

METALLURGY, MECHANICS, AND MATERIALS SCIENCE

960*. **Advanced Physical and Mechanical Properties of Materials(MTC)**
 Fall. 3(3-0) May reenroll for a maximum of 9 credits.
 P: Depend on subtitle R: Graduate students *Materials Science and Engineering, Mechanics*
 Subtitles: Microcracking in Brittle Materials. Anisotropic Crystalline Properties. Surfaces, Interfaces and Thin Film Structures.

960A*. **Microcracking in Brittle Materials**
 Fall. 3(3-0)
 P: MMM 454, MMM 875 R: Graduate students *Materials Science and Engineering, Mechanics*
 Microcracking mechanisms and the effect of microcracks on mechanical, thermal and electrical properties. Microcracking theories. Experimental investigations of microcracks.

960B*. **Anisotropic Crystalline Properties**
 Fall. 3(3-0)
 P: MMM 451, MMM 851 R: Graduate students *Materials Science and Engineering, Mechanics*
 Crystallography. Tensor representation. Magnetic susceptibility. Electric polarization. Stress and strain. Thermal expansion. Piezoelectricity. Elasticity. Transport properties.

960C*. **Surfaces, Interfaces and Thin Film Structures**
 Fall. 3(3-0)
 P: MMM 851, MMM 855, MMM 860 R: Graduate students *Materials Science and Engineering*
 Fundamental thermodynamic, kinetic, and mechanical aspects of surfaces, boundary structures, and thin films, with application to current and emerging techniques for control of surface and interface properties and fabrication of thin film structures.

970*. **Advanced Analytical Techniques(MTC)**
 Spring. 3(3-0) May reenroll for a maximum of 9 credits.
 P: Depends on subtitle R: Graduate students *Materials Science and Engineering*
 Subtitles: Advanced Techniques in Electron Microscopy. Advanced Analytical Methods in Materials Science. Advanced X-ray Methods.

970A*. **Advanced Techniques in Electron Microscopy**
 Spring. 3(3-0)
 P: MMM 870 R: Graduate students MSE or permission of instructor
 Advanced experimental methods in transmission electron microscopy. Includes, microanalytical, chemical, microbeam, diffraction and lattice imaging techniques.
 QP: MMM 832

970B*. **Advanced Analytical Methods in Materials Science**
 Spring. 3(3-0)
 P: MMM 451, MMM 870 R: Graduate students *Materials Science and Engineering*
 Advanced diffraction, fluorescence, spectrographic and microimaging techniques and their application to problems of structure determination and compositional analysis in materials science.
 QP: MMM 430 MMM 832

970C*. **Advanced X-ray Methods**
 Spring. 3(3-0)
 P: MMM 451 R: Graduate students *Materials Science and Engineering*
 Theoretical basis for advanced X-ray techniques useful in crystal structure analysis and materials research.
 QP: MMM 430

980*. **Advanced Processing Techniques(MTC)**
 Spring. 3(3-0) May reenroll for a maximum of 9 credits.
 P: Depend on subtitle R: Graduate students *Materials Science and Engineering*
 Subtitles: Ceramic Processing. High Temperature Deformation and Processing. Laser and plasma processing.

980A*. **Ceramic Processing**
 Spring. 3(3-0)
 P: MMM 851, MMM 875 R: Graduate students *Materials Science and Engineering*
 Fundamental aspects of ceramic powder processing with emphasis upon recent developments and the underlying principles involved. The class is organized in the order of the processing stream from making the powder to consolidation.
 QP: MMM 824 MMM 849

980B*. **High Temperature Deformation and Processing**
 Spring. 3(3-0)
 P: MMM 851, MMM 860 R: Graduate students *Materials Science Engineering*
 Theoretical and design principles needed to understand and control creep, superplasticity, cavitation, recrystallization, and texture changes are discussed for metal, alloy, intermetallic, ceramic and composite systems.
 QP: MMM 825 MMM 872

980C*. **Laser and Plasma Processing**
 Spring. 3(3-0)
 Application of laser and plasma technology in materials processing. Optical and surface properties. Thin films. Heat and mass flow. Heat-treating. Cutting, drilling, and joining.

990*. **Special Problems**
 Fall, Spring, Summer. 1 to 3 credits.
 May reenroll for a maximum of 6 credits.
 R: Graduate students *Materials Science and Engineering, Mechanics*, Individualized reading and research compatible with that expected of Doctoral candidates.
 QA: MMM 900

991*. **Selected Topics**
 Fall, Spring, Summer. 1 to 3 credits.
 May reenroll for a maximum of 6 credits.
 P: Depend on topic selected R: Graduate Students *Materials Science and Engineering, Mechanics*
 Special advanced topics in Materials Science and Engineering, and Mechanics.

