

953. Plasma Dynamics (Magneto-Gas Dynamics)

Winter. 3(3-0) 432; PHY 491.

Fundamental equations of hydrodynamics; Maxwell equations; continuum; channel flow; boundary layer; shocks; Alfvén wave propagation; one and two fluid theories; discrete particle approach; plasma oscillations; flow around bodies and in nozzles; space propulsion systems.

954. Ion Flow Dynamics

Spring. 3(3-0) 953.

Continuation of 953 as applied to the ion flow; extension of the neutral flow turbulence into electromagnetic turbulence, and method of characteristics applied to the ion flow dynamics.

999. Research

(EGR 999.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**MEDICAL
TECHNOLOGY**

M T

College of Human Medicine

College of Osteopathic Medicine

College of Veterinary Medicine

201. Medical Technology

Fall. 1(1-0) Approval of school.

Relationship of medical technology to medicine and research, and the necessary interaction with other paramedical sciences.

401. Seminar in Medical Technology

Fall. 1 credit. Seniors.

Acquaints students with 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 3 credits. May re-enroll for a maximum of 6 credits. Approval of department.

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

MEDICINE

MED

College of Human Medicine

512. Infectious Diseases

Fall. 3(3-0) MPH 511, or approval of department. Interdepartmental with and administered by the Microbiology and Public Health Department.

Infectious diseases of man, 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 re-enroll for a maximum of 12 credits. Human Medicine students.

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 re-enroll for a maximum of 43 credits. Primary clerkship, third year Human Medicine students.

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. 1 to 17 credits. May re-enroll for a maximum of 34 credits. H M 603.

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 re-enroll for a maximum of 34 credits. H M 603.

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

611. Cardiology Clerkship

Fall, Winter, Spring, Summer. 1 to 17 credits. May re-enroll 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 cuticularization, phonocardiography, echocardiography and electrocardiography.

612. Nephrology/Urology Clerkship

Fall, Winter, Spring, Summer. 1 to 17 credits. May re-enroll for a maximum of 34 credits. H M 602.

Integrated concepts of renal physiology and pathophysiology of renal disease. Clinical experience.

613. Dermatology Clerkship

Fall, Winter, Spring, Summer. 1 to 17 credits. May re-enroll 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 re-enroll for a maximum of 34 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.

615. Gastroenterology Clerkship

Fall, Winter, Spring, Summer. 1 to 17 credits. May re-enroll for a maximum of 34 credits. H M 602.

Referred patients with gastrointestinal problems are seen as either in- or out-patients. 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 re-enroll for a maximum of 34 credits. 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 re-enroll for a maximum of 34 credits. H M 602.

A combined office and in-patient experience that will provide the student with an opportunity to learn the concepts of evaluation and management of neurological disease.

**METALLURGY, MECHANICS
AND MATERIALS
SCIENCE**

MMM

College of Engineering

205. Mechanics I

Fall, Winter, Spring, Summer. 4(4-0) MTH 214 or concurrently.

Vector description of forces and moments. Two and three dimensional equilibrium problems. Statics of frames and machines. Friction. Shear and moments in beams and shafts.

206. Mechanics II

Fall, Winter, Spring, Summer. 4(4-0) 205, MTH 215, or concurrently.

Dynamics of particles and particle systems. Energy and momentum principles. Two and three dimensional rigid body dynamics.

211. Mechanics of Deformable Solids

Fall, Winter, Spring, Summer. 4(4-0) 205 or statics; MTH 215.

Deformable solids, stress and strain, principal axes, material behavior (elastic, plastic, visco-elastic, temperature dependent). Boundary value problems, torsion, beams. Instability, columns.

215. Materials Testing Laboratory

Fall, Winter, Spring, Summer. 1(0-3)

Physical properties of engineering materials, resistance to primary types of static loading.

230. Introduction to Materials Science

Fall. 4(4-0) Sophomores.

A qualitative survey of metals, ceramics, and polymers, and the relationship of electronic, molecular, and crystal structure to the physical, mechanical, thermal, electrical and magnetic properties.

320. Analytical Mechanics I

Fall. 3(3-0) MTH 215; PHY 289.

Measures of point motion, indicial notation, vector space and time transformations. Newton's, Lagrange's and Hamilton's equations. Motions of point objects; limiting wave forms.

321. Analytical Mechanics II

Winter. 3(3-0) 320.

Schrodinger's equation. Particle motions in various potentials; hydrogen-like atoms and molecules. Continuum models of particle systems; tensor properties, rigid and elastic solids, transfer of heat and electricity, flow relations.

