912. Theory of Plates
Winter. 4(4-0) MME 615 or C E 604 or approval of department. 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) MME 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) MME 813 or approval of department. Introduction to finite elasticity. Kinematics of large deformations, kinetics, constitutive relation - general theory and particular models, solution of basic problems. Non-uniqueness. Singular fields near crack-tips. Material stability.

916. Fracture Mechanics

917. Fatigue of Engineering Structures
Fall of odd-numbered years. 3(3-0) MME 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
Winter of even-numbered years. 3(3-0) MME 816; 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.

940. Modern Problems in Materials Science
Fall, Spring. 3(3-0) May reenroll for a maximum of 6 credits. Approval of department. Courses in the field of ceramics, martensitic transformations, oxidation and corrosion, electron microscopy, recrystallization and textures.

941. Crystal Defects
Winter of even-numbered years. 3(3-0) MME 525 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) MME 525 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.

MATERIALS SCIENCE

Microscopy and Crystallography

913. General Microscopy
Fall. 3(3-0) BCH 452 or concurrently. Principles of microscope design and use. Microscope types, objectives, illuminating systems, specimen preparation, magnification, resolution, and microphotography.

301. Introductory Microbiology I
Fall, Spring. 3(3-0) CEM 242, CEM 244 or BCH 451. Fundamentals of microbiology. Bacteria, Mycology, and Mycology Laboratory. Survey of microorganisms and major groups of microorganisms. Laboratory diagnosis.

302. Introductory Microbiology Laboratory
Fall, Spring. 2(0-4) MPH 301 or concurrently. Methodology of microbiology. Introduction to the use of microscopes and the techniques of staining, identification, and quantification.

303. Microbiology I: General
Fall. 4(4-0) BCH 451 or concurrently. Principles of microbiology emphasizing cell structure and function, 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. Bacteria, the qualitative aspects of growth and death, and bacterial interactions.

305. General Microbiology Laboratory II
Spring. 3(1.5) MPH 304. Continuation of MPH 303 with emphasis on immunology 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, foodborne disease and foodservice regulations.

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 6 credits. Approval of department. A four-term research project with thesis.

403. Elements of Cell Function and Structure
(MPH 403). Spring. 4(4-0) MPH 407, BCH 453 concurrently. Interdepartmental with the Department of Botany and Plant Pathology. Cell biology of eukaryotic cells, with emphasis on the molecular mechanisms that underlie cellular processes.

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 fungi, fungi of food, and fungi 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) MPH 407. 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 at W. K. Kellogg Biological Station 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 BLS 341. Interdepartmental with the Department of Zoology. Life history, host-parasite relationships (including physiology, immunology, immunopathology and pathology) and epidemiology of selected groups and species of protozoa, trematode, cestode and nematode parasites.
421. Microbial Physiology
Winter. 3(3-0) MPH 303, MPH 304, BCH 453. 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
Winter. 3(3-0) MPH 406. Students may not receive credit in both MPH 427 and MPH 461.

431. Microbial Parasitology
Winter. 3(3-0) MPH 406. Students may not receive credit in both MPH 427 and MPH 461. 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.

439. 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. 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 300 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 ecologic, physiologic, and public health aspects.

441. Food Microbiology Laboratory
Spring. 2(0-4) FSC 410 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(3-4) MPH 200 or MPH 301. Flora, methods of testing, and purification of environmental air and water. Treatment and disposal of sewage.

445. Basic Biotechnology
Spring. 3(3-0) MPH 200, MPH 301 or approval of department. Growth and genetic improvement of industrial microorganisms, fermentation fundamentals, and specific classical and recombinant-based bioprocesses and biotransformations of commercial importance will be covered.

461. Medical Immunology and Microbiology

464. Medical Microbiology and Immunology Laboratory
Winter. 3(3-0) MPH 461 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 department of Biochemistry and Physiology. Administered by the Department of Physiology. The chemistry, physics and mathematics of the permeability, energy transduction and surface functions of differentiated cell membranes and membrane-bound organelles is 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 8 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(3-3) Second-year 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, Mycology
Spring. 5(3-0) Third-year 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(3-2) Fifth-term Veterinary Medicine students or approval of department. Basic principles of parasitology (protozoology, helminthology, and enzootiology) and their relation to disease in animals.

500. Seminar
Fall, Winter, Spring. 1(1-0) May reenroll for a maximum of 5 credits. Approval of department.

510. 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-disciplines such as bacteriology, virology, protozoology, mycology, and helminthology; from experimental disciplines such as microbial genetics, immunology, physiology, and ecology.

513. 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.

521. Advanced Microbial Physiology
Spring of even-numbered years. 4(4-0) MPH 500. Mechanism and regulation of physiologic and metabolic activities unique to procaryotes including fermentation, photosynthesis, respiration and autotrophy.

523. Microbial Genetics
Winter. 3(3-9) BCH 511. Gene structure, gene function, and genetic regulation at the classical and molecular levels in procaryotes and lower eukaryotes.

525. Cell Structure and Function
Spring. 4(4-0) BCH 451 or BCH 401 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.

527. Immunology
Spring. 3(3-2) 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.

531. 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.
MILITARY SCIENCE

Office of the Provost

101. Introduction to the Military Profession
(M S 121) Fall, Winter, Spring. 3(1-1)
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 401A) Winter. 3(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 small bore 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 casual first aid, lifesaving techniques, CPR, and environmental injury prevention. Lab includes military skills and first aid applications.

202. Military Leadership II
(M S 401B) Winter. 1(1-1) M S 201 or approval of department.
Descriptive model of small unit leadership. Provides cadets 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 222) Spring. 2(2-2) M S 202 or approval of department.
Use of military topographical and special use maps to include intersection, resection, modified resection, and polar coordinates. Development of overlays for tactical operations. Lab includes actual land navigation in the field using the electronic compass.

301. Command and Control Communications
Fall. 3(2-3) M S 203 or approval of department.
Tactical wire and radio communications systems and equipment. Lab emphasizes practical application of communication skills.

302. Military Leadership III
Winter. 3(2-3) 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 leadership applications.

303. Small Unit Tactics
(M S 325) Spring. 3(2-3) 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 426) Fall. 3(2-2) 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 logistical support. Oral and written military communication. Lab includes practical experience in unit administration.

402. Military Leadership IV
(M S 402) Winter. 3(2-2) 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. 3(2-2) 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. 1 to 3 credits. May reenroll for a maximum of 12 credits. Approval of department.
Individual research and study in any 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(1-0) May reenroll for a maximum of 18 credits. Approval of department.
Performance of works for small ensembles.

118. Band

A. Marching Band
Fall. 1 credit. May reenroll for credit. Membership determined by audition.
The Marching Band participates at football games.

B. Spartan Brass
Winter. 1 credit. May reenroll for credit. Membership determined by audition.
The Spartan Brass participates at basketball games.

C. Concert Band
Fall, Winter. Spring. 1 credit. May reenroll for credit. Membership determined by audition.

D. Symphony Band
Fall, Winter, Spring. 1 credit. May reenroll for a maximum of 12 credits. Membership determined by audition. A 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.