999*. **Doctoral Dissertation Research**
 Fall, Spring, Summer. 1 to 12 credits.
 May reenroll for a maximum of 0 credits.
 R: Doctoral students *Materials Science and Engineering, Mechanics*
 Doctoral dissertation research
 QA: MMM 999

MICROBIOLOGY AND PUBLIC HEALTH MPH

101*. **Preview of Microbiology**
 Fall. 1(1-0)
 R: Open only to freshmen and sophomores.
 Not open to students with credit in a microbiology course.
 Overview of modern microbiology, emphasizing impact on society.
 QA: MPH 101

205. **Allied Health Microbiology**
 Fall. 3(3-0)
 P: CEM 141 or CEM 151.
 Microbial structure, function, growth, death, and control related to medical and public health concerns. Host-parasite relationships, immunology, action of major pathogenic groups. Commercial applications of microbiology.
 QP: CEM 141

206. **Allied Health Microbiology Laboratory**
 Fall. 1(0-2)
 P: MPH 205 or concurrently.
 Fundamentals of microbiological techniques including microscopy, staining, aseptic technique, culture media, identification, control with disinfectants and antibiotics, and safety in the microbiological laboratory.
 QP: MPH 200

301*. **Introductory Microbiology**
 Spring. 3(3-0)
 P: CEM 251.
 Fundamentals of microbiology, including microbial structure and function, nutrition and growth, death and control. Importance and applications of major microbial groups.
 QP: CEM 241 QA: MPH 301 MPH 303

302*. **Introductory Microbiology Laboratory**
 Spring. 1(0-3)
 P: MPH 301 or concurrently.
 Methodology of microbiology: microscopy, staining, aseptic technique, culture media, quantification, and laboratory safety.
 QP: MPH 301 ORMPH 303 CONCURR QA: MPH 302 MPH 304

401*. **Prokaryotic Physiology and Genetics**
 Fall. 4(4-0)
 P: MPH 301; BCH 461 or concurrently.
 Prokaryotic cell structure and function, macromolecular synthesis and control, unique metabolic pathways, and genetics of bacteria and bacteriophages.
 QP: MPH 303 ORMPH 301 BCH 451 QA: MPH 407 MPH 421

403*. **Eukaryotic Cells and Viruses**
 Spring. 4(4-0)
 P: BCH 462 or concurrently.
 Molecular analyses of eukaryotic cell structure and function, growth and division. Cell-cell communication and signalling. Virus structure and replication strategies, virus-cell interactions.
 QP: MPH 303 BCH 453 QA: MPH 403 MPH 413

408*. **Advanced Microbiology Laboratory**
 Fall. 3(1-6)
 P: MPH 302; MPH 401 or concurrently.
 R: Open only to Microbiology majors.
 Microbiological techniques and procedures to study physiology and genetics of bacteria and bacteriophages. Collection and critical assessment of quantitative data and written communication of results.
 QP: MPH 303 QA: MPH 304 MPH 306

425*. **Microbial Ecology**
 Spring. 3(3-0) Interdepartmental with the Department(s) of Crop and Soil Sciences.
 P: MPH 301
 Microbial population and community interactions; microbial activities in natural systems, including associations with plants or animals
 QP: MPH 301 ORMPH 303 QA: MPH 426 MPH 426A

