MA 108R INTERMEDIATE ALGEBRA. (3)
This course is remedial in nature and covers material commonly found in second year high school algebra. Specific topics to be discussed include numbers, fractions, algebraic expression, simplifying, factoring, laws of exponents, linear equations, simple graphs and polynomial algebra. This course is not available for degree credit toward a bachelor’s degree. Credit not available on the basis of special examination. Prereq: One year of high school algebra. Recommended for students with a Math ACTE score of 17 or less, or consent of department.

*MA 109 COLLEGE ALGEBRA. (3)
Selected topics in algebra and analytic geometry. Develops manipulative algebraic skills required for successful calculus study. Includes brief review of basic algebra, quadratic formula, systems of linear equations, introduction to analytic geometry including conic sections and graphing. This course is not available for credit to persons who have received credit in any mathematics course of a higher number with the exceptions of MA 112, 123, 160, 201 and 202. Credit not available on the basis of special examination. Prereq: Two years of high school algebra and a Math ACTE score of 19 or above, or MA 108R, or math placement test.

MA 110 ANALYTIC GEOMETRY AND TRIGONOMETRY. (4)
This is a course specifically designed for students intending to enroll in a calculus sequence. Topics will include trigonometric functions, exponentials and logarithms, graphs, polar coordinates, conic sections and systems of equations. Students may not receive credit for MA 110 and either of MA 109 or MA 112. This course is not available for credit to students who have received credit in any higher numbered mathematics course except for MA 123, 162, 199, 201 or 202. Credit is not available by special examination. Prereq: Two years of high school algebra and a Math ACTE score of 23 or above, or consent of department.

MA 112 TRIGONOMETRY. (2)
A standard course. Includes trigonometric functions, identities, multiple analytic formulas, laws of sines and cosines and graphs of trigonometric functions. This course is not available to persons who have received credit for any mathematics course of a higher number with the exception of MA 113, 123, 131, 132 and 162. Credit not available by special examination. Prereq: Two years of high school algebra or MA 108R.

MA 113 CALCULUS I. (4)
A course in one-variable calculus, including topics from analytic geometry. Derivatives and integrals of elementary functions (including the trigonometric functions) with applications. Lecture, three hours; recitation, two hours per week. Prereq: Math ACTE score of 26 or above, or MA 109 and MA 112, or MA 110, or consent of department.

MA 114 CALCULUS II. (4)
A continuation of MA 113, primarily stressing techniques of integration. Lecture, three hours; recitation, two hours per week. Prereq: High school trigonometry or MA 112; and of C or better in MA 113 or MA 132.

MA 123 ELEMENTARY CALCULUS AND ITS APPLICATIONS. (3)
An introduction to differential and integral calculus, with applications to business and the biological and physical sciences. Not open to students who have credit in MA 113. Prereq: Math ACTE score of 21 or above, or MA 109 or math placement test.

MA 132 CALCULUS FOR THE LIFE SCIENCES. (3)
Introduction to integral calculus, integration of logarithmic and exponential functions. Applications rates and reactions and radioactive decay. An introduction to biological models and their associated differential equations. Prereq: MA 123 or consent of instructor.

MA 162 FINITE MATHEMATICS AND ITS APPLICATIONS. (3)
Finite mathematics with applications to business, biology, and the social sciences. Linear functions and inequalities, matrix algebra, linear programming, probability. Emphasis on setting up mathematical models from stated problems. Prereq: MA 109 or equivalent.

MA 193 SUPPLEMENTARY MATHEMATICS WORKSHOP I: (Subtitle required). (1-2)
Laboratory offered (only) as an adjunct to certain mathematics lecture courses. Offered only on a pass/fail basis. Coreq: Set by instructor.

MA 194 SUPPLEMENTARY MATHEMATICS WORKSHOP II: (Subtitle required). (1-2)
Laboratory offered (only) as an adjunct to certain mathematics lecture courses. Offered only on a pass/fail basis. Coreq: Set by instructor.

MA 201 MATHEMATICS FOR ELEMENTARY TEACHERS. (3)
Basic concepts of measurement, geometry, probability, and statistics. Recommended only for majors in early elementary and middle school education. Prereq: MA 109.

MA 202 MATHEMATICAL PROBLEM SOLVING FOR ELEMENTARY TEACHERS. (3)
Development of mathematical problem solving skills. Students will solve problems from such areas as algebra, geometry, probability, number theory, and logic. Credit not available on the basis of special examination. Prereq: A grade of “C” or better in MA 201. Also recommended: a course in logic (e.g. PHI 120) or a course in calculus (e.g. MA 123).

MA 213 CALCULUS III. (4)
MA 213 is a course in multivariate calculus. Topics include three-dimensional vectors calculus, partial derivatives, double and triple integrals, sequences, and infinite series. Lecture, three hours; recitation, two hours per week. Prereq: MA 114 or equivalent.

MA 214 CALCULUS IV. (3)
MA 214 is a course in ordinary differential equations. Emphasis is on first and second order equations and applications. The course includes series solutions of second order equations and Laplace transform methods. Prereq: MA 213 or equivalent.

#MA 241 GEOMETRY FOR MIDDLE SCHOOL TEACHERS. (3)
A course in plane and solid geometry designed to give middle school mathematics teachers the knowledge needed to teach a beginning geometry course. Cannot be counted toward the mathematics minor or major. Prereq: One semester of calculus.

MA 261 INTRODUCTION TO NUMBER THEORY. (3)
Topics from classical number theory, including discussions of mathematical induction, prime numbers, division algorithms, congruences, and quadratic reciprocity. Prereq: Consent of instructor.

MA 310 MATHEMATICAL PROBLEM SOLVING FOR TEACHERS. (3)

MA 320 INTRODUCTORY PROBABILITY. (3)
Set theory; fundamental concepts of probability, including conditional and marginal probability; random variables and probability distributions (discrete and continuous); expected values and moments; moment-generating and characteristic functions; random experiments; distributions of random variables and functions of random variables; limit theorems. Prereq: MA 213 or equivalent. (Same as STA 320.)

MA 321 INTRODUCTION TO NUMERICAL METHODS. (3)

MA 322 MATRIX ALGEBRA AND ITS APPLICATIONS. (3)

MA 330 HISTORY OF MATHEMATICS. (3)
A survey of the development of mathematics. Topics may include: the Egyptians and Babylonians, mathematics of the Greek Classical Age, Euclid and the Alexandrian School, the Renaissance, Fermat and the beginning of calculus, the work of Newton and Leibnitz, nineteenth century geometry, analysis and set theory. Prereq: MA 114.

MA 340 DISCRETE STRUCTURES IN COMPUTER SCIENCE. (3)
Topics include permutations, combinations and partitions; inclusion-exclusion principle; generating functions and recurrence relations; elementary algorithms concerning graphs and trees; generation of random combinatorial and graphical examples; Boolean algebra, Boolean functions, switching circuits and mathematical logic; introduction to algebraic coding theory. Prereq: CS 245 and CS 270. Restricted to computer science, electrical engineering, mathematics and mathematical sciences majors. Others by permission. (Same as CS 340.)

MA 341 TOPICS IN GEOMETRY. (3)
Selected topics in geometry including Euclidean and some non-Euclidean geometries. Prereq: Consent of instructor.
MA 351 ELEMENTARY TOPOLOGY I. (3)
A beginning course, with particular emphasis on point-set topology in Euclidean spaces. Prereq: MA 213 or consent of instructor.

MA 352 ELEMENTARY TOPOLOGY II. (3)
A continuation of MA 351, to include a discussion of metric spaces, completeness, general topological spaces, compactness, connectedness. Prereq: MA 351 or consent of instructor.

MA 361 ELEMENTARY MODERN ALGEBRA I. (3)
A beginning course, with particular emphasis on groups and rings. Prereq: MA 322 or consent of instructor.

MA 362 ELEMENTARY MODERN ALGEBRA II. (3)
A continuation of MA 361 to include a discussion of fields and topics in linear algebra. Prereq: MA 361 or consent of instructor.

MA 375 COMMUNICATING MATHEMATICS. (3)
A course intended to provide understanding of an experience with contemporary mathematical communication in a modern institutional setting. Primarily intended for, but not restricted to, prospective school and college teachers of mathematics, including students who may intend to enroll in a graduate program and work as a graduate teaching assistant while pursuing an advanced degree. May be used to satisfy the general studies communication requirement. May not be counted as an upper division mathematics course in mathematics degree programs. Lecture, one hour; laboratory, four hours per week. Prereq: MA 214, MA 322, at least one of (MA 351, MA 361, MA 471), and consent of instructor.