322. Analytical Mechanics III

Spring. 3(3-0) 321.

Quantum and statistical models of particle systems; the Maxwell-Boltzmann, Einstein-Bose and Fermi-Dirac distributions; analysis of ideal atomic, electron and photon gases; properties of dense gases and liquids; thermal, elastic and electrical properties of crystals.

340. Materials Chemistry I

Fall. 4(4-0) CEM 153.

An integrated treatment of the physical chemistry of metals and other engineering materials is presented by 340, 341 and 342. Physico-chemical systems; thermodynamics and thermochemistry; equilibrium; solutions and phase equilibrium; electrochemistry; corrosion; reaction kinetics in condensed phases; diffusion; surface phenomena.

- 341. Materials Chemistry II**
Winter. 4(4-0) 340 or approval of department.
Continuation of 340.
- 342. Materials Chemistry III**
Spring. 4(4-0) 341.
Continuation of 340, 341.
- 360. Physical Metallurgy I**
Fall. 4(4-0) CEM 153 or approval of department.
Relationship of properties to microstructure as affected by solidification transformations in heterogeneous systems, cold work, recrystallization, and grain growth. Emphasis on the important commercial metals and alloys.
- 361. Physical Metallurgy II**
Winter. 4(4-0) 360.
Continuation of 360.
- 362. Physical Metallurgy III**
Spring. 4(4-0) 360, 361.
Continuation of 360, 361.
- 370. Metals and Alloys I**
Fall, Winter. 4(3-3)
Principles of physical metallurgy applied to engineering metals and alloys.
- 371. Metals and Alloys II**
Winter. 3(3-0) 370.
Continuation of 370.
- 372. Metals and Alloys III**
Spring. 3(3-0) 371.
Continuation of 371.
- 380. Physical Metallurgy Laboratory I**
Fall. 1(0-3) 360 or concurrently.
First of an integrated sequence of laboratory courses designed to illustrate the parallel theory courses. Introduction to metallography, pyrometry, and testing of metals.
- 381. Physical Metallurgy Laboratory II**
Winter. 1(0-3) 380; 361 concurrently.
Continuation of 380.
- 382. Physical Metallurgy Laboratory III**
Spring. 1(0-3) 381; 362 concurrently.
Continuation of 381.
- 400. Special Problems**
Fall, Winter, Spring, Summer. 1 to 3 credits. May re-enroll for a maximum of 9 credits. Approval of department.
Individualized reading and research.
- 404. Dynamics of Mechanical Systems**
Fall. 3(3-0) 206.
Principles of Newtonian dynamics. Lagrangian dynamics of rigid-body systems. Introductory orbital mechanics. Euler's dynamical equations and gyroscopic motion. Engineering applications.
- 411. Mechanics of Deformable Solids II**
Spring. 3(3-0) 211.
Continuation of 211. Unsymmetrical bending, curved beams, torsion of non-circular shapes, shear center, beam columns. Introduction to energy theorems with applications to determinate and indeterminate beams, and rings.
- 413. Applied Solid Mechanics**
Winter. 3(3-0) 212.
Methods of solution of problems in elasticity, plasticity and viscoelasticity. One- and two-dimensional mathematical models will be considered.
- 414. Principles and Techniques of Experimental Solid Mechanics**
Spring. 3(3-0) 211.
Fundamental concepts and current technology for static and dynamic measurement of strain and acceleration. Main topics discussed are resistance strain gages, photoelasticity, accelerometers; brittle coatings, Moire patterns, and holography.
- 430. X-Ray Crystallography**
Fall. 4(2-6) 342 or approval of department.
Symmetry, elementary crystallography, general properties of x-rays, introduction to radiation safety, interaction of x-rays with matter, application of x-ray diffraction to materials problems.
- 440. Color and Appearance of Materials**
Fall. 3(3-0) Approval of department.
Color in art and technology; light and its interaction with colored materials; light sources and illuminants; color notation and classification; colored materials.
- 455. Advanced Physical Metallurgy I**
Winter. 3(3-0) PHY 364 or approval of department.
Atomic theory of metals and alloys. Nature of chemical and metallic bonds. Lattice vibration and specific-heat theory. Relation of electron energy bands in metals to cohesion, structure, electrical and magnetic properties.