MICROBIOLOGY AND PUBLIC HEALTH

- 426*. Biogeochemistry**
 Summer. 3(1-4) Interdepartmental with the Department(s) of Geological Sciences, Crop and Soil Sciences, Zoology.
 P: BS 110 or BS 111, CEM 143 or CEM 251
 Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Studies in aquatic and terrestrial habitats will link to practical and societal applications.
 QP: BS 210 BS 211BS 212ANDCEM 143
- 445*. Basic Biotechnology**
 Fall. 3(3-0)
 P: MPH 205 or MPH 301.
 Growth and genetic improvement of industrial microorganisms. Fermentation fundamentals. Specific classical and recombinant-based bioprocesses and bioconversions of commercial importance.
 QP: MPH 200 ORMPPH 301ORMPPH 303 QA: MPH 445
- 451*. Immunology**
 Fall. 3(3-0)
 P: MPH 403 or concurrently.
 Structure and function of molecules involved in immune responses. Quantitation of immune responses and cellular participants. Immunologic abnormalities. Immunotherapy. Experimental approaches to dissection of immune functions.
 QP: BS 211 QA: MPH 427
- 461*. Molecular Pathogenesis**
 Spring. 3(3-0)
 P: MPH 401; MPH 403 or concurrently.
 Molecular basis of microbial virulence. Nature of determinants and their role in overcoming host defense mechanisms.
 QP: MPH 407 MPH 413 QA: MPH 429
- 463*. Medical Microbiology**
 Fall. 3(3-0)
 P: MPH 301.
 Properties of pathogenic bacteria and viruses and their mechanisms of pathogenicity.
 QP: MPH 301 ORMPPH 303 QA: MPH 461
- 464*. Diagnostic Microbiology Laboratory**
 Fall. 1(0-3.)
 P: MPH 463 or concurrently. R: Open only to Microbiology and Medical Technology and Clinical Laboratory Sciences majors.
 Diagnostic procedures for the identification of pathogenic bacteria.
 QP: MPH 461 QA: MPH 464
- 471*. Medical Parasitology**
 Spring. 2(1-2)
 P: MPH 302. R: Open only to Medical Technology and Clinical Laboratory Sciences majors. Biology and laboratory diagnosis of protozoan and helminth infections of humans.
 QP: BS 210 BS 211BS 212 QA: MPH 437
- 490*. Special Problems in Microbiology**
 Fall, Spring, Summer. 1 to 3 credits.
 May reenroll for a maximum of 6 credits.
 R: Approval of department.
 Library research or tutorial instruction in advanced laboratory techniques.
 QA: MPH 490
- 491*. Current Topics in Microbiology**
 Spring. 3(3-0)
 P: MPH 401, MPH 403 or concurrently.
 R: Open only to Microbiology majors.
 Capstone experience for Microbiology majors. Presentation and discussion of journal articles, and writing position papers. Topics include: microbial physiology, ecology, genetics, molecular biology, virology, immunology, or pathogenesis.
 QP: MPH 303 MPH 407 QA: MPH 390
- 492*. Undergraduate Research Seminar**
 Spring. 1(1-0)
 C: MPH 499 or MPH 499H R: MPH
 Presentation and group discussion of undergraduate research results. Successful completion of research and seminar constitutes a capstone experience for the Microbiology major.
 QP: MPH 490
- 499*. Undergraduate Research**
 Fall, Spring, Summer. 1 to 3 credits.
 May reenroll for a maximum of 6 credits.
 R: Open only to Microbiology majors.
 Participation in a laboratory research project. Together with MPH 492 constitutes a capstone experience.
 QA: MPH 490
- 499H*. Honors Research**
 Fall, Spring, Summer. 1 to 3 credits.
 May reenroll for a maximum of 6 credits.
 R: Open only to Honors College students and Microbiology majors.
 A three-or-more semester research project with thesis and oral report. A portion of Microbiology capstone experience.
 QA: MPH 400H
- 522. Medical Microbiology and Immunology**
 Spring. 5(4-2)
 R: Graduate-professional students in colleges of Human and Osteopathic Medicine.
 Basic principles of microbiology (bacteriology, virology, mycology and parasitology) and immunology and their relation to disease in humans.
- 531C*. Medical Microbiology: Virology**
 Fall. 3(2-2)
 P: Completion of Year 1 of the College of Veterinary Medicine. R: Year 2 College of Veterinary Medicine Veterinary Medicine none
 General properties of animal viruses: pathogenesis, immune response and immunoprophylaxis in viral diseases; principles of clinical virology.
- 531D*. Medical Microbiology: Parasitology**
 Fall. 3(2-3)
 P: Completion of Year 1 of the College of Veterinary Medicine. R: Year 2 College of Veterinary Medicine Veterinary Medicine none
 Basic principles of parasitology(protozoology, helminthology, and entomology) and their relation to disease in animals.
- 561*. Veterinary Immunology**
 Spring. 2(2-0)
 P: Admission to the College of Veterinary Medicine. R: College of Veterinary Medicine Veterinary Medicine none
 Basic scientific concepts of immunochemistry, immunobiology, and immunopathology as they relate to the healthy state and the host response to infection and parasitism.
- 563*. Principles of Medical Bacteriology, Mycology, Parasitology and Virology**
 Spring. 4(3-3)
 P: Admission to the College of Veterinary Medicine. R: College of Veterinary Medicine Veterinary Medicine none
 Structure, function and diagnostic characteristics of bacteria, fungi, helminths,protozoa, and viruses as related to pathogenicity and control; role of arthropods in disease transmission; action of antimicrobial agents; disfunction.
- 565*. Bacterial, Mycotic, Parasitic and Viral Diseases**
 Fall. 6(6-0)
 P: Admission to the College of Veterinary Medicine. R: College of Veterinary Medicine Veterinary Medicine none
 Mechanisms of pathogenesis of selected infectious diseases of common animal species; antibacterial and antifungal therapy; viral and parasitic diagnosis, epidemiology and management; host immune response.
- 813*. Molecular Virology**
 Spring of odd-numbered years. 3(3-0)
 R: graduate students
 Molecular nature and biochemistry of replication of animal viruses. Emphasis is on current advances, research concepts, and the role of viruses in molecular biology research.
 QA: 813
- 821*. Microbial Physiology**
 Spring of odd-numbered years. 3(3-0)
 P: MPH 401 R: graduate students
 Molecular architecture, assembly of cell parts, metabolism, and general physiology of typical eubacteria.
 QP: MPH 303 QA: 821
- 827*. Bacterial Diversity**
 Fall of odd-numbered years. 3(3-0)
 P: MPH 401 and BCH 461 R: graduate students
 Morphological and physiological properties of diverse groups of bacteria and the relation of these properties to ecological niche and importance.
 QP: MPH 303 MPH 304BCH 401BCH 453 QA: 831
- 828*. Bacterial Diversity Laboratory**
 Fall of odd-numbered years. 2(0-6)
 P: MPH 827 or concurrent R: graduate students
 Representative groups of bacteria will be isolated and studied.
 QP: MPH 831 QA: 832
- 833*. Microbial Genetics**
 Fall. 3(3-0)
 R: graduate students
 Gene structure and function, genetic regulation at the classical and molecular levels in prokaryotes and lower eukaryotes.
 QP: BCH 811 QA: 823
- 841*. Soil Microbiology**
 Spring of even-numbered years. 3(3-0)
 Interdepartmental with the Department(s) of Crop and Soil Sciences.
 P: MPH 425 R: graduate students
 Ecology, physiology, and biochemistry of microorganisms indigenous to soil. Emphasis on current research techniques.
 QP: MPH 426 QA: MPH 842
- 851*. Immunology**
 Fall of odd-numbered years. 3(3-0)
 R: graduate students
 Functional aspects of immune responses; synthesis, structure, and function of effector molecules; cell-cell interactions; emphasis on current advances and research techniques.
 QP: MPH 427 BCH 451 QA: 851
- 890*. Special Problems in Microbiology Clerkship**
 Fall, Spring, Summer. 2(-)
 P: Completion of Year 3 of the College of Veterinary Medicine R: Year 4 College of Veterinary Medicine Veterinary Medicine none
 In-depth study of special student interest areas.