MA 398, 399 INDEPENDENT WORK IN MATHEMATICS. (3 ea.)
Reading courses for upper division students of high standing. Prereq: Mathematics or mathematics sciences major and a standing of 3.0 in the department.

MA 415G GRAPH THEORY. (3)
Theory of linear undirected graphs, including definitions and basic concepts, trees, connectivity, traversability, factorization, planarity and matrices. In addition, algorithm for finding spanning trees, testing connectivity, finding Euler trails, finding a maximum matching in a bipartite graph, and testing planarity will be presented at appropriate times. Applications of algorithms to operations research, genetics and other areas. About 55 percent of the course will be on general theory of graphs, 30 percent on algorithms and 15 percent on applications of these algorithms. Prereq: CS 101 or equivalent. (Same as CS 415G.)

MA 416G PRINCIPLES OF OPERATIONS RESEARCH I. (3)
The course is an introduction to modern operations research and includes discussion of modeling, linear programming, dynamic programming, integer programming, scheduling and inventory problems, and network algorithms. Prereq: MA 213 or equivalent. (Same as CS 416G.)

MA 417G PRINCIPLES OF OPERATIONS RESEARCH II. (3)
A continuation of MA 416 with topics selected from stochastic models, decision making under uncertainty, inventory models with random demand, waiting time models and decision problems. Prereq: CS/MA 416G and MA/STA 320, or consent of instructor. (Same as STA 417G.)

MA 422 NUMERICAL SOLUTIONS OF EQUATIONS. (3)
Linear equations: Gaussian elimination, special linear systems, orthogonalization, eigenproblem, iterative methods. Nonlinear equations: solutions of equations in one variable, solutions of systems of nonlinear equations. Optimization. Prereq: CS/MA 321 and MA 322; or consent of instructor. (Same as CS 422.)

MA 432G METHODS OF APPLIED MATHEMATICS I. (3)
Partial differentiation, Jacobians, implicit function theorem, uniform convergence of series, line and surface integrals. Green’s and Stokes’ theorems. Prereq: MA 214 or equivalent.

MA 433G INTRODUCTION TO COMPLEX VARIABLES. (3)
Elementary complex variable theory with applications. Complex field, analytic functions, Cauchy theorem, power series, residue theory. Prereq: MA 214.

MA 471G ADVANCED CALCULUS I. (3)
A careful and rigorous investigation of the calculus of functions of a single variable. Topics will include elementary topological properties of the real line, convergence limits, continuity, differentiation and integration. Prereq: MA 214 and MA 322.

MA 472G ADVANCED CALCULUS II. (3)
A continuation of MA 471G to functions of several variables. A careful and rigorous investigation of the extensions of the concepts of the one variable calculus to n-dimensions. Prereq: MA 471G or consent of instructor.
MA 527 APPLIED MATHEMATICS IN THE NATURAL SCIENCES I. (3)
Construction, analysis and interpretation of mathematical models applied to problems in the natural sciences. Physical problems whose solutions involve special topics in applied mathematics are formulated, various solution techniques are introduced, and the mathematical results are interpreted. Fourier analysis, dimensional analysis and scaling rules, regular and singular perturbation theory, random processes and diffusion are samples of selected topics studied in the applications. Intended for students in applied mathematics, science and engineering. Prereq: MA 432G or three hours in an equivalent junior/senior level mathematics course or consent of the instructor. (Same as EM/ME 527.)

MA 532 ORDINARY DIFFERENTIAL EQUATIONS. (3)
Successive approximations and elementary existence theorems for scalar and vector equations, qualitative behavior of solutions as functions of initial conditions and parameters, linear systems with constant and periodic coefficients, stability theorems for second order linear and nearly linear equations, second order boundary value problems and regular singular point theory. Prereq: MA 322 and either 432G or 471G.

MA 533 PARTIAL DIFFERENTIAL EQUATIONS. (3)
Elementary existence theorems, equations of first order, classification of linear second order equations, the Cauchy and Dirichlet problems, potential theory, the heat and wave equations, Green’s and Riemann functions, separation of variables, systems of equations. Prereq: MA 532 and MA 472G or equivalent.

MA 537 NUMERICAL ANALYSIS. (3)
Floating point arithmetic. Direct methods for the solution of systems of linear algebraic equations. Polynomial and piecewise polynomial approximation, orthogonal polynomials. Numerical integration: Newton Cotes formulas and Gaussian quadrature. Basic methods for initial value problems for ordinary differential equations. The emphasis throughout is on the understanding and use of software packages for the solution of commonly occurring problems in science and engineering. Prereq: CS/MA 321 or equivalent or graduate standing or consent of instructor. Knowledge of a procedural computer language is required. (Same as CS/EGR 537.)

MA 551 TOPOLOGY I. (3)
Topological spaces, products, quotients, subspaces, connectedness, compactness, local compactness, separation axioms, convergence. Prereq: Consent of instructor.

MA 561 MODERN ALGEBRA I. (3)
Algebraic structures, quotient structures, substructures, product structures, groups, permutation groups, groups with operators, and the Jordan-Hölder theorem. Prereq: Consent of instructor.

MA 565 LINEAR ALGEBRA. (3)
Review of finite dimensional linear algebra, the rank of a matrix, systems of linear equations, determinants, characteristic and minimal polynomials of a matrix, canonical forms for matrices, the simplicity of the ring of linear mappings of a finite dimensional vector space, the decomposition of a vector space relative to a group of linear mappings and selected topics of a more advanced nature. Prereq: MA 322 or consent of instructor.

MA 570 MULTIVARIATE CALCULUS. (3)
A self-contained course in n-dimensional analysis, including the general form of Stokes’ theorem. Prereq: MA 432G or equivalent.

MA 575 PRINCIPLES OF ANALYSIS. (3)
Real and complex numbers, sequences and series, continuity, differentiation, integration, and uniform convergence. Prereq: MA 471G or equivalent or consent of instructor.

MA 611 INDEPENDENT WORK IN MATHEMATICS. (3-9)
Reading course for graduate students in mathematics. May be repeated to a maximum of nine credits. Prereq: Major in mathematics, a standing of at least 3.0 and consent of instructor.

MA 613 PROBLEMS SEMINAR IN OPERATIONS RESEARCH.

MA 615 NUMERICAL TECHNIQUES FOR NONLINEAR OPTIMIZATION.

MA 617 MARKOVIAN DECISION PROBLEMS. (3)
Graphs, networks, min flow-max cut theorem and applications; transportation problems, shortest route algorithms, critical path analysis, multi-commodity networks, covering and packing problems; integer programming, branch-and-bounding techniques, cutting plane algorithms, computational complexity. Prereq: MA 515, can be taken concurrently with MA 515.

MA 622 MATRIX THEORY AND NUMERICAL LINEAR ALGEBRA II. (3)

MA 625 NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS. (3)
Numerical solution techniques for boundary value problems for ordinary differential equations, and for parabolic and elliptic partial differential equations. Prereq: CS/MA/ EGR 537 or consent of instructor.

MA 628 APPLIED MATHEMATICS IN THE NATURAL SCIENCES II. (3)
Continuation of MA/EM 527 with emphasis on special topics and techniques applied to partial differential equations that occur in various physical field theories. Field equations of continuum mechanics of solids and fluids are reviewed. The method of characteristics, elliptic functions and integrals, Legendre polynomials, Mathieu functions, integral equations and transforms, and the methods of potential theory are examples of selected topics studied in introductory applications. Intended for students in applied mathematics, science and engineering. Prereq: MA/EM 527. (Same as EM 628.)

MA 630 MATHEMATICAL FOUNDATIONS OF STOCHASTIC PROCESSES AND CONTROL THEORY I. (3)
A modern treatment of stochastic processes from the measure theoretic point of view with applications to control theory; the basic notions of probability theory, independence, conditional expectations, separable stochastic processes, martingales, Markov processes, second order stochastic processes. Prereq: MA 432G and 670.

MA 633 THEORY OF PARTIAL DIFFERENTIAL EQUATIONS. (3)
A continuation of MA 533. Topics may include hypoelliptic operators and interior regularity of solutions; (P(D)-convexity and existence theorems; regularity up to the boundary; applications of the maximum principle; semi-group theory for evolution equations; perturbation methods; well-posed and improperly posed problems; equations with analytic coefficients; a asymptotic behavior of solutions; nonlinear problems. Prereq: MA 533.

