810. Introduction to the Mechanics of a Continuous Medium
Fall, Summer. 4(4-0) MMM 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) MMM 810; MTH 422 or approval of department.
Fundamentals of linear elasticity. Solution of plane elasticity problems. St. Venant bending and torsion. Basic singular solutions. Variational methods.

814. Mechanics of Composite Materials I
Winter. 3(3-0) MMM 810, MMM 813 or concurrently.
Composite materials and their applications. Anisotropic elasticity theory. Macromechanics and micromechanics of composites. Applications in the mechanics of composite structures.

815. Advanced Strength of Materials
Fall, Summer. 3(3-0) MMM 411.
General theory of torsion, unsymmetrical bending, shear flow. Curved beams. Thick-walled cylinders. Beams on elastic foundations. Bending of plates.

817. Plasticity
Spring of odd-numbered years. 4(4-0) MMM 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.

820. Energy Methods in Applied Mechanics
Fall of odd-numbered years. 3(3-0) MTH 422 or approval of department.
Energy and variational formulations in solid mechanics. Approximate methods (Ritz, Galerkin) based on energy approach. Applications to vibration and stability problems.

823. Theory of Vibrations I
Fall. 4(4-0) M E 455. Interdepartmental with and administered by the Department of Mechanical Engineering.
Discrete and continous parameter systems with linear and nonlinear characteristics. Variational principles; equations of motion. Matrices, quadratic forms; self-adjoint operators; eigenvalues. Transient and random excitations. Theory developed through physical problems.

832. Electron Microscopy
Spring. 4(3-3) MMM 831 or approval of department.
Theory of image formation in electron microscopy and intensity of electron diffraction. Transmission and replica microscopy.

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) MMM 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) MMM 851.
Applications of ceramic materials. Glass-ceramics, nuclear fuel elements, hot-pressed translucent oxides, pre-stressed ceramics, ceramic coating, pyrolytic materials.

860. Theoretical Metallurgy I
Fall. 3(3-0) MMM 330 or approval of department.
Metallurgical thermodynamics, introduction to statistical thermodynamics, kinetics of metallurgical processes.

861. Theoretical Metallurgy II
Winter. 3(3-0) MMM 860.
Introduction to quantum theory of metals, physical properties of metals and alloys.

890. Selected Topics
Fall, Winter, Spring, Summer. 3(3-0) May reenroll 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. Master's Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

900. Special Problems
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 6 credits. Approval of department.
Individualized reading and research compatible with the student's interest and ability.

909. Elastic Thin Shells
Spring. 4(4-0) MMM 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.

911. Theory of Elastic Stability
Winter of odd-numbered years. 4(4-0) MMM 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) MMM 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
Spring. 3(3-0) MMM 813 or approval of department.
Further topics in linear elasticity. Introduction to finite elasticity and solutions of some basic problems. Nonlinear crack problems.

916. Fracture Mechanics
Fall of even-numbered years. 3(3-0) MMM 813.
Brittle and ductile fracture in structural materials. Elastic stress fields near cracks, theories of brittle fracture, elastic fracture mechanics. Elastic-plastic analysis of crack extension. Plastic instability. Running cracks.

917. Fatigue
Spring of even-numbered years. 3(3-0) MMM 411 or approval of department.
Theories of cyclic deformation and fatigue. Macro and micro failure. Notched components. Combined loading. High temperature fatigue, environmental effects. Case studies.

918. Theory of Viscoelasticity
Fall of even-numbered years. 3(3-0) MMM 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
Winter of odd-numbered years. 4(4-0) MTH 422; M E 823 or approval of department. Interdepartmental with the Department of Mechanical Engineering.
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.

999. Doctoral Dissertation Research
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

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) CEM 130, B S 211, approval of department.
Survey of immunology and microbiology with emphasis on pathogenic microorganisms, antimicrobial agents, and laboratory diagnosis.

301. Introductory Microbiology
Fall, Spring. 3(3-0) CEM 242, CEM 244 or BCH 200.
Fundamentals of microbiology. Ranges of cell structure and activities; nutrition, growth, and importance of major microbial groups.