MICROBIOLOGY AND PUBLIC HEALTH

892* Seminar
 Fall, Spring. 1(1-0) May reenroll for a maximum of 6 credits.
 R: Graduate students

QA: 800

899* Master's Thesis Research
 Fall, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 24 credits.
 R: graduate students

QA: MPH 899

991* Current Topics in Microbiology
 Fall, Spring. 1 to 3 credits. May reenroll for a maximum of 6 credits.
 R: graduate students

Topics are selected from taxonomic subsciences such as bacteriology, virology, cell biology, immunology and from from transecting subdisciplines such as genetics, physiology, molecular biology and ecology.
 QA: MPH 900

999* Doctoral Dissertation Research
 Fall, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 36 credits.
 R: graduate students

QA: MPH 999

MILITARY SCIENCE MS

101. Leadership: The Military Profession
 Fall, Spring, Summer. 1(1-1)

Analysis of military profession from several academic perspectives. Technical, ethical, and personal ramifications of officership. Introduction to military leadership. Lab introduces military skills.
 QA: MS101 MS102

102. Leadership: Land Navigation
 Fall, Spring. 1(1-1)

Military topographic and special maps: intersection, resection, modified resection, and polar coordinates. Tactical operation overlays. Preview of small unit leader's role in the Army. Lab: use of lensatic compass.
 QA: MS102 MS203

201. Leadership Assessment Program, the Military Leader
 Fall, Spring, Summer. 1(1-1)

Individual leadership development using standardized assessment technology. Administration, personal relations, and decision making. Military writing and professional obligations. Lab includes rappelling and marksmanship.
 QP: MS103 QA: MS201 MS202

202. Leadership: First Aid/Fitness Training
 Fall, Spring, Summer. 1(1-1)

Emergency first aid including casualty evaluation, lifesaving measures, CPR, and environmental injury prevention. Leader's role in implementing Army Physical Fitness Program. Individual and group fitness programs. Lab: hands on leadership training.
 QP: MS201 QA: MS103 MS201