MA 641, 642 DIFFERENTIAL GEOMETRY. (3 ea.)
Tensor products, exterior algebra, differentiable maps, manifolds, geodesics, metric properties of curves in Euclidean fundamental forms, surfaces. Prereq: Consent of instructor.

MA 651 TOPOLOGY II. (3)
Embedding and metrization, compact spaces, uniform spaces and function spaces. Prereq: MA 551.

MA 654 ALGEBRAIC TOPOLOGY I. (3)
Homotopy and homology theories, complexes and applications. Prereq: MA 551, 561, 651 or equivalent.

MA 655 ALGEBRAIC TOPOLOGY II. (3)
Singular homology theory and applications, homology of products, singular and Cech cohomology with applications. Prereq: MA 654.

MA 661 MODERN ALGEBRA II. (3)
Rings, fields of quotients, rings of polynomials, formal power series, modules, exact sequences, groups of homomorphisms, normal isomorphisms, algebras and tensor algebras. Prereq: MA 561 or consent of instructor.

MA 667 GROUP THEORY. (3)
A study of homomorphisms for groups, finite groups, solvable groups, nilpotent groups, free groups, and abelian groups. Prereq: MA 661.

MA 671 FUNCTIONS OF A COMPLEX VARIABLE I. (3)
Differentiation and integration, contour integration, poles and residues. Taylor and Laurent series, and conformal mapping. Prereq: MA 575 or consent of instructor.

MA 672 FUNCTIONS OF A COMPLEX VARIABLE II. (3)
A continuation of MA 671 to include the Riemann Mapping theorem, Dirichlet problem, multiple valued functions, Riemann surfaces and applications. Prereq: MA 671.

MA 676 ANALYSIS I. (3)
Sequences and series of real and complex numbers, sequences of functions. Riemann-Stieltjes integration, Lebesque measure and integration. Prereq: MA 575 or consent of instructor.
MC 500 INTRODUCTION TO SERVICE-LEARNING. (3)
This interdisciplinary course is designed to introduce students to the theories, concepts, and practices of Service-Learning. Service-Learning is a form of experiential education which engages the students in enhancing the common good through the application of classroom learning to service. Prereq: Upper division status. (Same as EXP 500.)

MD 810 PHYSICIANS, PATIENTS, AND SOCIETY I. (4)
In small groups, students and their assigned preceptors will study written clinical scenarios. Students will investigate, contemplate, comprehend, and discuss biological, clinical, psychological, economic, social, legal, and ethical issues concerning the problem-based histories. Prereq: Admission to Medical School (first year). (Same as BSC 810.)

MD 811 INTRODUCTION TO THE MEDICAL PROFESSION I. (7)
This course combines small-group meetings, lectures, and practical experience in providing students with the basic skills necessary to successfully engage in clinical rotations. First year medical students participate in four modules: observation period, interviewing and communication, clinical decision making, and physical examination. Prereq: Admission to Medical School (first year).

MD 812 HUMAN STRUCTURE/CELL AND TISSUE BIOLOGY. (4)
The organization of cells, tissues and organs is presented in lectures and in the laboratory through the study of in vivo materials, histological sections and electron microscopic illustrations with focus on the correlation of structure and function. Small group discussions on select topics supplement full classroom work. Lecture, 20 hours per week. Prereq: Admission to Medical School (first year). (Same as ANA 812.)

MD 813 HEALTHY HUMAN. (2)
The course uses problem-based learning, lectures, and small group discussions to introduce students to the concepts of health and human development. Lecture, four hours per week. Prereq: Admission to Medical School (first year).

MD 814 HUMAN STRUCTURE/GROSS ANATOMY. (6)
The course consists of lecture, small group, laboratory, and palpation exercises that provide a basic understanding of anatomical structures, organization and development. Anatomical structures are introduced as a basis for future functional correlates and principles are taught via laboratory discussions, prosections, dissections, films and skeletal materials. Lecture, 20 hours per week. Prereq: Admission to Medical School (first year). (Same as ANA 814.)

MD 816 CELLULAR STRUCTURE AND FUNCTION/GENETICS. (3)
The course combines small group meetings, lecture, clinical correlations, problem-based learning, and problem-solving sessions in providing an understanding of the relationship of human genetics to human health and disease. Close integration with biochemistry topics provides a better picture of how biochemistry, genetics and molecular biology contribute to normal human development and medicine. Lecture, 20 hours per week. Prereq: Admission to Medical School (first year). (Same as MI 816.)

MD 817 NEUROSCIENTES. (6)
The course is an integrated presentation of relevant topics in human neuroanatomy and neurophysiology as well as introductory correlations with neurology and psychiatry. Teaching methodology includes lecture, small group discussion, laboratory and self-study units. Lecture, 20 hours per week. Prereq: Admission to Medical School (first year).

MD 818 HUMAN FUNCTION. (8)
This course provides in-depth instruction on the physiological mechanisms of body function from the single cell to the organism level. The course is team taught by medical scientists and clinicians. Teaching methodologies include didactic and Socratic lectures, small group discussions, demonstrations and live model and computer simulated laboratories. Lecture, 20 hours per week. Prereq: For MD 818/PFY 818: Admission to medical school (first year). For OB1814: Admission to the Dental School and OB1812. (Same as OB1 814/PFY 818.)
MD 819 CELLULAR STRUCTURE AND FUNCTION/BIOCHEMISTRY. (7)
The course combines lecture, small group activities, clinical correlations, problem-based learning, and problem-solving sessions in providing an understanding of the relationship of biochemical principles to human health and disease. Close integration with genetics topics provides a better picture of how biochemistry, molecular biology and genetics contribute to normal human development and medicine. Lecture, 20 hours per week. Prereq: Admission to Medical School (first year). (Same as BCH 819.)

MD 820 PATIENTS, PHYSICIANS, AND SOCIETY II. (5)
In this course, students will approach written clinical scenarios with initiative by researching, gathering, and selecting materials to produce resource packets within and for their small groups. Students will be challenged with complex ethical, legal, social, psychological, economic and biological issues. Prereq: Admission to second year of medical curriculum. (Same as BSC 820.)

MD 821 INTRODUCTION TO THE MEDICAL PROFESSION II. (7)
This course is an intermediate clinical medicine course combining small-group tutorials, lectures, and practical experience. Second year medical students participate in three components: interviewing and communication skills, radiology and laboratory skills, and physical examination and diagnosis. Prereq: MD 811.

MD 822 IMMUNITY, INFECTION, AND DISEASE. (9)
The course provides basic concepts of immunology and of bacterial, viral, fungal and protozoal biology. It focuses on mechanisms of human immunity, immunologically mediated disease, and pathogenesis in infectious disease. The material covered includes relevant pathology associated with both immunologic and infectious diseases, and a brief summary of infectious diseases from an organ system perspective. Lecture, 20 hours per week. Prereq: Admission to second year of medical curriculum. (Same as MI 822.)

*MD 823 MECHANISMS OF DISEASE AND TREATMENT/PATHOLOGY. (9)
This is a course in basic mechanisms of disease causation and specific diseases of the organ systems. It introduces fundamental disease processes and the pathophysiology of major diseases affecting each of the organ systems. It stresses how disease alters normal structure and function and is closely integrated with PAT 824. Various teaching methodologies utilized include lectures, small group discussions, workshops, case studies, and computer-assisted instruction. Lecture, 20 hours per week. Prereq: Admission to second year of medical curriculum. (Same as PAT 823.)

*MD 824 MECHANISMS OF DISEASE AND TREATMENT/PHARMACOLOGY. (9)
This course introduces the principal actions of substances which are used as drugs for treatment of diseases and suffering in humans. It will cover the general principles of drug action, how drugs alter the function of normal and pathologic tissues and organisms and how they influence the disease process. Drugs used in the treatment of disease processes will be integrated with discussion of those diseases in PAT 823. Lecture, 20 hours per week. Prereq: Admission to second year of medical curriculum. (Same as PHA 824.)

#MD 826 MECHANISMS OF DISEASE AND TREATMENT/PSYCHIATRY. (2)
This is an introduction to psychopathology and the psychiatric nomenclature for second year medical students. It occurs during the spring and fits within the context of the larger pathology segment of MD 826. Integration with the pharmacology sequence that runs before and after is in place. Prereq: Promotion to the second year of medical school. (Same as PSC 826.)