- 456. Advanced Physical Metallurgy II**
Spring. 3(3-0) 455.
Nature of interfaces. Driving forces and kinetics of phase transformation. Plastic deformation of single crystals and relationship to mechanical properties of metals and alloys. Strengthening mechanisms.
- 460. Metallurgical Engineering I**
Fall. 4(3-2) 362 or approval of department.
Extractive metallurgy. Mineral dressing, beneficiation, and physical processing of ores. Chemical metallurgy of ore reduction. Production of iron and steel, copper, aluminum, magnesium, nickel, lead and zinc. Stoichiometric heat, and material balances. Combustion of fuels.
- 461. Metallurgical Engineering II**
Winter. 4(3-2) 460 or approval of department.
Fluid flow and heat transfer in metallurgical processes. Refractories. Heat-treating furnaces and protective furnace atmospheres. Commercial processes for carburizing, cyaniding, and nitriding.
- 462. Metallurgical Engineering III**
(465.) Spring. 4(3-2) 461 or approval of department.
Mechanical processing of metals. Forming, shaping and fabricating operations. Rolling mills, extrusion presses, forging practice, and welding systems. Powder metallurgy processes. Selection of materials and equipment. Quality control.
- 470. The Cast Alloys**
Winter. 4(4-0) 362, or 372.
Physical metallurgy of the cast alloys. Solidification and transformation. Nucleation and inoculation. Mode of solidification as influencing foundry properties in ferrous and nonferrous alloys. Casting design as related to foundry practice.
- 475. Alloy Development and Application**
Fall. 4(4-0) 361, 362, or approval of department.
Physical metallurgy, development, and applications of special steels and alloys: the high-strength structural steels, machine steels, ultra high-strength steels, maraging steels, corrosion-resistant steels and alloys, high-temperature alloys.
- 800. Special Problems**
Fall, Winter, Spring. 1 to 6 credits. May re-enroll for a maximum of 6 credits. Approval of department.
Individualized reading and research compatible with the student's interest and ability.
- 801. Advanced Engineering Mechanics I**
Fall, Summer. 3(3-0) 206 or 320.
Principles of classical dynamics; Lagrangian equations for electromechanical systems; Hamiltonian formulation; matrix treatment of vibrations.
- 802. Advanced Engineering Mechanics II**
Winter. 3(3-0) 801.
Rigid-body mechanics; the gyroscope; canonical transformations; Hamilton-Jacobi theory; engineering applications of advanced mechanics.
- 803. Advanced Engineering Mechanics III**
(820.) Spring. 3(3-0) Approval of department.
Variational methods for point objects; wave motion. Schrodinger's equation and particle motions in potential wells. Continuum, quantum and statistical models of particle systems.
- 805. Strain and Motion Measurement**
Spring, Summer. 4(3-3) Approval of department.
Resistance strain gages and accelerometers are examined in detail with particular regard to the analysis and design of the whole measuring system. Student project involving transducer design. Other motion measurement techniques.
- 806. Optical Strain Measurement**
(814.) Winter of even-numbered years. 4(3-3) Approval of department.
Whole-field techniques such as photoelasticity, photoelastic coatings, Moire techniques, and brittle coating. Interferometers and model analysis. Necessary theory of optics is presented.
- 810. Introduction to the Mechanics of a Continuous Medium**
Fall, Summer. 4(4-0) 211; MTH 421 concurrently or approval of department.
Stress, deformation and rate-of-deformation tensors. Balance of mass, momentum, and energy. Field equations. Examples of constitutive equations. Selected special solutions in elasticity and Newtonian fluids.
- 813. Theory of Elasticity I**
Winter. 4(4-0) 810; MTH 422 or approval of department.
Fundamentals of linear elasticity. Solution of plane elasticity problems by use of Airy's stress functions, complex-function theory, variational methods, and finite differences.