301. Leadership: Command and Control Communication
 Fall, Spring, Summer. 3(2-3)
 P: MS 202.

Wire and radio communications for tactical operations. Encryption/decryption, use of codes, and electronic warfare. Theories and models of behavioral sciences for leadership. Lab emphasizes communication skills.
 QP: MS 202 QA: MS301 MS302

302. Leadership: Small Unit Tactics
 Fall, Spring, Summer. 3(2-2)
 P: MS 301.

Military topographic and special maps: intersection, resection, modified resection, and polar coordinates. Tactical operation overlays. Preview of small unit leader's role in the Army. Lab: use of lensatic compass.
 QP: MS301 QA: MS302 MS303

401. Leadership: Management
 Fall, Spring, Summer. 3(2-3)
 P: MS 302.

Army training personnel administration and logistics systems, and the leader's role as a trainer and effective manager. Oral and written communication. Leadership assessment and development. Lab: practical experience in unit administration.
 QP: MS302 QA: MS401 MS402

402. Military Law, Ethics and Professionalism
 Spring, Summer. 3(2-3)
 P: MS 401.

Military legal system. Application of military justice. Fundamental values and principles of conduct in the profession of arms. Development of subordinates and the role of noncommissioned officers. Lab includes leadership development assessment.
 QP: MS401 QA: MS402 MS403

490. Independent Study in Military Science
 Fall, Spring, Summer. 1 to 4 credits.
 R: Open only to juniors and seniors.

Approval of department.
 Individual research in areas related to military science.
 QA: MS499

MUSIC MUS

112*. Chamber Music
 Fall, Spring. 1(0-2) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of broad range of chamber music literature.
 QA: MUS 112

114*. Marching Band
 Fall. 1(0-9) May reenroll for a maximum of 6 credits.
 R: Audition required.

Rehearsal and performance of broad range of marching band literature at football games.
 QA: MUS 118A

115*. Spartan Brass
 Spring. 1(0-2) May reenroll for a maximum of 6 credits.
 R: Audition required.

Rehearsal and performance of broad range of brass literature at basketball and hockey games.
 QA: MUS 118B

116. Campus Band
 Fall, Spring. 1(0-3) May reenroll for a maximum of 10 credits.

Rehearsal and performance of broad range of band literature chosen from baroque period to the present.
 QA: MUS 118F

117*. Concert Band
 Fall, Spring. 1(0-3) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of broad range of wind literature from various historical periods and styles.
 QA: MUS 118C

118*. Wind Symphony
 Fall, Spring. 1(0-5) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of broad range of wind literature from various periods and styles.
 QA: MUS 118E

120*. Symphony Orchestra
 Fall, Spring. 1(0-5) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of symphonic and operatic repertoire.
 QA: MUS 133A

121*. Chamber Orchestra
 Fall, Spring. 1(0-4) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of representative chamber works of baroque, classic and contemporary composers.
 QA: MUS 133B

123*. Collegiate Choir
 Fall, Spring. 1(0-3) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of representative literature for mixed choir with emphasis on renaissance, baroque, classical, romantic, and contemporary composers.
 QA: MUS 189

124*. Choral Union
 Fall, Spring. 1(0-2) May reenroll for a maximum of 10 credits.
 R: Audition required.

University and community chorus. One evening rehearsal per week, culminating in performance of a major work with orchestra.
 QA: MUS 191

125. Glee Club, Men and Women
 Fall, Spring. 1(0-3) May reenroll for a maximum of 10 credits.

Rehearsal and performance of broad range of choral literature chosen from medieval period to the present.
 QA: MUS 192

126*. State Singers
 Fall, Spring. 1(0-4) May reenroll for a maximum of 10 credits.
 R: Audition required.

Mixed choir performing music from all periods.
 QA: MUS 190

127*. University Chorale
 Fall, Spring. 1(0-4) May reenroll for a maximum of 10 credits.
 R: Audition required.

Mixed chamber choir for experienced singers performing representative literature from all periods.
 QA: MUS 193

129*. Percussion Ensemble
 Fall, Spring. 1(0-3) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance of representative works for percussion and mallet ensembles.
 QA: MUS 112

130*. Jazz Band
 Fall, Spring. 1(0-4) May reenroll for a maximum of 10 credits.
 R: Audition required.

Rehearsal and performance in large jazz ensemble. Literature from classic bands of Ellington and Basie to contemporary composers.
 QA: MUS 195