MD 830 WOMEN’S MATERNAL AND CHILD HEALTH/PEDIATRICS. (6)
This course will provide an opportunity for the students to see the cycle of birth and neonatal care and to observe the mother/infant relationship through labor and delivery, the newborn nursery, and the follow-up examination. Inpatient pediatrics will be a component of this rotation. Laboratory, 40 hours per week. Prereq: Admission to third year of medical curriculum.

MD 832 CLINICAL NEUROSCIENCES/NEUROLOGY. (4)
This course provides opportunity for third year medical students to recognize, treat, and understand the etiology and pathology of common neurologic disorders and emergencies. Laboratory, forty hours per week. Prereq: Admission to third year of medical curriculum.

MD 833 CLINICAL NEUROSCIENCES/PSYCHIATRY. (4)
This course provides opportunity for third year medical students to recognize, treat, and understand the etiology and pathology of common psychiatric disorders and emergencies. Laboratory, forty hours per week. Prereq: Admission to third year of medical curriculum.

*MD 834 PRIMARY CARE/FAMILY PRACTICE. (4)
This course introduces third year medical students to primary care family practice in rural and urban settings. Students participate in patient-centered teaching during which they work with primary care Family Physicians seeing ambulatory patients in their offices. Students are allowed to interview, examine, and formulate treatment plans for patient problems under the direct supervision of their faculty preceptors. Prereq: Admission to third year of medical curriculum.

#MD 835 PRIMARY CARE/INTERNAL MEDICINE. (4)
This clinical course introduces third year medical students to primary care internal medicine practice in rural or urban settings. Students participate in patient-centered teaching during which time they work with primary care internists in their clinics. Students interview, examine, and formulate treatment plans for patient problems under the direct supervision of their faculty preceptors. Laboratory, 40 hours per week. Prereq: Admission to third year of medical curriculum.

MD 836 MEDICAL SURGICAL CARE/MEDICINE. (8)
This course is an introduction to the concepts of internal medicine. It is designed around the principles of Problem Based Learning to help students solve complex medical problems. The course will use didactic exercises, computer simulated problems and clinical material and experiences to integrate basic sciences into the practice of medicine. Laboratory, 40 hours per week. Prereq: Admission to third year of medical curriculum.

MD 837 MEDICAL SURGICAL CARE/SURGERY. (8)
This course is an introduction to the concepts in surgery. It is designed around the principles of Problem Based Learning to help students solve complex surgical problems. The course will use didactic exercises, computer simulated problems and clinical material and experiences to integrate basic sciences into the practice of medicine and surgery. Laboratory, 40 hours per week. Prereq: Admission to third year of medical curriculum.

MD 838 WOMEN’S MATERNAL AND CHILD HEALTH/OBG. (6)
The clerkship will provide an opportunity for students to see the cycle of birth and neonatal care and to observe the mother/infant relationship through the outpatient clinic, labor and delivery, the newborn nursery, and the follow-up examination. Laboratory, 40 hours per week. Prereq: Admission to third year of medical curriculum.

#MD 839 PRIMARY CARE/PEDIATRICS. (4)
This clinical course introduces third year medical students to primary care pediatric practice in rural or urban settings. Students participate in patient-centered teaching during which time they work with primary care pediatricians in their clinics. Students interview, examine, and formulate treatment plans for patient problems under the direct supervision of their faculty preceptors. Laboratory, 40 hours per week. Prereq: Admission to third year of medical curriculum.

*MD 840 DEAN’S COLLOQUIUM. (1)
A two week experience which serves as a summation of the medical school experience and a transition to the role as practitioner. It will be taught using multiple educational formats. Lecture, 20-30 hours per week. Prereq: Admission to fourth year of medical curriculum.

MD 841 GERONTOLOGY. (4)
This course combines several teaching techniques to provide students with basic skills necessary to care for elderly patients in a variety of clinical settings. Fourth year students participate in a four-week block rotating at locations in Lexington, with emphasis on assessment and rehabilitation. Laboratory, 40 hours per week. Prereq: Admission to fourth year of medical curriculum.

MD 842 ADVANCED CLINICAL PHARMACOLOGY AND ANESTHESIOLOGY. (6)
This course uses lectures, interactive small groups, and firsthand experience to introduce anesthesiology as it relates to pharmacology and physiology. The course also teaches pharmacology and therapeutics utilizing clinical cases. Students develop their own personal formularies during the course. Laboratory, 40 hours per week. Prereq: Admission to fourth year of medical curriculum. (Same as PHA 842.)

MD 843 EMERGENCY MEDICINE. (4)
This course will provide the students with an introduction to the field of Emergency Medicine, Emergency Medical Services (EMS), and the approach to the acutely ill or injured patient. The students will complete an ACLS class during this rotation. Laboratory, 40 hours per week. Prereq: Admission to fourth year of medical curriculum. (Same as ER 843.)
ME 101 ORIENTATION TO MECHANICAL ENGINEERING (Freshman and Transfer Students). (1)
Introduction to the profession of mechanical engineering: its history, practice, and methods of analysis.

ME 105 BASIC ENGINEERING GRAPHICS. (2)
Basic Engineering Graphics involves the use of basic engineering drawing equipment with freehand sketching and use of a micro-computer graphics workstation in the study of orthographic projection, auxiliary view projection, section views, pictorial drawing, with introduction to dimensioning and tolerancing. Class, six hours.

ME 151 MANUFACTURING ENGINEERING. (3)
A background course in the area of manufacturing processes and systems. Includes a study of machining operations, foundry mechanization, forging, sheet metal work, powder metal products, production molding and production machines and processes.

ME 220 ENGINEERING THERMODYNAMICS I. (3)
Fundamental principles of thermodynamics. Prereq: PHY 231. Prereq or concur: MA 214.

ME 310 ENGINEERING EXPERIMENTATION I. (3)
An instrumentation laboratory to provide the student with an understanding of the characteristics and application of instrumentation related to basic measurements in mechanical engineering. Design and planning of experiments. Uncertainty analysis. Principles and application of technical writing and information retrieval. Lecture, two hours; laboratory, two hours. Prereq: Engineering standing, CS 221 and ME 330.

ME 311 ENGINEERING EXPERIMENTATION II. (3)
A laboratory to instruct the student in the performance of basic mechanical engineering components and systems. Performance of experiments, application of theory and reporting. Introduction to experimentation. Introduction to error analysis. Lecture, one hour; laboratory, four hours. Prereq: ME 310, 321, 325 and engineering standing.

ME 321 ENGINEERING THERMODYNAMICS II. (3)

ME 325 ELEMENTS OF HEAT TRANSFER. (3)
Fundamental principles of conduction, convection, radiation heat transfer. Numerical methods for heat transfer problems. Design and applications of heat transfer equipment such as fins and heat exchangers. Prereq: ME 330, MA 214, CS 221 and engineering standing.

ME 330 FLUID MECHANICS. (3)
Introduction to the physical properties of fluids, fluid statics. Equations of conservation of mass, momentum and energy for systems and control volumes. Dimensional analysis and similarity. Principles of inviscid and real fluid flows; flow through pipes and around bodies. Application and design of fluid handling systems. Prereq: Engineering standing. ME 220 or CME 200, CS 221 and MA 214. (Same as CME 330.)

ME 340 INTRODUCTION TO MECHANICAL SYSTEMS. (3)
Modeling of mechanical, thermal, hydraulic and other phenomena from a systems viewpoint. Analysis of continuous-time models for free and forced response. Laplace transforms, transfer functions and block diagrams. Introduction to numerical simulation. Analysis of higher-order systems. Prereq: EM 313, CS 221, engineering standing.

ME 344 MECHANICAL DESIGN. (3)
Fundamentals of design with methods of approximation. Introduction to optimum design considerations. Synthesis and problems on the design of various mechanical elements. Prereq: ME 151, EM 302, engineering standing; concur: EM 313.

ME 346 MECHANICAL SYSTEMS DESIGN. (3)
A course emphasizing the role of analysis in design. Actual design objectives are met through the use of mathematical modeling techniques and the application of the principles of dynamics, kinematics and vibrations. Prereq: EM 313, engineering standing; concur: ME 344.