302. Introductory Microbiology Laboratory
Fall, Spring. 2(0-4) MPH 301 or concurrently.
Methodology of microbiology including microscopy, staining, asepsis, cultural media and quantification.

303. Microbiology I: General
Fall. 4(4-0) BCH 451 or concurrently.
Principles of microbiology emphasizing cell structure and function, metabolism, growth and death, differentiation, diversity, and microbial interaction.

304. General Microbiology Laboratory I
Fall. 3(1-5) MPH 303 or concurrently.
Techniques and procedures of general microbiology emphasizing the isolation and identification of bacteria, the qualitative aspects of growth and death, and bacterial interactions.

306. General Microbiology Laboratory II
Spring. 3(1-5) MPH 304.
Continuation of MPH 304 with emphasis on immunologic and genetic techniques and procedures.

310. Food Safety and Microbiology
Fall. 4(3-3) CEM 143 or concurrently or approval of department. Not open to students with credit in FSC 440. Interdepartmental with and administered by Food Science.
Effects of food handling, preparation and service on food safety. Microorganisms in foods, sanitation, food borne disease and food service regulations.

400H. Honors Research
Fall, Winter, Spring, Summer. 2 credits. May reenroll for a maximum of 8 credits. Approval of department.
A four-term research project with thesis.

405. Microbiology II: Immunobiology/Cell Biology
(427.) Winter. 4(4-0) MPH 303; BCH 452 or concurrently. Students may not receive credit in both MPH 405 and MPH 462.
Cell biology of eukaryotic cells with immune system as model. Emphasize structure-function relationships in subcellular organelles, antigen metabolism and regulatory mechanisms of immune responsiveness.

406. Medical Mycology
Fall, Spring. 4(2-6) BOT 402 or approval of department. Interdepartmental with and administered by the Department of Botany and Plant Pathology.
Characteristics, habits, and laboratory identification of fungus diseases infecting humans. Emphasis on laboratory techniques and morphological characteristics of the various mycoses.

407. Microbiology III: Microbial Genetics
(423.) Spring. 4(4-0) MPH 405; BCH 453 or concurrently.
Genetics and molecular biology of bacteria and viruses with emphasis on the genetic principles developed from their study.

413. Animal Cells and Viruses
Fall. 3(3-0) MPH 407.
Basic features of animal cell structure and function, and of animal viruses as tools to understand eukaryotic gene expression, as pathogens, and as examples of diversity and divergence with cellular mechanisms.

416. General Parasitology
Fall. 3(3-0) B S 210, B S 211, B S 212 or LBS 141.
Life history, host-parasite relationships (including physiology, immunology, immunopathology and pathology) and epidemiology of selected groups and species of protozoan, tremotode, cestode and nematode parasites.

417. General Parasitology Laboratory
Fall. 2(0-4) MPH 416 or concurrently or approval of department.
Identification and life histories of representative species of major groups of animal parasites. Selected concepts of host-parasite associations will be tested experimentally.

420. Biology of Animal Parasites
Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the departments of Fisheries and Wildlife, and Zoology.
Parasitism of animals by protozoa, helminths and anthropods with emphasis on the interrelationships of host-parasite associations with the natural environments.

425. Microbial Ecology
Spring. 3(3-0) MPH 301 or approval of department. MPH majors must enroll concurrently in MPH 425A.
Microbial activities in natural ecosystems; their association with plants and animals, and their transformations of carbon, nitrogen and sulfur in soil and aquatic habitats.

425A. Microbial Ecology Recitation
Spring. 1(1-0) MPH 425 concurrently.
Quantitative aspects of microbial ecology.

429. Host-Parasite Relationships
Winter. 3(3-0) MPH 407, MPH 413.
Molecular basis of microbial virulence determinants and their role in overcoming mechanisms of host defense.

437. Introductory Medical Parasitology
Fall. 5(3-5) B S 210, B S 211, B S 212. Primarily for Medical Technology students.
Biology of protozoan, helminth, and arthropod infections of humans. Laboratory diagnosis of these infections.

440. Food Microbiology
Spring. 3(3-0) MPH 200 or MPH 301 or approval of department. 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.

