909. Elastic Thin Shells
        Spring, (4-4) 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) MMM 815 or C E 804 or approval of department; MTH 421. 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.

914. Theory of Elasticity II
        Spring of odd numbered years, 3(3-0) MMM 813 or approval of department.
        Further topics in linear elasticity including complex variable solutions, elastodynamics, variational principles, St Venant's principle, anisotropic material behavior.

915. Theory of Elasticity III
        Spring of even numbered years, 3(3-0) MMM 813 or approval of department.

916. Fracture Mechanics
        Fall of even numbered years, 3(3-0) MMM 813.

917. Fatigue of Engineering Structures
        Fall of odd numbered years, 3(3-0) MMM 402 or approval of department.

918. Theory of Viscoelasticity
        Winter of even numbered years, 3(3-0) MMM 810.

940. Modern Problems in Materials Science
        Fall, Spring, 3(3-0) May reenroll for a maximum of 9 credits. Approval of department. Current field of research in ceramics, martensitic transformations, oxidation and corrosion, electron microscopy, recrystallization and textures.

941. Crystal Defects
        Winter of even numbered years, 3(3-0) MMM 825 or approval of department.
        Defects in thermodynamic equilibrium. Vacancies, Interstitials, color centers. Role of defects in diffusion, radiation damage. Geometrical and elastic properties of dislocations, dislocation reactions, grain boundary structures and kinetics.

942. Advanced Topics in Phase Transformations
        Winter of odd numbered years, 3(3-0) MMM 825 or approval of department.
        Precipitation and ripening, gradient energy terms, spinodal decomposition, surface and strain effects, allotropic and polytropic transformations, martensitic transformations, electronic effects, charge density waves, thermoelastic and shape memory alloys.

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

MICROBIOLOGY AND PUBLIC HEALTH

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

101. Preview of Microbiology
        Winter, 3(1-0) Open only to freshmen or sophomores without previous coursework in Microbiology.
        Overview of modern microbiology, emphasizing impact on society.

200. Elementary Microbiology Lectures
        Winter, 3(3-0) 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.

201. Elementary Microbiology Laboratory
        Winter, 1(0-2) MPH 200 or concurrently.
        Fundamentals of microbiological methodology including microscopy, staining, aerobic technique, culture media, growth, and control with disinfectants and antibiotics.

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 206.
        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 interactions.

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 immunological and genetic techniques and procedures.

390. Current Topics in Microbiology
        Winter, 3(3-0) May reenroll for a maximum of 6 credits. MPH 303, MPH 304, BCH 451, BCH 452 or concurrently, or approval of department.
        Students read, present and discuss journal papers treating microbial physiology, ecology or genetics, molecular biology, virology, immunology or host-microbe interactions.

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.

403. Elements of Cell Function and Structure
        Fall, 4(4-0) MPH 407, BCH 452 concurrently. Interdepartmental with the Department of Botany and Plant Pathology.
        Cell biology of eukaryotic cells, with an emphasis on the molecular mechanisms that underlie cellular processes.

406. Medical Mycology
        Spring, 4(2-6) BTO 320 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. Microbial Genetics
        Winter, 4(4-0) MPH 303; BCH 452 or concurrently.
        Genetics and molecular biology of bacteria and viruses with emphasis on the genetic principles developed from their study.

413. Virology
        Fall, 3(3-0) BCH 453 or MPH 403.
        Viruses and modern molecular biology, stressing principles of viral replication and gene expression of the major classes of viruses; viral diseases; some elements of epidemiology of viral infections.

416. General Parasitology
        Fall, Summer of odd numbered years.
        Given as W. K. Kellogg Boarding Summer of odd numbered years. Fall, 3(3-0) Summer of odd numbered years: 3 credits. B S 210, B S 211, B S 212 or LBS 141. Interdepartmental with the Department of Zoology.
        Life history, host-parasite relationships (including physiology, immunology, immunoparasitology and pathology) and epidemiology of selected groups and species of protozoan, nematode,cestode and nematode parasites.
Descriptions — Microbiology and Public Health of Courses

415. General Parasitology Laboratory
Fall. Summer of odd-numbered years. Given at W. K. Kellogg Biological Station. Summer of odd-numbered years: 2 credits. MPH 410 or concurrently or approval of department. Interdepartmental with the Department of Zoology.
Identification and life histories of representative species of major groups of animal parasites. Selected concepts of host-parasite associations will be tested experimentally.

421. Microbial Physiology
Winter. 3(3-0) MPH 303, MPH 304, BCH 452.
Cell structure and function, macromolecular synthesis and control.