ME 347 DYNAMIC ANALYSIS OF DESIGN PROBLEMS. (3)
A course emphasizing the role of analysis in design. Actual design objectives are met through the use of mathematical modeling techniques and the application of the principles of dynamics, kinematics and vibrations. Prereq: EM 313, engineering standing; concur: ME 344.

ME 358 ECONOMIC ANALYSIS OF MECHANICAL SYSTEMS. (3)
Formulation of economic relationships. Familiarization with alternate mechanical systems and application of economic principles of selection of alternates. Prereq: ME 321, engineering standing or consent of instructor.

ME 380 TOPICS IN MECHANICAL ENGINEERING (Variable topics). (3)
A lecture-recitation course on a topic of current interest. Modern developments in mechanical engineering will be stressed. Offered as a technical elective in mechanical engineering. May be repeated to a maximum of nine credits. Prereq: Variable, given when topic identified and engineering standing.

ME 395 INDEPENDENT WORK IN MECHANICAL ENGINEERING. (1-6)
Special research and problems for individual students who wish to pursue independent investigations. May be repeated to a maximum of six credits. Prereq: Consent of department chairperson via permit.

ME 406 COMPUTER-AIDED GRAPHICS AND DESIGN. (3)
Development of computer graphics and interactive graphics methods and applications to problem solving and design practices. Emphasis on graphics principles, data management, interactive programming, and integrated analysis/design. Prereq: CS 221 and engineering standing; concur: ME 344.

ME 407 ENGINEERING ETHICS. (1)
Review of the growth and development of the profession, engineering ethics, obligations to employers and peers, limits of professional responsibility, codes of ethics and enforcement, and case studies.

ME 408 SAFETY ENGINEERING. (2)
Review of general safety hazards, system engineering safety, fault free analysis, reliability, accident reconstruction and investigation. Case studies will be included. Concur: ME 344.

ME 412 SENIOR DESIGN PROJECT. (3)
A project concerned with the design of a complex system of current interest to mechanical engineers. Students will work in small groups and emphasis will be on original work. Lecture, one hour; laboratory, four hours per week. Prereq: ME 325, and engineering standing.

ME 440 DESIGN OF CONTROL SYSTEMS. (3)

ME 480G HEATING, VENTILATING AND AIR-CONDITIONING. (3)
An introductory course emphasizing the engineering systems aspects of thermal environmental design. Principles and applications of building energy requirements and thermal comfort criteria. Prereq: ME 325 and Engineering standing or consent of instructor. (Same as AEN 480G.)

ME 501 MECHANICAL DESIGN WITH FINITE ELEMENT METHODS. (3)
Mechanical design techniques based on the finite element method, using machine design background as the starting point. Techniques for modeling machine elements will be shown in relation to the basic FEM theory. Emphasis will be on quantifying loads, the resulting stress and deflection, and relating them to design allowances, leading to an acceptable design solution. Prereq or concur: ME 344 and ME 406.

ME 503 LEAN MANUFACTURING PRINCIPLES AND PRACTICES. (3)
Introduction of the fundamental concepts for production improvement utilizing lean manufacturing principles and practices. This course will consist of lectures, manufacturing simulation laboratory, plant tours, design projects, and assigned problems drawn from industry. Prereq: Engineering standing or consent of instructor. (Same as MFS 503.)

ME 505 MODELING OF MANUFACTURING PROCESSES AND MACHINES. (3)
A study of the major manufacturing processes and equipment. Emphasis on mathematical and computer models of these processes, as used in automated manufacturing and control of these processes. Lecture, two hours; laboratory, two hours. Prereq: EM 313 and EM 302. (Same as MFS 505.)

ME 506 MECHANICS OF COMPOSITE MATERIALS. (3)
A study of the structural advantages of composite materials over conventional materials, considering high strength-to-weight and stiffness-to-weight ratios. Fiber reinforced, laminated and particulate materials are analyzed. Response of composite structures to static and dynamic loads, thermal and environmental effects, and failure criteria are studied. Prereq: EM 302, engineering standing or consent of instructor. (Same as EM/ MSE 506.)
ME 507 DESIGN FOR MANUFACTURING. (3)
The topics will include fundamentals of concurrent engineering, product life cycle, product specification, standardization, functional requirements and datum features, selection of materials and manufacturing processes, cost analysis, case studies on design for quality, economy, manufacturability and productivity. Prereq: ME 344 and engineering standing. (Same as MFS 507.)

ME 512 MANUFACTURING SYSTEMS. (3)
This course introduces students to fundamentals of design, planning and control of manufacturing systems aided by computers. Concepts of control hardware, NC programming languages, software aspects related to NC manufacturing, programmable controllers, performance modeling of automated manufacturing systems, group technology and flexible manufacturing systems, etc. will be addressed. Prereq: ME 507 and MFS 512.

ME 513 MECHANICAL VIBRATIONS. (3)
The analysis of vibrational motion of structural and mechanical systems. Single- and multi-degree-of-freedom systems; free vibrations; nonperiodic excitation; harmonic excitation. Modal analysis and computer programs for analysis of these systems. Vibration of continuous body, including strings and bars; torsional and flexural modes. Energy methods. Prereq: ME 511, MFS 512, and MFS 513. (Same as EM 513.)

ME 527 APPLIED MATHEMATICS IN THE NATURAL SCIENCES I. (3)
Construction, analysis, and interpretation of mathematical models applied to problems in the natural sciences. Physical problems whose solutions involve special techniques in applied mathematics are presented, and the mathematical results are interpreted. Fourier analysis, dimensional analysis and scaling, regular and singular perturbation theory, random processes and diffusion are introduced. The analysis of problems. Prereq: MA 214, ME 513, and MFS 513. (Same as EM 527.)

ME 530 GAS DYNAMICS. (3)
Consideration of the mass, energy and force balances applied to compressible fluids. Isentropic flow, diabatic flow, flow with friction, wave phenomena and one-dimensional gas dynamics. Applications to duct flows and to jet and rocket propulsion engines. Prereq: ME 315, ME 330, ME 361, and ME 507. (Same as MFS 531.)

ME 531 FLUID DYNAMICS I. (3)
Stress at a point (introduced as a tensor of rank two). Equation of conservation of mass, rate of strain tensor, derivation of Navier-Stokes equation, source-sink flows, motion due to a doublet, vortex flow, two- and three-dimensional irrotational flow due to a moving cylinder with circulation, two-dimensional airfoils. Prereq: MFS 530, MA 432G, and Engineering standing. (Same as EM 531.)

ME 532 ADVANCED STRENGTH OF MATERIALS. (3)
Unsymmetrical bending of beams, thin plates, stress analysis of thick-walled cylinders, and rotating discs. Theory of elastic energy, curved beams, stress concentration, and fatigue. Prereq: EM 502 and Engineering standing. (Same as EM 532.)

ME 542 KINEMATIC SYNTHESIS OF MECHANISMS. (3)
Theory and practice as related to the chemical and physical processing of polymer systems. Polymer rheology, heat transfer in polymer flows, polymer engineering properties, polymer processing operations and materials selection; flow instabilities. Prereq: MCE 330, MCE 425 or ME 325, or consent of instructor. (Same as CME/MFS/MSE 554.)

ME 554 CHEMICAL AND PHYSICAL PROCESSING OF POLYMER SYSTEMS. (3)
Theory and practice as related to the chemical and physical processing of polymer systems. Polymer rheology, heat transfer in polymer flows, polymer engineering properties, polymer processing operations and materials selection; flow instabilities. Prereq: MCE 330, MCE 425 or ME 325, or consent of instructor. (Same as CME/MFS/MSE 554.)

ME 556 INTRODUCTION TO COMPOSITE MATERIALS. (4)
Applications, materials selection and design of composite materials. Relation between properties of constituent materials and those of composite. Processing methods for materials and for some structures. Lab focuses on preparation and testing of composite materials and constituent materials. Lecture, three hours; laboratory, three hours per week. Prereq: MA 214, CHE 236, PHY 232, MSE 201, or consent of instructor. (Same as EM/MSE 556.)

ME 560 ENGINEERING OPTICS. (3)
Fundamentals of geometrical and physical optics; applications as related to problems in engineering design and research; details of some optical measurement techniques; introduction to lasers and their applications to heat transfer and combustion research; inverse analytical techniques for determining optical properties of small particles from light scattering and extinction measurements. Prereq: Engineering standing.

