

832. Refrigeration
Spring, 3(3-0) M 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) 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) 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 hot-wire anemometry.

851. Modeling of Engineering Systems I
Fall, 3(3-0) M E 458 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) M E 851. Interdepartmental with Systems Science.

Continuation of M E 851. Modeling of nonlinear dynamic systems. Applications of phase-plane and linearization methods. Simulation of nonlinear systems. Design project.

853. Finite Dimensional Dynamical Systems
Spring, 3(3-0) M E 851 or SYS 826 or approval of department.

Transition matrices and matrix exponentials, periodicity and reducibility; controllability and observability, weighting patterns, realizations and minimal realizations, least squares theory, free and fixed endpoint problems, canonical equations, conjugate and focal points.

855. Digital Data Acquisition and Control
Winter, 3(3-0) M E 458, M E 463.

Real-time digital measurement and control programming. Analog-to-digital and digital-to-analog converters. Computer structure, binary arithmetic, boolean operations, open-loop and closed-loop control, laboratory projects.

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

Nonlinear estimation of parameters in ordinary and partial differential equations. Related concepts in probability and statistics. Least squares, maximum likelihood and other estimators. Sequential methods. Optimum experiment design. Model-building.

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

Linear and nonlinear waves in bounded and unbounded media. Reflection, refraction, diffraction. Dispersion. Shock and acceleration waves. Waveguides. acoustical and optical analogies. Application to elastic, viscoelastic, plastic and fluid media.

890. Special Topics
Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll 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. Variable credit. Approval of department.

917. Advanced Heat Conduction
Winter of even-numbered years. 3(3-0) M E 817 or CHE 826 or MTH 841.

Exact analytical techniques including use of Green's function and integral transforms; approximate numerical methods; phase change problems; ablation; inverse heat conduction problems.

925. Mechanical Engineering Problems
Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 9 credits. Approval of department.

Analysis of advanced engineering problems involving design, thermodynamics, fluid dynamics, gas dynamics, space.

960. Nonlinear Control
Fall of even-numbered years. 3(3-0) SYS 827, M E 458 or E E 413. Interdepartmental with Systems Science.

Input-output stability of feedback systems; describing function methods; relay control; stabilizing controllers; design techniques selected from variable structure, high-gain, geometric, Lyapunov-based, vibration, feedback linearization and tracking controls.

980. Advanced Topics in Heat Transfer
Spring, 3(3-0) M E 813, M E 814, M E 817 or approval of department.

Advanced topics in conduction, convection, radiation or phase-change heat transfer, interactive combined modes, or combined heat and mass transfer.

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

MEDICAL TECHNOLOGY M T

College of Natural Science

110. Clinical Laboratory Science and Health Care Delivery
Winter, 2(2-0)

The history and definition of medical technology, its diagnostic and therapeutic role in health care delivery, and its relationship to other allied health professions.

210. Exploration of the Disciplines of the Clinical Laboratory Sciences
Fall, 2(2-0) Sophomores in medical technology.

Clinical laboratory disciplines including hematology, immunohematology, chemistry, microbiology, cytology, and histology through an examination of laboratory testing and its roles in the assessment, prevention, monitoring of health state.

211. Introduction to the Clinical Laboratory
Fall, 1(0-2) M T 210 or concurrently.

Basic laboratory techniques in clinical microbiology, immunohematology, hematology, hemostasis, clinical chemistry and clinical microscopy.

300. Foundations of Laboratory Practices
Fall, 3(3-0) Clinical Laboratory Sciences majors.

Quality assurance of clinical laboratory analysis.

400. Clinical Laboratory Sciences Educational Practices
Spring, 2(2-0) Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Development and implementation of educational programs for clinical laboratory personnel. Includes scope of CLS education, administration of programs and accreditation standards.

401. Clinical Biochemistry Laboratory
(M T 301.) Spring, 1(0-3) M T 300, M T 412.

Laboratory techniques in clinical biochemistry. Emphasis on the quality assurance and clinical correlation of body fluid analysis.

410. General Pathology
(PTH 404., M T 404.) Spring, 3(3-0) ANT 316; PSL 432 or concurrently. Interdepartmental with the Department of Pathology.

Features of lethal and sublethal cell injury and inflammation and repair process. Definition of the major causes of pathologic change with a consideration of specific associated diseases.

411. Basic Histopathology
Spring, 2(1-2) ANT 420, PSL 432; M T 410 or concurrently. Interdepartmental with the Department of Pathology.

Microscopic examination of cell injury and death, inflammation and tissue repair. Pathologic tissue changes in diseases resulting from degenerative changes, abnormal metabolism, neoplasia, immunologic processes, infection, mechanical trauma and malnutrition.

412. Clinical Biochemistry
(BCH 412.) Winter, 3(3-0) BCH 401; CEM 162. Medical Technology and Clinical Laboratory Sciences majors.

A comprehensive survey of clinical biochemistry; assessment of normal and pathologic physiology.

420. Hematology
Spring, Summer, 3(3-0) BCH 401, PSL 432.

Physiology, pathophysiology and laboratory assessment of hematological states.

421. Hematology Laboratory
Spring, Summer, 1(0-2) or 2(0-4) M T 420 or concurrently.

Laboratory techniques in hematology. Normal and abnormal blood cell morphology.