441. Food Microbiology Laboratory
Spring. 2(0-4) FSC 440 or concurrently or approval of department. Interdepartmental with and administered by Food Science.
Laboratory practice with major groups of microorganisms of importance to the food industry. Concurrent enrollment in FSC 440 recommended.

444. Environmental Microbiology
Spring. 3(2-4) MPH 200 or MPH 301.
Flora, methods of testing, and purification of environmental air and water. Treatment and disposal of sewage.

461. Medical Immunology and Microbiology
Winter. 5(5-0) MPH 301, MPH 302. Interdepartmental with Medical Technology.
The immune system, cellular interaction of the in vitro and in vivo reaction, and associated immunopathology. Characterization of infectious agents and their pathogenic processes.

464. Medical Microbiology and Immunology Laboratory
Winter. 2(0-6) MPH 462, MPH 463 or concurrently.
Basic immunologic and taxonomic laboratory techniques of selected bacterial pathogens.

IDC. Biological Membranes
For course description, see Interdisciplinary Courses.

490. Special Problems in Microbiology
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. Approval of department.
Tutorial instruction in laboratory or library research for advanced undergraduates.

503. Introduction to Medical Biology
Fall. 5(5-0) Admission to the College of Human Medicine. Interdepartmental with the departments of Biochemistry, Physiology, and Pharmacology and Toxicology.
Principles of medical biology for medical students.

511. Medical Microbiology and Immunology
Winter. 1 to 5 credits. May reenroll for a maximum of 5 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 humans.

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

521. Medical Microbiology and Immunology
Winter. 1 to 6 credits. May reenroll 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 humans.

531A. Medical Microbiology: Immunology
Winter. 4(3-2) Second-term Veterinary Medicine students or approval of department.
Basic principles of immunology (immunobiology and immunochemistry) and their relation to disease in animals.

531B. Medical Microbiology: Bacteriology and Mycology
Spring. 5(3-6) Third-term Veterinary Medicine students or approval of department.
Basic principles of bacteriology and mycology and their relation to disease in animals.

531C. Medical Microbiology: Virology

Fall. 3(2-2) Fourth-term Veterinary Medicine students or approval of department.

General properties of animal viruses; pathogenesis, immune response and immunoprophylasis in viral diseases; principles of clinical virology.

531D. Medical Microbiology: Parasitology

Winter. 4(3-3) Fifth-term Veterinary Medicine students or approval of department.

Basic principles of parasitology (protozoology, helminthology, and entomology) and their relation to disease in animals.

618. Infectious Disease Clerkship

Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602 and MED 608 or PHD 608. Interdepartmental with and administered by the Department of Medicine.

The clerkship emphasizes acquisition in depth of knowledge and skills essential in solution of clinical problems in infectious and immunologic diseases. Integrated basic science input is afforded through relevant seminars.

800. Seminar

Fall, Winter, Spring, Summer. 1(1-0) May reenroll for a maximum of 9 credits. Approval of department.

810. Topics in Microbiology

Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 10 credits if different topic is taken. Approval of department.

Topics will be selected from taxonomic subsciences such as bacteriology, virology, protozoology, mycology, and helminthology; from transecting disciplines such as microbial genetics, immunology, physiology, and ecology.

813. Molecular Virology

Winter. 4(4-0) Background in biochemistry, and approval of department.

Molecular nature and biochemistry of replication of bacterial and animal viruses. Emphasis is on current advances, research concepts, and the role of viruses in molecular biology research.

821. Advanced Microbial Physiology

Spring of even-numbered years. 4(4-0) MPH 303.

Mechanism and regulation of physiologic and metabolic activities unique to procaryotes including fermentation, photosynthesis, respiration and autotrophy.

823. Microbial Genetics

Fall. 3(3-0) BCH 811.

Gene structure, gene function, and genetic regulation at the classical and molecular levels in prokaryotes and lower eukaryotes.

827. Immunochemistry

Spring. 3(3-0) MPH 427; BCH 452, or ZOL 441, and CEM 383 recommended.

Structure and reactivity of antigens and antibodies; synthesis of immunoglobulins. Emphasis is on current advances and research concepts.

829. Host-Parasite Relationships

Fall. 3(3-0) MPH 427, MPH 429 or approval of department.