ME 563 BASIC COMBUSTION PHENOMENA. (3)
Simultaneous application of fluid mechanics, heat and mass transfer, chemical kinetics and thermodynamics to combustion. Topics covered include chemical kinetics, chain and thermal explosions, detonation and deflagration, flammability limits, stirred reactors. Flame stabilization in high and low velocity streams, laminar and turbulent diffusion flames, droplet burning, and metal combustion. Prereq: ME 330 and Engineering standing; prereq or concur: ME 525.

*ME 580 HEATING, VENTILATING AND AIR CONDITIONING. (3)
A course emphasizing the use of thermodynamics, fluid mechanics, and heat transfer principles in environmental design. Building energy requirements will be computed and thermal comfort criteria will be studied. Prereq: BAE 427 or ME 321 or consent of instructor. (Same as BAE 580.)

ME 585 FOURIER SERIES AND BOUNDARY VALUE PROBLEMS. (3)
An introductory treatment of Fourier series and its application to the solution of boundary value problems in the partial differential equations of physics and engineering. Orthogonal sets of functions, Fourier series and integrals, solution of boundary value problems, theory and application of Bessel functions and Legendre polynomials. Prereq: MA 432G or equivalent. (Same as MA 485G/EM 585.)

ME 599 TOPICS IN MECHANICAL ENGINEERING (Subtitle required). (3)
A detailed investigation of a topic of current significance in mechanical engineering such as: computer-aided manufacturing, special topics in robotics, and current topics in heat transfer. May be repeated under different subtitles to a maximum of nine credits. A particular topic may not be offered more than once in the ME 599 number. Prereq: Variable; given when topic is identified.

PREREQUISITE FOR GRADUATE WORK: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics.

ME 601 ADVANCED CAE APPLICATIONS. (3)
This course will include development of theory for application to several topics in advanced engineering applications of computers in design. This course will examine the experimental basis and fundamental theoretical framework for plastic materials. The analysis of plastic deformations in simple bending, torsion, tension and compression, and some two dimensional problems are presented. Connection between mechanics parameters, design variables and metallurgical phenomena are discussed. Limit analysis is studied. Prereq: EM 601/641, or EM/ME 651 or consent of instructor. (Same as EM 603.)

ME 602 DYNAMICS OF DISTRIBUTED MECHANICAL SYSTEMS. (3)
Applications of small-oscillation shell theory to continuum mechanical systems modeled by shells, plates, rings, arches, membranes, beams, etc. Study of natural frequencies, modes shapes, forced-vibration characteristics, system dampings, dynamic influence function, combination of subsystems, active and passive vibration controls and dampings. Prereq: ME 540 or EM 513, or consent of instructor.

ME 603 MECHANICS OF PLASTIC SOLIDS I. (3)
Permanent changes in shape of solid materials occur as plastic deformations in many engineering applications, such as extrusion, forging and rolling. This course examines the experimental basic and fundamental theoretical framework for plastic solids. The analysis of plastic deformations in simple bending, torsion, tension and compression, and some two dimensional problems are presented. Connection between mechanics parameters, design variables and metallurgical phenomena are discussed. Limit analysis is studied. Prereq: EM 601/641, or EM/ME 651 or consent of instructor. (Same as EM 603.)

ME 606 SEMINAR AND PROJECT IN MANUFACTURING SYSTEMS ENGINEERING. (3)
A project course for manufacturing systems. Course consists of seminar presentations by outside professionals and faculty and a course project on a realistic manufacturing systems assignment. Lecture, two hours; laboratory, two hours. (Same as EE/MFS 606.)

ME 607 ANALYSIS OF METAL CUTTING PROCESSES. (3)
Advanced study of metal cutting involving the mechanics of metal cutting including cutting forces, tool-life/tool-life and temperature analysis, surface finish and integrity, chip control, machinability assessments and advances in cutting tool technology. Prereq: ME 505. (Same as MFS/MSE 607.)

ME 608 NONTRADITIONAL MANUFACTURING PROCESSES. (3)
A comprehensive study of wave propagation in fluids; derivation of the scalar wave equation and a study of its elementary solutions for time harmonic and transient waves in one, two and three dimensions. Radiation and scattering of waves at fluid and solid boundaries. Integral equation solution of the scalar velocity wave potential; numerical methods. Prereq or concur: MA 432G.
ME 611 BOUNDARY ELEMENT METHODS IN ENGINEERING. (3)
Introduction of boundary element methods for use in solving common engineering
equations, such as the Laplace equation, the Poisson equation, the wave equation,
and the diffusion equation. Both the theoretical and numerical aspects of the boundary element
technique are presented. Application areas include heat conduction, potential flow
problems, acoustic wave propagation, general diffusion, and stress analysis. Prereq: EGR
537 or consent of instructor. (Same as EGR 611.)

ME 613 NONLINEAR OSCILLATIONS. (3)
Many physical systems exhibit some nonlinear behavior. This course presents some
methods of analyzing discrete, nonlinear, dynamical systems and applies the methods
to typical mechanical systems. Various kinds of nonlinear behavior, including resonance
phenomena such as harmonics, parametric excitation, and discontinuous jumps in
amplitude are considered. Lyapunov stability criteria and Floquet and Routhian
procedures for performing stability analyses of systems are introduced, and their physical
interpretations for various systems are studied. Prereq: EM/ME 513. (Same as EM 613.)

ME 620 ADVANCED ENGINEERING THERMODYNAMICS I. (3)
Critical treatment of the laws of thermodynamics, relations among thermodynamic
properties; stability of systems; thermodynamic processes; selected special topics. Prereq:
ME 321.

ME 625 ADVANCED HEAT CONDUCTION. (3)
Comprehensive study of heat convection; derivation of equations of convection of mass,
momentum, and energy; boundary layer equations; classical solutions of laminar
convection problems; turbulent convection; analogies between momentum and energy.
Prereq: ME 325, MA 432G or concurrent.

ME 627 RADIATION HEAT TRANSFER. (3)
Principles of thermal radiation, the determination of radiation properties, and the analysis
of radiation heat transfer. Results of recent radiation researches are included in the
discussions. Prereq: ME 325, MA 432G or concurrent.

ME 628 BOILING AND CONDENSATION. (3)
Phase-change heat transfer including boiling and condensation. Phenomenological
study of boiling using hydrodynamic instability. Theory of two-phase flow and its
application to forced flow boiling. Film and dropwise condensation. Prereq: ME 325.

ME 631 FLUID DYNAMICS II. (3)
A continuation of ME 531 with emphasis on viscous flow. Exact and approximate
solutions, boundary layer theory. Jets, wakes, rotating systems, compressible boundary
layer and hydrodynamic stability. Prereq: ME 531 or consent of instructor.

ME 634 TURBULENT FLOWS. (3)
Physical and analytical description of turbulent flows, isotropic turbulence, boundary
layers and shear flows, free turbulence in jets and wakes. Measurement techniques. Prereq:
ME 529 or ME 531.

ME 640 ADVANCED ANALYSIS AND SIMULATION OF
DYNAMIC SYSTEMS. (3)
An extension of ME 540 emphasizing advanced techniques. The concept of random
processes in mechanical engineering problems; nonparametric and parametric models.
The use of correlation, spectral analysis and digital filtering in data analysis and model
building. Prereq: ME 540.

ME 641 FOUNDATIONS OF SOLID MECHANICS. (3)
A brief review of vectors and an in-depth discussion of tensors and tensor calculus. Stress,
deflection and strain. Continuum balance principles of mass, momentum and energy,
the equations of motion and the energy equation. Entropy, the principles of material frame
indifference and material symmetry. Various constitutive models, including elasticity
(linear and/or non-linear), plasticity and viscoelasticity. Thermoelasticity, hyperelasticity,
hypoelasticity, and electroelasticity may also be addressed. Prereq: EM 531 or
ME 532 or consent of instructor. (Same as EM 601.)

ME 644 ADVANCED DYNAMICS I. (3)
Many physical systems in engineering involve rigid bodies in translation and rotation.
Such motions are studied in this course by the use of Euler’s Laws. The kinematical
description of the motions utilize the concept of reference frames. The inertia properties
of rigid bodies, and the energy functions for rigid bodies are covered. Analytical and
numerical solutions of dynamical systems of engineering interest are considered. Prereq:
EM 313; prereq, or concur: MA 432G. (Same as EM 645.)