**Descriptions — Medical Technology
of
Courses**

430. Immunohematology
Fall. 3(3-0) MPH 461.

Genetics and immunology pertinent to blood group systems, antibody identification, and compatibility testing. Common practices of transfusion centers. Clinical correlations related to transfusion reactions and to hemolytic disease of the newborn.

431. Immunohematology Laboratory
Fall. 1(0-2) or 2(0-4) M T 430 or concurrently.

Techniques relevant to practice of immunohematology. Special emphasis on blood typing, antibody screening and identification, compatibility testing, prenatal and postnatal testing, quality assurance and problem solving.

440. Clinical Microscopy and Hemostasis
Winter, Summer. 2(2-0) 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.

441. Clinical Microscopy and Hemostasis Laboratory
Winter. 1(0-2) or 2(0-4) M T 440 concurrently.

Routine urinalysis including the physical, chemical and microscopic examination. Semi-automated procedures for routine coagulation testing including prothrombin times, partial thromboplastin times, and factor assays.

451. Senior Seminar I
Fall. 3(3-0) Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Problem oriented learning approach to develop managerial, scientific and educational leadership for the clinical laboratory. Topics to include clinical chemistry, hematology, immunology, microbiology, hemostasis, quality control, instrumentation.

452. Senior Seminar II
Winter. 3(3-0) M T 451.

Continuation of M T 451. Problems of increasing difficulty and based on additional topics in immunohematology and medical mycology.

453. Senior Seminar III
Spring. 3(3-0) M T 452.

Continuation of M T 452. Problems of increasing difficulty and based on additional topics from medical parasitology.

461. Medical Immunology and Microbiology
Winter. 5(5-0) MPH 301, MPH 302. Students may not receive credit in both MPH 461 and MPH 427. Interdepartmental with and administered by the Department of Microbiology and Public Health.

The immune system, cellular interaction of the in vitro and in vivo reaction, and associated immunopathology. Characterization of infectious agents and their pathogenic processes.

481. Clinical Chemistry
Fall, Winter, Spring, Summer. 6 credits. Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Application of the theory and technical skills of chemistry in a clinical laboratory.

482. Clinical Hematology
Fall, Winter, Spring, Summer. 5 credits. Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Application of the theory and technical skills of hematology in a clinical laboratory.

483. Clinical Immunohematology
Fall, Winter, Spring, Summer. 4 credits. Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Application of the theory and technical skill of immunohematology in a clinical laboratory.

484. Clinical Microbiology
Fall, Winter, Spring, Summer. 6 credits. Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Application of theoretical and technical aspects of clinical microbiology in a clinical laboratory.

485. Clinical Immunology
Fall, Winter, Spring, Summer. 1 credit. Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Application of theoretical and technical aspects of clinical immunology in a clinical laboratory.

486. Clinical Hemostasis
Fall, Winter, Spring, Summer. 1 credit. Clinical Laboratory Sciences majors, approval of Medical Technology Program.

Clinical experience in the area of hemostasis. Structured to achieve proficiency in psychomotor skills, instrumentation, quality assurance, test evaluation and comprehension of concepts and principal in coagulation.

487. Clinical Body Fluid Analysis
Fall, Winter, Spring, Summer. 1 credit. Clinical Laboratory Sciences major, approval of Medical Technology Program.

Application of the theory and technical skills used in the analysis of body fluids in a clinical laboratory.

495. Independent Study
Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 10 credits. Approval of department.

Independent study including assigned reading and reviews of appropriate scientific periodicals.

800. Seminar
Fall Winter, Spring. 1(1-0) May reenroll for a maximum of 2 credits. Approval of Medical Technology Program.

Current research topics in the clinical laboratory sciences.

810. Preparation for Research in the Clinical Laboratory Sciences
Winter. 3(2-3) Approval of Medical Technology Program.

Directed reading and discussions related to research methodology, proposal presentations both written and oral, and research funding. Exposure to medical technology research facilities.

820. Advanced Human Hematology
(PTH 820.) Fall of odd-numbered years. 2(2-0) M T 420, M T 421 or approval of department. Interdepartmental with the Department of Pathology.

Selected topics in hematology including the pathogenesis, mechanisms and morphological picture of hemotologic diseases in humans.

840. Advanced Hemostasis
(PTH 840.) Fall of even-numbered years. 2(2-0) M.S. candidates in Clinical Laboratory Science or approval of department. Interdepartmental with the Department of Pathology.

Physiology, pathophysiology and laboratory evaluation of hemostatic disorders.

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

MEDICINE MED

College of Human Medicine

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.

590. 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.

607. Ambulatory Care Clerkship
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. FMP 602. Interdepartmental with the departments of Family Practice, and Pediatrics and Human Development. Administered by the Department of Family Practice.

Outpatient experience, lasting an equivalent of 34 half-days and extending over a minimum of 26 weeks. Continuous and comprehensive patient care under supervision of appropriate physicians.

608. Internal Medicine Clerkship
Fall, Winter, Spring, Summer. 2 to 18 credits. May reenroll for a maximum of 42 credits. FMP 602, approval of department.

Based in community hospitals, this clerkship will stress interviewing skills, history, physical examination, along with problem solving and therapy, and care of the whole patient leading to independence in patient management.

609. Hematology Clerkship
Fall, Winter, Spring, Summer. 2 to 12 credits. May reenroll for a maximum of 12 credits. MED 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. 2 to 12 credits. May reenroll for a maximum of 12 credits. MED 608.

Development of skills in data collection, problem solving and management of the more prevalent cancers in children and adults.