426. Microbial Ecology
(MPH 425.) Spring. 3(3-0) MPH 301 or MPH 303. MPH majors must enroll concurrently in MPH 426A. Interdepartmental with the Department of Crop and Soil Sciences.
Microbial activities in natural ecosystems; their association with plants and animals, and their transformations of carbon, nitrogen and sulfur in soil and aquatic habitats.

426A. Microbial Ecology Recitation
(MPH 425A.), Spring. 1(1-0) MPH 426 concurrently. Interdepartmental with the Department of Crop and Soil Sciences.
Quantitative aspects of microbial ecology.

427. Immunobiology
Spring. 3(3-0) B 211 or approval of department.
Structure and function of molecules in the immune system, cellular participants and detection and measurement of immune responses; diversity; immunologic abnormalities; protective immune mechanisms. Experimental approaches to dissection of functions.

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
Winter. 3(3-5) B 5210, B 5211, B 5212. Prerequisite: Medical Technology students. Biology of protozoan, helmith, 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.

445. Basic Biotechnology
Spring. 3(3-0) MPH 300, MPH 301 or approval of department.
Growth and genetic improvement of industrial microorganisms, fermentation fundamentals, and specific classical and recombinant-based bioprocesses and biocatalysis of commercial importance will be covered.

460. Medical Microbiology
Fall. 3(3-0) MPH 302 or MPH 304, MPH 427 or approval of department, Interdepartmental with the Medical Technology Program.
Characterization of infectious agents and their pathogenic processes.

461. Medical Immunology and Microbiology
(MPH 462; MPH 483.) Winter. 5(5-0)
MPH 301, MPH 302. Students may not receive credit in both MPH 461 and MPH 427. Interdepartmental with Medical Technology.

464. Medical Microbiology and Immunology Laboratory
Fall. 2(0-6) MPH 490, MPH 427 or concurrently.
Basic immunologic and taxonomic laboratory techniques of selected bacterial pathogens.

470. Biological Membranes
(IDC 470.) Spring. 3(3-0) BCH 401.
Interdepartmental with the departments of Biochemistry, and Physiology. Administered by the Department of Physiology.
The chemistry, physics and mathematics of the permeability, energy transductions and surface functions of differentiated cell membranes and membranous organelles are compared. A brief discussion of theoretical and experimental models is included.

490. Special Problems in Microbiology
Fall, Winter, Spring. 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.

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.

531B. Medical Microbiology: Bacteriology and Mycology
Spring. 3(3-5) 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. 4(3-2) Fourth-term Veterinary Medicine students or approval of department.
General properties of animal viruses; pathogenesis, immune response and immunopathology 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.

800. Seminar
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 6 credits. Approval of department.

810. Topics in Microbiology
Fall, Winter, Spring. 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 sub-sciences such as bacteriology, virology, protozoology, mycology, and helminthology; from transecting disciplines such as microbial genetics, immunology, physiology, and ecology.

813. Molecular Virology
Winter of even-numbered years. 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 odd-numbered years. 4(4-0)
MPH 202.
Mechanism and regulation of physiological and metabolic activities unique to procaryotes including fermentation, photosynthesis, respiration and autotrophy.

823. Microbial Genetics
Fall. 3(3-0) BCH 811 or concurrently.
Gene structure, gene function, and genetic regulation at the classical and molecular levels in procaryotes and lower eukaryotes.

825. Cell Structure and Function
Spring. 4(4-0) BCH 451 or BCH 461 or approval of instructor. Interdepartmental with the departments of Biochemistry, and Physiology. Administered by the Department of Biochemistry.
Molecular basis of structure and function of cells. Fundamental properties of cells: reproduction, dynamic organization, integration, programmed and interactive information transfer considered through original investigations in all five kingdoms.

827. Immunocytochemistry
Spring of even-numbered years. 3(3-0)
MPH 427; BCH 452 or ZOL 441; CEM 383 recommended.
Structure and reactivity of antigens and antibodies; synthesis of immunoglobulins. Emphasis is on current advances and research concepts.
831. **Bacterial Diversity**  
Spring of even-numbered years. 3(0-6)  
M PH 302, 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 even-numbered years. 3(0-6) MPH 383 or concurrently.
Representative groups of bacteria will be isolated and studied.

842. **Advanced Soil Microbiology**  
Fall of odd-numbered years. 3(3-0) MPH 426 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. **Doctoral Dissertation Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

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

**MILITARY SCIENCE**

**Office of the Provost**

101. **Introduction to the Military Profession**  
(M S 121.) Fall, Winter, Spring. 1(1-1) Approval of department.
Analysis of the military profession from several academic perspectives. Exploration of the technical, ethical, and personal ramifications of service as an officer in the U.S. Army. Lab introduces military skills.