ME 645 ADVANCED CONTROL SYSTEM ANALYSIS. (3)
Conceptual development and study of complex systems; their synthesis and design;
analysis and optimization of system parameters. Input-output relationships; formulation
of mathematical models, parameters and constraints on physical systems. Prereq: ME
343.

ME 647 SYSTEM OPTIMIZATION I. (3)
Introduction to linear and nonlinear optimization and their use in engineering design.
Emphasis on numerical approaches and use of optimization methods for engineering
systems (e.g. biological, mechanical, structural). Prereq: CS 221; one mathematics
course beyond MA 214 or equivalent. (Same as AEN 647.)

ME 651 MECHANICS OF ELASTIC SOLIDS I. (3)
Many engineering applications involve the use of materials that behave elastically when
performing their designed function. This course concerns the general analysis of small
deformations, stress, and stress-deformation relations for elastic bodies. The solution
of typical problems frequently encountered in engineering applications, e.g., extension,
bending, and torsion of elastic bars, stress concentrations and thermoelastic behavior,
are studied. Some modern computational methods currently used in engineering practice
are introduced. Prereq: MA 432G or consent of instructor. (Same as EM 651.)

ME 653 METHODS OF APPLIED DIFFERENTIAL EQUATIONS. (3)
Integrals of nonlinear partial differential equations; similarity variables and other
transformations; perturbation methods; weighted residual methods; numerical methods;
selected topics. Prereq: MA 432G or consent of instructor. (Same as EM 653.)

ME 690 ADVANCED ALGORITHMS FOR COMPUTATIONAL FLUID DYNAMICS. (4)
Theory and implementation of main algorithms widely used for solving multi-
dimensional partial differential equations arising in engineering applications such as fluid
dynamics, heat and mass transfer, semiconductor simulation, etc. Numerical solution
of steady and time-dependent linear partial differential equations on rectangular domains
via finite difference techniques. Linearization methods for treatment of nonlinear
problems. Numerical grid generation for transforming irregular domains into rectangular
computational grids. Prereq: MA 537, or consent of instructor, and competence with
a high-level programming language.

ME 699 TOPICS IN MECHANICAL ENGINEERING
Subtitle required. (3)
A detailed investigation of a topic of current significance in mechanical engineering. May
be repeated to a maximum of nine credits under different subtitles. A particular topic
may be offered at most twice under the ME 699 number. Prereq: Variable; given when
topic is identified.

ME 748 MASTER’S THESIS RESEARCH. (0)
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters.
Prereq: All course work toward the degree must be completed.

ME 749 DISSERTATION RESEARCH. (0)
Half-time to full-time work on dissertation. May be repeated to a maximum of six
semesters. Prereq: Registration for two full-time semesters of 769 residence credit
following the successful completion of the qualifying exams.

ME 768 RESIDENCE CREDIT FOR MASTER’S DEGREE. (1-6)
May be repeated to a maximum of 12 hours.

ME 769 RESIDENCE CREDIT FOR DOCTOR’S DEGREE. (0-12)
May be repeated indefinitely.

ME 780 SPECIAL PROBLEMS IN MECHANICAL ENGINEERING. (3)
This course consists of individual work in one of the various fields of mechanical
engineering. May be repeated three times for a maximum of 12 credits. Prereq: Approval
of instructor.

ME 790 RESEARCH IN MECHANICAL ENGINEERING. (1-9)
Work may be taken in any field of mechanical engineering, subject to the approval of
the director of graduate studies. May be used to satisfy pre-qualifying examination
residency credit. May be repeated to a maximum of 18 hours.

MED Medicine

MED 616 BIOLOGY AND THERAPY OF CANCER. (3)
Biology of cancer will be discussed at the molecular, cellular and organismic level.
Emphasis will be placed on cellular signaling, apoptosis and cell cycle regulation in
cancer cells, which affects tumor cell behavior and its interactions with the host immune
system. The biology of hematopoietic cells will also be included. Clinicians active in treatment
and research of various types of cancer will be invited to participate in the lectures. Prereq:
BCH 501, 502, BIO 685. (Same as MI 616.)
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<tr>
<td>MFS 505 LEAN MANUFACTURING PRINCIPLES AND PRACTICES</td>
<td>(3)</td>
<td>Introduction of the fundamental concepts for production improvement utilizing lean manufacturing principles and practices. This course will consist of lectures, manufacturing simulation laboratory, plant tours, design projects, and assigned problems drawn from industry. Prereq: Engineering standing or consent of instructor. (Same as ME 503.)</td>
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<tr>
<td>MFS 505 MODELING OF MANUFACTURING PROCESSES AND MACHINES</td>
<td>(3)</td>
<td>A study of the major manufacturing processes and equipment. Emphasis on mathematical and computer models of these processes, as used in automated manufacturing and control of these processes. Lecture, two hours; laboratory, two hours. Prereq: EM 313 and EM 302. (Same as ME 505.)</td>
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<tr>
<td>MFS 507 DESIGN FOR MANUFACTURING</td>
<td>(3)</td>
<td>The topics will include fundamentals of concurrent engineering, product life cycle, product specification, standardization, functional requirements and datum features, selection of materials and manufacturing processes, cost analysis, case studies on designing for quality, economy, manufacturability and productivity. Prereq: ME 344 and engineering standing. (Same as ME 507.)</td>
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<tr>
<td>MFS 512 MANUFACTURING SYSTEMS</td>
<td>(3)</td>
<td>This course introduces students to fundamentals of design, planning and control of manufacturing systems aided by computers. Concepts of control hardware, NC programming languages, software aspects related to NC manufacturing, programmable controllers, performance modeling of automated manufacturing systems, group technology and flexible manufacturing systems, etc. will be addressed. Prereq: Engineering standing. (Same as ME 512.)</td>
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<tr>
<td>MFS 525 ORGANIZATIONAL LEARNING FOR LEAN MANUFACTURING</td>
<td>(3)</td>
<td>Learning organizations are skilled at creating, acquiring, and transferring knowledge, and at modifying their behavior to reflect the new knowledge and insights. In this context, this course will discuss leadership styles, adult learning principles, communication, organizational behaviors, and a structure for learning. Prereq: MFS 503 or consent of instructor.</td>
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<tr>
<td>MFS 526 OPERATIONS MANAGEMENT IN LEAN MANUFACTURING</td>
<td>(3)</td>
<td>Principles and practices of lean manufacturing organizations. The focus is on manufacturing as a sociotechnical system and how to limit variability through various methods of control. This course will cover the principles of lean manufacturing and the tools and techniques needed to implement and sustain the concepts. Prereq: MFS 503 or consent of instructor.</td>
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<tr>
<td>MFS 554 CHEMICAL AND PHYSICAL PROCESSING OF POLYMER SYSTEMS</td>
<td>(3)</td>
<td>Theory and practice as related to the chemical and physical processing of polymer systems. Polymer rheology, heat transfer in polymer flows, polymer engineering properties. Polymer processing operations and materials selection; flow instabilities. Prereq: CME 330, CME 425 or ME 325; or consent of instructor. (Same as CME/ME MSE 554.)</td>
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<tr>
<td>MFS 563 SIMULATION OF INDUSTRIAL PRODUCTION SYSTEMS</td>
<td>(3)</td>
<td>Discrete event simulation and its application to performance analysis of industrial production systems. Topics include concepts for characterizing production systems, approaches to structuring simulation models, instruction in a simulation language, and techniques for comparing alternative system designs and control strategies. Applications to manufacturing, commercial and mining production systems are considered. Prereq: CS 221 or 270, STA 281 or 381, engineering standing. (Same as MNG 563.)</td>
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<tr>
<td>MFS 581 QUALITY CONTROL</td>
<td>(3)</td>
<td>The purposes and goals of quality control, economics of quality control, quality engineering, statistics and probability in quality control and the functions of a quality control/assurance program in a manufacturing setting. Prereq: STA 381, Engineering standing, MSE 301 or consent of instructor. (Same as MSE 581.)</td>
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<tr>
<td>MFS 599 TOPICS IN MANUFACTURING SYSTEMS ENGINEERING (Subtitle required)</td>
<td>(3)</td>
<td>A detailed investigation of a topic of current significance in manufacturing systems engineering such as computer-aided manufacturing, special topics in robotics, and lean/ agile manufacturing. May be repeated under different subtitles to a maximum of six credits. A particular topic may be offered at most twice under the MFS 599 number. Prereq: Variable; given when topic is identified.</td>
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**MFS Manufacturing Systems Engineering**