Pathogenesis and host responses to selected bacterial, parasitic, and fungal pathogens. Emphasis is on current research models which exemplify a variety of host-parasite relationships.

831. Bacterial Diversity

Spring of odd-numbered years. 3(3-0) MPH 303, MPH 304; BCH 401 or BCH 453 or concurrently.

Morphological and physiological properties of diverse groups of bacteria and how these properties relate to their ecological niche and importance.

832. Bacterial Diversity Laboratory

Spring of odd-numbered years. 2(0-6) MPH 831 or concurrently.

Representative groups of bacteria will be isolated and studied.

842. Advanced Soil Microbiology

Fall of odd-numbered years. 3(3-0) MPH 425 or approval of department. Interdepartmental with the Department of Crop and Soil Sciences.

Biochemistry, biology, and community ecology of microorganisms indigenous to soil. Emphasis on current research problems.

843. Soil Microbiology Laboratory

Fall of odd-numbered years. 2(0-6) MPH 842 concurrently or approval of department. Interdepartmental with the Department of Crop and Soil Sciences.

Fundamental techniques of dealing with microorganisms indigenous to soil. Metabolic activity of microorganisms. Interaction between microorganisms and plants.

890. Special Problems in Microbiology

Fall, Winter, Spring, Summer. 2 to 6 credits. May reenroll for a maximum of 12 credits. Approval of department.

899. Master's Thesis Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

900. Topics in Microbiology

Fall, Winter, Spring, Summer. 2(2-0) May reenroll if different topic is taken. Approval of department.

Topics will be selected from taxonomic subsciences such as bacteriology, virology, protozoology, mycology, algology, and helminthology; and from transecting disciplines such as microbial genetics, immunology, physiology, and ecology.

999. Doctoral Dissertation Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

MILITARY SCIENCE M S

Office of the Provost

041. General Military Science

Application of leadership techniques, the decision making process and staff planning. Military customs and traditions. Students will concurrently enroll in a selected non-Military Science course to fulfill military professional requirements.

A. Leadership Fundamentals

Winter. 0(0-1) Approval of department.

B. Basic Military Skills

Winter. 0(0-1) Approval of department or M S II standing.

C. Advanced Military Skills

Winter. 0(0-1) Approval of department or M S III standing.

D. Leadership Applications

Winter. 0(0-1) Approval of department or M S IV standing.

121. Preview of Military Science

Fall, Winter, Spring. 1(1-0) Approval of department.

Role of the ROTC officer in the Army. Assists the student in planning a curriculum to satisfy requirements for a commission.

122. Marksmanship and Weapon Safety

Spring. 1(0-2) M S 121 or approval of department.

Small arms marksmanship and safety. Practical exercises on local firing ranges. Individual basic military marksmanship and the skills necessary to participate in a competitive or recreational shooting program.

221. Leadership and Health Care

Fall. 1(1-0) M S 121, M S 041A, M S 122.

Develop the leadership role in the health and welfare of subordinates and self. Includes injury prevention and emergency first aid techniques.

223. Land Navigation

Spring. 2(2-0) M S 121 and approval of department.

Use of military topographic maps and special use maps. Development of map profiles and overlays for tactical operations. Land navigation with lensatic and silva compass.

324. Leadership Through Training

Fall. 4(4-2) Basic course, approval of department.

Designing, preparing, and presenting effective training for individuals and groups.

325. Military Management

Spring. 4(3-2) M S 324 or approval of department.

Task analysis approach to missions. The subject of tactics is used as a teaching vehicle for the managerial approach to the preparation and exectution phases of military operations. Emphasis is placed on physical and moral leadership during the laboratory sections.

426. Military Law and Unit Administration

Fall. 2(2-0) Approval of department.

Military legal system and the responsibilities of the commander and junior leaders in the application of military justice. Operation and administration in military units to provide personnel and logistic support.

427. Seminar

Spring. 2(2-0) Approval of department.

Military professional ethics. Value inputs, reasoning, and decision making. Current military policies and trends as a pre-commission orientation.

499. Independent Study in Military Science

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Approval of department and Juniors.

Individual research and study in an area related to military science as approved and directed by the Department of Military Science.