102. **Military Leadership I**  
(M S 041A.) Winter. 1(1-1) M S 101 or approval of department.  
Introduction to military leadership. Draws upon examples from military history to illustrate what a military leader must be, know, and do to lead soldiers in battle. Lab includes both military skills and leadership applications.

103. **Army Physical Fitness Training**  
Spring. 1(0-3) M S 102 or approval of department.  
The leader's role in implementing the Army Physical Fitness Program to provide for the physical well being of subordinates. Individual and group fitness programs are introduced. Includes rappelling and smallbore rifle marksmanship.

201. **Military First Aid**  
(M S 221.) Fall. 1(1-1) M S 103 or approval of department.  
Emergency first aid techniques including casualty evaluation, lifesaving measures, CPR, and environmental injury prevention. Lab includes military skills and first aid applications.

202. **Military Leadership II**  
(M S 041B.) Winter. 1(1-1) M S 201 or approval of department.  
Descriptive model of small unit leadership. Provides students with a realistic preview of the small unit leader's role in the Army. Lab includes small unit drill and ceremonies.

203. **Land Navigation**  
(M S 223.) Spring. 1(1-2) M S 202 or approval of department.  
Use of military topographic and special use maps to include interpretation, resection, modified resection, and polar coordinates. Development of overlays for tactical operations. Lab includes actual land navigation in the field using the lensatic compass.

301. **Command and Control Communications**  
Fall. 2(3-3) M S 303 or approval of department.  
Tactical wire and radio communications systems and employment during tactical operations to provide effective control of military operations. Encryption/decryption, use of codes, and electronic warfare. Lab emphasizes practical application of communication skills.

302. **Military Leadership III**  
Winter. 2(3-2) M S 301 or approval of department.  
Application of the theories and models of the behavioral sciences to leadership as it functions in a military environment. Case studies from military history. Lab emphasizes practical leadership applications.

303. **Small Unit Tactics**  
(M S 325.) Spring. 2(3-2) M S 302 or approval of department.  
Offensive and defensive military tactics. Incorporates practical exercises which allow cadets to view the modern battlefield through the eyes of the infantry platoon leader. Lab emphasizes tactical employment of the infantry squad and platoon.

401. **Training Management and Unit Administration**  
(M S 428.) Fall. 2(2-3) M S 303 or approval of department.  
The Army training management system and the leader's role as a trainer. Operations and administration in military units to provide effective personnel management and logistic support. Oral and written military communication. Lab includes practical experience in unit administration.

402. **Military Leadership IV**  
(M S 041B.) Winter. 2(3-2) M S 401 or approval of department.  
Leadership assessment, development, and training practices. Integration of theory, practice, and self-assessment in leadership development of subordinates and the role of the noncommissioned officer. Lab includes leadership development and assessment exercises.

403. **Military Law, Ethics, and Professionalism**  
(M S 427.) Spring. 2(3-2) M S 402 or approval of department.  
Military legal system and the responsibilities of leaders in the application of military justice. Examination of fundamental values and principles of conduct in the profession of arms. Lab includes practical exercises in professional development.

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.

**MUSIC**

**College of Arts and Letters**

112. **Chamber Music**  
Fall, Winter, Spring, Summer. 1(2-0) May reenroll for a maximum of 18 credits. Approval of department.  
Performance of works for small ensembles.

115. **Band**

A. **Marching Band**  
Fall. 1 credit. May reenroll for a maximum of 6 credits. Membership determined by audition.  
The Marching Band participates at football games.
B. **Spartan Brass**  
Winter. 1 credit. May reenroll for a maximum of 6 credits. Membership determined by audition.  
The Spartan Brass participates at basketball and hockey games.
C. **Concert Band**  
Fall, Winter, Spring. 1 credit. May reenroll for a maximum of 12 credits. Membership determined by audition.  
Public appearances are scheduled on campus each term.

D. **Symphony Band**  
Fall, Winter, Spring. 1 credit. May reenroll for a maximum of 12 credits. Membership determined by audition. High level of achievement in performing ability is required.  
Concerts are scheduled both on and off campus.
E. **Wind Symphony**  
Fall, Winter, Spring. 1 credit. May reenroll for a maximum of 12 credits. Membership determined by audition. The highest level of performance is required. Full range of wind literature is performed. Public concerts are presented both on and off campus.
F. **Campus Band**  
Fall, Winter, Spring. 1 credit. May reenroll for a maximum of 12 credits. Open to all MSU students in any academic discipline. Preparation for and participation in one concert.