological theories and hotwire anemometry.

851. Modeling of Engineering Systems I
Fall. 3(3-0); M E 456 or E E 415. Interdepartmental with Systems Science.
Modeling of engineering components and dynamic systems; mechanical, electrical, fluid, thermal, and transducer effects. Linear state-space responses, impedance methods. Simulation of linear models. Design project.

852. Modeling of Engineering Systems II
Winter. 3(3-0) ME 851. Interdepartmental with Systems Science.

853. Finite Dimensional Dynamical Systems
Spring. 3(3-0) ME 851 or SYS 826 or approval of department.
Transition matrices and matrix exponentials, periodicity and reducibility, controllability and observability, weighted patterns, realizations and minimal realizations, least squares theory and fixed endpoint problems, canonical equations, conjugate and focal points.

854. Optimization Theory and Applications
(862.) Winter. 4(4-0) MTH 434 or approval of department.
Formulation of optimization problems; projection methods and least squares theory; elementary fundamentals of calculus of variations; techniques applied to problems in dynamics, optimization of airflow shapes, and fuel consumption.

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

870. Wave Motion in Continuous Media I
Winter of even-numbered years. 4(4-0) MTH 422; MMM 810 or approval of department.

890. Special Topics
Fall, Winter, Spring, Summer. 2 to 4 credits. May recrroll for a maximum of 9 credits. Approval of department.
Special topics in mechanical engineering of current interest and importance.

899. Master's Thesis Research
Fall, Winter, Spring, Summer. 1 credit. Approval of department.

920. Mechanical Engineering Problems
Spring. 3(3-0) ME 870 or approval of instructor.
Analysis of advanced engineering problems involving design, thermodynamics, fluid dynamics, gas dynamics, space.
520. Special Problems in Medicine
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. Human Medicine students or approval of department.
Each student will work under direction of a staff member on an experimental, theoretical or applied problem.

580. Immunohematology Laboratory
Fall, Spring, 2(0-2) M T 430 or concurrently.
Laboratory techniques in hematology. Normal and abnormal blood cell morphology.

462. Medical Technology
Fall, Winter, Spring, Summer. 1 to 17 credits. H M 602. A clerkship covering four aspects of chest diseases: tuberculosis, diagnosis, pulmonary function, and physiology. The student works with medical residents, utilizing outpatient and hospital facilities.

510. Medical Chest Clerkship
Fall, Winter, Spring, Summer. 1 to 17 credits. H M 602.
A clerkship covering four aspects of chest diseases: tuberculosis, diagnosis, pulmonary function, and physiology. The student works with medical residents, utilizing outpatient and hospital facilities.

431. Immunohematology
Fall, Winter, Spring, Summer. 2(0-4) credits. Approval of department.

511. Medical Genetics Laboratory
Fall, Winter, Spring, Summer. 1(0-2) credits. May reenroll for a maximum of 3 credits. H M 602.
Referred patients with gastrointestinal problems are seen as either inpatients or outpatients. Many long-term problems are followed. Patients with recurrent problems are seen conjointly with Social Service.

512. Clinical Microscopy and Hemostasis
Fall, Winter, 2(0-2) PSL 432, BCH 401.
Renal physiology pertinent to the physical, chemical, and microscopic analysis of urine. The coagulation and fibrinolytic mechanisms including inherited and acquired diseases, laboratory testing and anticoagulant therapy.

432. Clinical Microscopy and Hemostasis Laboratory
Winter, Summer. 1 to 3 credits. MED 608.
Development of skills in data collection, problem solving and management related to common hematologic disorders of children and adults.

450. Independent Study
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. H M 602.
Independent study including assigned reading and reviews of appropriate scientific periodicals.

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512. Infectious Diseases
Spring, 4(3-3) MPH 511, or approval of department. Interdepartmental with and administered by the Department of Microbiology and Public Health.
Infectious diseases of humans, including biology of the causative microorganism, epidemiology, pathogenesis, host-parasite relationships, clinical and laboratory diagnosis, and clinical management.

520. Biology of Blood Diseases
Fall, 2(2-0) Enrollment in a college of medicine or a graduate program in a biological science.
Correlates basic science and clinical concepts of hematology.