815. Advanced Strength of Materials I

Fall, Summer. 3(3-0) 211.

Elasticity, energy methods, general bending of straight bars, curved beams, shear center, torsion.

816. Advanced Strength of Materials II

Winter. 3(3-0) 815; MTH 215.

Beams on elastic support, beam columns, axially symmetric stress distribution, symmetrical bending of circular plates, introduction to theory of elasticity.

817. Plasticity

Spring. 4(4-0) 810; MTH 422 or approval of department.

Yield conditions, stress-strain relations, plastic potential, hardening theories; torsion, bending, thick-walled spherical and cylindrical shells under internal pressure; plane strain of perfectly plastic material.

823. Theory of Vibrations I

Fall. 4(4-0) ME 455. Interdepartmental with and administered by the Mechanical Engineering Department.

Discrete and continuous parameter systems with linear and non-linear characteristics. Variational principles; equations of motion. Matrices, quadratic forms; self-adjoint operators; eigenvalues. Transient and random excitations. Theory developed through physical problems.

831. Advanced X-Ray Metallography

Winter. 3(3-0) Approval of department.

Development of crystallographic space groups, theory of the intensity of diffracted X-rays; Weissenberg method, crystal structure analysis.

832. Electron Microscopy

Spring. 4(3-3) 831 or approval of department.

Theory of image formation in electron microscopy and intensity of electron diffraction. Transmission and replica microscopy.

835. Orthopedic Biomechanics

Fall. 3(3-0) Approval of department. Basic theories of mechanics with application to orthopedics. Elastic and viscoelastic materials will be considered and experimental demonstrations of tissue response.

840. Symmetry and the Properties of Crystals

Spring. 3(3-0)

Point-group theory and symmetry in tensor properties of crystals; systematic treatment of properties, e.g., electrical polarization, magnetic induction, pyro- and piezo-electricity, elasticity, transport properties and birefringence.

850. Modern Ceramic Materials I

Fall. 3(3-0) CEM 462; PHY 840; or approval of department.

Crystalline macrostructure and microstructure of ceramics and glasses; dependence of microstructure on amounts, size, shape, and distribution of phases; modification of microstructure by control of nucleation and growth; composite materials.

851. Modern Ceramic Materials II

Winter. 3(3-0) 850.

Properties of ceramic materials with specific reference to mechanical, optical, electrical, magnetic and thermal properties.

852. Modern Ceramic Materials III

Spring. 3(3-0) 851.

Applications of ceramic materials. Glass-

ceramics, nuclear fuel elements, hot-pressed translucent oxides, pre-stressed ceramics, ceramic coatings, pyrolytic materials.

860. Theoretical Metallurgy I

Fall. 3(3-0) 342.

Metallurgical thermodynamics, introduction to statistical thermodynamics, kinetics of metallurgical processes.

861. Theoretical Metallurgy II

Winter. 3(3-0) 860.

Introduction to quantum theory of metals, physical properties of metals and alloys.

862. Theoretical Metallurgy III

Spring. 3(3-0) 861.

Imperfection in crystalline solids, dislocation theory and mechanical properties of metals and alloys.

870. Ferrous Physical Metallurgy

Fall. 3(3-0) 342, 362.

Theory of steel hardening and hardenability from nucleation, growth, and shear considerations.

871. Nonferrous Physical Metallurgy

Winter. 3(3-0) 342, 361.

Binary, ternary and complex alloy systems, shear mechanism, recrystallization and grain growth, age hardening, and other diffusion mechanisms.

872. Physical Metallurgy of Alloy Steels

Spring. 3(3-0) 870, 871.

Steels for extreme service conditions.

875. Ferrous Metallurgy

Fall. 3(3-0) 462.

Stoichiometric material and heat balance calculations of the blast furnace, open hearth and electric furnace processes.

876. Nonferrous Process Metallurgy

Winter. 3(3-0) 462.

Stoichiometric material and heat balance calculation in nonferrous extractive metallurgy.

880. Metals and Alloys I

Fall. 3(3-0) 372.

Topics in engineering properties and application of wrought steels for engineers other than metallurgical.

881. Metals and Alloys II

Winter. 3(3-0) 372.

Similar to 845, but with reference to nonferrous alloys.

882. Metals and Alloys III

Spring. 3(3-0) 372.

Similar to 845, but with reference to cast alloys.

885. Seminar

Fall, Winter, Spring. 1 credit. 899 concurrently.

890. Selected Topics

Fall, Winter, Spring, Summer. 3(3-0) May re-enroll for a maximum of 18 credits if a different topic is taken. Approval of department.

A newly developing area in metallurgy, mechanics, or materials science selected by the department for offering each term. Information on the specific topic to be covered should be obtained from the department office before registration.

899. Research

(EGR 899.) Fall, Winter, Spring, Summer. Variable credit. Approval of department.

900. Special Problems

Fall, Winter, Spring Summer. 1 to 6 credits. May re-enroll for a maximum of 6 credits. Approval of department.

Individualized reading and research compatible with the student's interest and ability.

901. Modern Mathematical Mechanics

Winter of odd-numbered years. 3(3-0) Approval of department.

Application of functional analysis and tensor theory to classical and contemporary problems in dynamics and material properties.

