960A*. Advanced Physical and Mechanical Properties of Materials (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.
R: Graduate students Materials Science and Engineering.

960A*. Advanced Physical and Chemical Properties of Materials (MTC) Fall. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.
Subtitles: Advanced methods in transmission electron microscopy; Advanced techniques in electron microscopy.

960B*. Anisotropic Crystalline Properties Fall. 3(3-0)
P: MMM 451, MMM 855, MMM 860 R: Graduate students Materials Science and Engineering.
Subtitles: Advanced methods in transmission electron microscopy.
R: Graduate students Materials Science and Engineering.

960C*. Surfaces, Interfaces and Thin Film Structures Spring. 3(3-0)
P: MMM 551, MMM 855, MMM 860 R: Graduate students Materials Science and Engineering.
Subtitles: Advanced techniques in electron microscopy; Advanced analytical methods in materials science.
R: Graduate students Materials Science and Engineering.

960D*. 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.

960E*. Advanced X-ray Methods Spring. 3(3-0)
P: MMM 451 R: Graduate students Materials Science and Engineering.
R: Graduate students Materials Science and Engineering.

960F*. Advanced Physical and Mechanical Properties of Materials (MTC) Spring. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960G*. Advanced Physical and Chemical Properties of Materials (MTC) Fall. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960H*. Anisotropic Crystalline Properties Fall. 3(3-0)
P: MMM 451, MMM 851 R: Graduate students Materials Science and Engineering.
Subtitles: Microcracking in Brittle Materials.
R: Graduate students Materials Science and Engineering.

960I*. 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.

960J*. Advanced X-ray Methods Spring. 3(3-0)
P: MMM 451 R: Graduate students Materials Science and Engineering.
R: Graduate students Materials Science and Engineering.

960K*. Advanced Physical and Chemical Properties of Materials (MTC) Spring. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960L*. Advanced Physical and Chemical Properties of Materials (MTC) Fall. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960M*. Advanced Physical and Chemical Properties of Materials (MTC) Spring. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960N*. 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.

960P*. Advanced X-ray Methods Spring. 3(3-0)
P: MMM 451 R: Graduate students Materials Science and Engineering.
R: Graduate students Materials Science and Engineering.

960Q*. Advanced Physical and Chemical Properties of Materials (MTC) Spring. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960R*. 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.

960S*. Advanced X-ray Methods Spring. 3(3-0)
P: MMM 451 R: Graduate students Materials Science and Engineering.
R: Graduate students Materials Science and Engineering.

960T*. Advanced Physical and Chemical Properties of Materials (MTC) Spring. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960U*. 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.

960V*. Advanced X-ray Methods Spring. 3(3-0)
P: MMM 451 R: Graduate students Materials Science and Engineering.
R: Graduate students Materials Science and Engineering.

960W*. Advanced Physical and Chemical Properties of Materials (MTC) Spring. 3(3-0) May reenroll for a maximum of 9 credits.
P: Depends on subtitle.
R: Graduate students Materials Science and Engineering.

960X*. 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.

960Y*. Advanced X-ray Methods Spring. 3(3-0)
P: MMM 451 R: Graduate students Materials Science and Engineering.
R: Graduate students Materials Science and Engineering.
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 bioconversions and bioconversions of commercial importance.
QP: MPH 300 OR MPH 301 OR MPH 303
QA: MPH 445

451*. ImmunoLOGY
Fall. 4(3-1)
P: MPH 403 or concurrently.
QP: BS 211, QA: MPH 427

461*. Molecular Pathogenesis
Spring. 4(3-1)
P: MPH 401 or 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 205
Properties of pathogenic bacteria and viruses and their mechanisms of pathogenicity.
QP: MPH 301 ORMPH 303 QA: MPH 461

464*. Diagnostic Microbiology Laboratory
Fall. 1(0-3)
P: MPH 403 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(2-1)
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 211 BS 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)
P: MPH 499 or MPH 495 or R: MPH 490. Presentation and aggregate 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

522. Medical Microbiology and Immunology
Spring. 5(4-1)
P: 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(2-1)
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(2-1)
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 immunohematology, immunopathology, 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, helminth parasites, and viruses as related to pathogenicity and control; role of arthropods in disease transmission; action of antimicrobial agents; dysfunction.

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)
P: MPH 401. 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

816*. 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 even-numbered years. 3(3-0)
P: MPH 401 and BCH 461. R: graduate students
Representative groups of bacteria will be isolated and studied.
QP: MPH 831 QA: 832

833*. Microbial Genetics
Fall. 3(3-0)
P: 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)
P: 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 461 QA: 851

890*. Special Problems in Microbiology Clerkship
Fall, Spring, Summer. 2(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.
993. Seminar
Fall, Spring. 1(1-0) May reenroll for a maximum of 6 credits. 
R: Graduate students
QA: 800

994. Master’s Thesis Research
Fall, Spring, Summer. 1 to 12 credits. 
May reenroll for a maximum of 24 credits. 
R: graduate students
QA: MPH 999

995. Current Topics in Microbiology
Fall, Spring. 1 to 3 credits. 
May reenroll for a maximum of 6 credits.
Topics are selected from taxonomic experiences such as bacteriology, virology, cell biology, immunology and from within the subdisciplines such as genetics, physiology, molecular biology and ecology.
QA: MPH 990

996. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 12 credits. 
May reenroll for a maximum of 30 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.
QA: 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.
QA: MS201 QA: MS103 MS201

301. Leadership: Command and Control Communication
Fall, Spring, Summer. 3(3-2) 
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.
QA: MS 202 QA: MS301 MS302

302. Leadership: Small Unit Tactics
Fall, Spring, Summer. 3(3-2) 
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.
QA: MS301 QA: MS302 MS303

401. Leadership: Management
Fall, Spring, Summer. 3(2-3) 
P: MS 305 
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.
QA: MS302 QA: MS301 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 commissioned officers. Lab includes leadership development assessment.
QA: MS401 QA: MS402 MS403

403. 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 8 credits. 
R: Audition required.
Rehearsal and performance of broad range of marching band literature at football games.
QA: MUS 113A

115*. Spartan Band
Spring, 1(0-3) May reenroll for a maximum of 8 credits.
R: Audition required.
Rehearsal and performance of broad range of brass literature at basketball and hockey games.
QA: MUS 115B

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 selected from baroque period to the present.
QA: MUS 113F

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 band literature selected from baroque period to the present.
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 historical 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, classical and contemporary composers.
QA: MUS 133B

122*. 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

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 190

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 Choir
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

E-126 Courses with an asterisk (*) have not been approved by the University Committee on Curriculum.