909. Elastic Thin Shells

Spring. 4(4-0) 815 or C E 804 or approval of department; MTH 421. Interdepartmental with and administered by Civil Engineering.

Elements of differential geometry, membrane theory of shells, Pucher's stress function, deformation and bending of shells of revolution and shallow shells.

910. Nonlinear Continua

Winter of even-numbered years. 4(4-0) 810.

Modern nonlinear theories of continua. Equations of balance and constitutive equations. Topics selected from finite elasticity, nonlinear viscosity and viscoelasticity, electroelasticity. General tensors are introduced and used throughout.

911. Theory of Elastic Stability

Fall of odd-numbered years. 4(4-0) 815 or approval of department.

Theory and methods of determining buckling strength and post-buckling behavior of bar, plate and shell elements and of elastic systems.

912. Theory of Plates

Winter. 4(4-0) 815 or C E 804 or approval of department; MTH 422. Interdepartmental with Civil Engineering.

Bending of thin elastic plates with various shapes and boundary conditions; application of energy principles and approximate methods of solution; thick plates; large deflection theory; sandwich plates.

915. Theory of Elasticity II

(913.) Spring. 3(3-0) 813 or approval of department.

Saint-Venant bending and torsion. Problems in three-dimensional linear elasticity using the Galerkin vector and Neuber-Papkovich functions.

918. Theory of Viscoelasticity

Fall of even-numbered years. 3(3-0) 810; MTH 422 or approval of department.

Fundamental linear viscoelastic stress-strain relations. Model representation. Three dimensional and general deformation laws. Correspondence principle. Quasi-static, dynamic and buckling problems.

920. Theory of Vibrations II

(904.) Winter of odd-numbered years. 4(4-0) MTH 422; M E 823 or approval of department. Interdepartmental with the Mechanical Engineering Department.

Vibrations of one, two, and three-dimensional models of elastic and inelastic continua. Interaction phenomena. Stability. Variational methods. Applications to aeronautics, aerospace, and undersea technology.

921. Theory of Vibrations III

(903.) Spring of odd-numbered years, Summer. 4(4-0) 920 or approval of department.

ment. Interdepartmental with the Mechanical Engineering Department.

Nonlinear oscillations. Resonance; subharmonics; self-sustained motions; stability. Methods of Poincare, van der Pol, etc. Random vibrations. Parametric excitations; stochastic processes; power spectra. Applications.

933. Advanced Elasticity
Spring of even-number years. 3(3-0)
813, 910 or approval of department.
Selected topics in non-linear elasticity.

941. Advanced Topics in Mechanical Metallurgy
Fall of even-numbered years; Winter and Spring of odd-numbered years. 3(3-0)
May re-enroll for a maximum of 9 credits.
Various aspects of dislocation theory and its application to the mechanical and physical properties of solids.

942. Advanced Topics in the Kinetics of Phase Transformation
Fall of odd-numbered years; Winter and Spring of even-numbered years. 3(3-0)
May re-enroll for a maximum of 9 credits.

999. Research
(EGR 999.) Fall, Winter, Spring
Summer. Variable credit. Approval of department.

MICROBIOLOGY AND PUBLIC HEALTH MPH

College of Human Medicine
College of Natural Science
College of Osteopathic Medicine
College of Veterinary Medicine

100. Preview of Microbiology
Winter. 2(2-0) Freshmen and Sophomores only.

Science and scientists of microbiology, presented in historical perspective and carried to the forefront of current research. A rigorous preview for students seriously curious about microbiology.

200. Elementary Microbiology
Fall, Winter. 4(3-2) Three terms of Natural Science. Primarily for majors outside the College of Natural Science.

Description of bacteria and related forms of microorganisms, their growth and nature, their application in industry, and their control in public health.

234. Elementary Medical Microbiology
Fall. 5(4-4) Three terms of Natural Science. Primarily for Nursing students.

Survey of immunology and microbiology with emphasis on pathogenic microorganisms, antimicrobial agents, and laboratory diagnosis.

301. Introductory Microbiology
Fall, Spring. 3(3-0) B S 212; BCH 200.

Fundamentals of microbiology with emphasis on the comparative nature of the various groups of microorganisms, their distribution and activities.

302. Introductory Microbiology Laboratory
Fall, Spring. 1(0-4) 301 or concurrently.

Laboratory based on the subject matter of 301.

400. Bacteriology for High School Science
Summer. 4(4-4) Bachelor's degree and teaching certificate.

Fundamental concepts, experiments, and projects useful in secondary school science courses.

400H. Honors Work
Fall, Winter, Spring, Summer. 1 to 6 credits. May re-enroll for a maximum of 12 credits. Approval of department.
Tutored reading and experimentation.

401. General Microbiology
Fall. 5(5-0) B S 212; BCH 401 or concurrently.

Comparative biology of microorganisms: viruses, rickettsiae, bacteria, fungi, algae, and protozoa.

402. General Microbiology Laboratory
Fall. 3(1-6) 401 or concurrently.
Laboratory based on the subject matter of 401.

413. General Virology
(463.) Winter. 3(3-0) 427 or concurrently.

Physical, chemical, and biological properties of the viruses.

414. General Virology Laboratory
Winter. 1(0-4) 413 or concurrently.

Laboratory procedures employed for cultivation and identification of viruses.

416. General Parasitology
(406.) Winter. Summer at W. K. Kellogg Biological Station. 3(2-4) B S 212.
Biology of parasitic animals.

421. Microbial Physiology
Winter. 3(3-0) 401, 402.

Cell structure and function, growth and death, and metabolism of microorganisms.

422. Microbial Physiology Laboratory
Winter. 2(0-6) 421 or concurrently.
Laboratory work based upon the subject matter in 421.

423. Microbial Genetics
(431.) Spring. 3(3-0) BCH 401; ZOL 441 recommended.

Fundamental genetic concepts as exemplified in microorganisms.

424. Microbial Genetics Laboratory
Spring. 2(0-6) 423 or concurrently.

Laboratory work based upon the subject matter in 423.

425. Microbial Ecology
Summer. 6(3-9) 402. Given at W. K. Kellogg Biological Station.

Lecture emphasizes biological and biochemical properties of diverse naturally occurring microorganisms. The laboratory stresses the analysis and description of natural metabolic activity. Methodology includes enrichment techniques but also qualitative and quantitative monitors of environmental changes.

427. Immunobiology
(460.) Winter. 3(3-0) B S 212; BCH 200 or BCH 401.

Biological and biochemical mechanisms of the immune response. Emphasis is on concepts of immunity.

428. Immunobiology Laboratory
Winter. 2(0-6) 427 or concurrently.
Basic laboratory techniques in immunobiology.

429. Microbiology of Infectious Diseases
(461.) Spring. 5(2-8) 301 or 402 and 427.

Biology, immunology, pathogenicity, and medical aspects of microorganisms associated with infectious diseases of man. Methods of isolation and identification are emphasized in the laboratory.

436. Introductory Medical Parasitology
(309, 336.) Fall. 5(3-5) Primarily for Medical Technology students.

Biology and laboratory diagnosis of protozoan, helminth, and arthropod infections of man.

440. Food Microbiology
(371.) Spring. 4(2-6) 200 or 301 or 401. Interdepartmental with and administered by Food Science.

Major groups of microorganisms of importance to the food industry are studied with emphasis on ecological, physiological, and public health aspects.

442. Soil Microbiology
(481.) Spring. 4(3-4) 200 or 301 or 401. Interdepartmental with Soil Science.

Major groups of microorganisms of importance in soils are studied with emphasis on ecological, biochemical, and physical aspects.

444. Environmental Microbiology
(351.) Spring. 3(2-4) 200 or 301 or 401.

Flora, methods of testing, and purification of environmental air and water. Treatment and disposal of sewage.

511. Medical Microbiology and Immunology
Spring. Variable credit. May re-enroll for a maximum of 7 credits. A biochemistry course. Enrollment in College of Human Medicine or approval of department.

Basic principles of microbiology (bacteriology, virology, mycology and parasitology) and immunology. Selected type-infections relate these principles to disease in man.

512. Infectious Diseases
Fall. 3(3-0) 511, or approval of department. Interdepartmental with the Department of Medicine.

Infectious diseases of man, including biology of the causative microorganism, epidemiology, pathogenesis, host-parasite relationships, clinical and laboratory diagnosis, and clinical management.

521. Medical Microbiology and Immunology
Winter. Variable credit. May re-enroll for a maximum of 6 credits. A biochemistry course. Enrollment in College of Osteopathic Medicine or approval of department.

Basic principles of microbiology (bacteriology, virology, mycology and parasitology) and immunology. Selected type-infections relate these principles to disease in man.

531A. Medical Microbiology: Immunology
(566, 531.) Winter. 2(1-2) A course in biochemistry and admission to the veterinary professional program, or approval of department.

Basic principles of immunology (immunobiology and immunochemistry) and their relation to disease in animals.