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<tr>
<td>MED 825 SECOND-YEAR ELECTIVE, MEDICINE</td>
<td>(1-4)</td>
<td>With the advice and approval of his or her faculty adviser, the second-year student may choose approved electives offered by the Department of Medicine. The intent is to provide the student an opportunity for exploration and study in an area which supplements and/or complements required course work in the second-year curriculum. Pass-fail only. Prereq: Admission to second-year medical curriculum and approval of adviser.</td>
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</tr>
<tr>
<td>MED 580-899 FOURTH-YEAR ELECTIVE FOR MEDICAL STUDENTS</td>
<td>(1-6)</td>
<td>With the advice and approval of the faculty adviser and the Student Progress and Promotions Committee, the fourth-year student may choose approved electives offered by the various departments in the College of Medicine. The intent is to provide the student an opportunity to develop his fund of knowledge and clinical competence. Prereq: Admission to the fourth year, College of Medicine and/or permission of the Student Progress and Promotions Committee.</td>
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</table>

**Approved electives:**
- MED 505 CLINICAL ENDOCRINOLOGY AND METABOLISM, ADULT
- MED 851 GASTROINTESTINAL DISEASE, UK AND VAH
- MED 852 DERMATOLOGY – SECTION 1
- MED 856 NEPHROLOGY, BONE AND MINERAL METABOLISM
- MED 857 PULMONARY MEDICINE
- MED 858 CARDIOLOGY – UK
- MED 860 INFECTIOUS DISEASES
- MED 862 CARDIOLOGY – VAH
- MED 863 RESEARCH IN MEDICINE
- MED 870 ACTING INTERNSHIP IN MEDICINE
- MED 872 FOURTH YEAR REMEDIAL CLINICAL CLERKSHIP
- MED 873 MEDICAL SPECIALTIES AND GENERAL MEDICINE CLINICS
- MED 874 STUDENT HEALTH SERVICE
- MED 876 HEMATOLOGY—ONCOLOGY, UK
- MED 879 GENERAL MEDICAL CONSULTING SERVICE
- MED 881 ALLERGY—MEDICINE
- MED 890 INTERNAL MEDICINE OFF-SITE

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**University of Kentucky 2001-2002 Undergraduate Bulletin**

**KEY:** # = new course * = course changed † = course dropped ¶ = course removed from Bulletin due to inactivity
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<tr>
<td>MGT 301</td>
<td>BUSINESS MANAGEMENT.</td>
<td>(3)</td>
<td>A study of planning, organizing and controlling; an interdisciplinary approach; actual decision-making cases. Prereq: STA 291, ECO 201, 202 and ACC 202, or consent of instructor.</td>
</tr>
<tr>
<td>MGT 320</td>
<td>SURVEY OF PERSONNEL AND INDUSTRIAL RELATIONS.</td>
<td>(3)</td>
<td>Survey of the field of personnel and industrial relations. Introduction of the topics of manpower planning, selection, placement, training, compensation, administration, labor-management relationships, hours of work, and health and safety. Prereq: MGT 301 or consent of instructor.</td>
</tr>
<tr>
<td>MGT 340</td>
<td>ETHICAL AND REGULATORY ENVIRONMENT.</td>
<td>(3)</td>
<td>This course focuses on ethical principles, the nature of the capitalist-collectivist continuum, government influence on business, and the responsibility of business to society. Topics to be considered include major approaches to ethical reasoning, antitrust law, social regulation, and the economic and social theories that undergird the concept of the social responsibility of business. Prereq: Junior standing or consent of instructor.                                                                klärung der Beziehung zur rei</td>
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<tr>
<td>MGT 341</td>
<td>BUSINESS LAW I.</td>
<td>(3)</td>
<td>An introduction to the United States legal system and its application to the business community. Topics to be considered include: contracts, agency, commercial paper, and real property. Prereq: Junior standing or consent of instructor.</td>
</tr>
<tr>
<td>MGT 390</td>
<td>SPECIAL TOPICS IN MANAGEMENT (Subtitle required).</td>
<td>(3)</td>
<td>Readings, projects, lecture and/or discussion to illuminate current topics of special interest or concern in management. May be repeated to a maximum of six credits. May not be repeated under the same title. A particular topic may be offered at most twice under the MGT 390 number. Prereq: Consent of instructor.</td>
</tr>
<tr>
<td>MGT 395</td>
<td>INDEPENDENT STUDY IN MANAGEMENT.</td>
<td>(1-6)</td>
<td>Course designed to accommodate students’ independent exploration of specific topics within management. Course must be under the supervision of an instructor. May be repeated to a maximum of six credits. Prereq: GPA of 3.0, upper division status, approval of instructor and chairperson.</td>
</tr>
<tr>
<td>MGT 410</td>
<td>ANALYSIS OF ORGANIZATIONAL BEHAVIOR.</td>
<td>(3)</td>
<td>The behavior of business organizations and their participants is analyzed in the contemporary language of social psychology, systems, and models. Various theories of the firm are reviewed and evaluated. The interdependence of economic, social and behavioral factors is stressed. Prereq: MGT 301 or consent of instructor.</td>
</tr>
<tr>
<td>MGT 423</td>
<td>MANAGING EMPLOYEE RELATIONS.</td>
<td>(3)</td>
<td>Analysis of theory and practices in managing relationships with employees. The emphasis is on organizational conflict, employee commitment, and problems in union and nonunion situations from a managerial perspective. Prereq: MGT 320, MGT 410, ECO 481G or consent of instructor.</td>
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MI 494G IMMUNOBIOLOGY. (3)
A survey of theories and mechanisms of immunity, including: nature of antigens and antibodies, antigen-antibody reactions, immunocompetent cells, immunogenetics, allergic reactions, tumor immunology and transplantation immunology. Prereq: BCH 401G (may be taken concurrently) and BIO 208 or BIO 308 or consent of instructor. (Same as BIO 494G.)
M1 710 SPECIAL TOPICS IN MICROBIOLOGY. (2)
A variety of topics relating to modern molecular and cell biology. Prereq: Consent of instructor.

M1 720 MICROBIAL STRUCTURE AND FUNCTION. (4)
Molecular basis of structure and function in unicellular microbes. Molecular genetic and structural approaches to the analysis of bacterial architecture, growth, division, and differentiation. Prereq: Consent of instructor, BCH 501, BCH 502. (Same as BIO 720 and OBI 720).

M1 748 MASTER’S THESIS RESEARCH. (0)
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

M1 749 DISSERTATION RESEARCH. (0)
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams. (Same as MB 749.)

M1 768 RESIDENCE CREDIT FOR MASTER’S DEGREE. (1-6)
May be repeated to a maximum of 12 hours. (Same as MB 768.)

M1 769 RESIDENCE CREDIT FOR THE DOCTOR’S DEGREE. (1-12)
May be repeated indefinitely. (Same as MB 769.)

M1 772 SEMINAR IN MICROBIOLOGY. (0-1)
Review of current literature in microbiology; presentation of papers on work in progress in the department on or assigned topics; reports on meetings of national and international scientific and professional societies and symposia. Required of all graduate students. Two hours per week. May be repeated nine times for a maximum of 10 credits. (Same as BIO 772.)

M1 798 RESEARCH IN MICROBIOLOGY. (1-9)
May be repeated to a maximum of 24 credits. Prereq: Consent of instructor. (Same as BIO 798.)

M1 816 CELLULAR STRUCTURE AND FUNCTION/GENETICS. (3)
The course combines small group meetings, lecture, clinical correlations, problem-based learning, and problem-solving sessions in providing an understanding of the relationship of human genetics to human health and disease. Close integration with biochemistry topics provides a better picture of how biochemistry, genetics and molecular biology contribute to normal human development and medicine. Lecture, 20 hours per week. Prereq: Admission to Medical School (first year). (Same as MD 816.)

M1 822 IMMUNITY, INFECTION, AND DISEASE. (9)
The course provides basic concepts of immunology and of bacterial, viral, fungal and protozoal biology. It focuses on mechanisms of human immunity, immunologically mediated disease, and pathogenesis in infectious disease. The material covered includes relevant pathologies associated with both immunologic and infectious diseases, and a brief summary of infectious diseases from an organ system perspective. Lecture, 20 hours per week. Prereq: Admission to second year of medical curriculum. (Same as MD 822.)

M1 825 SECOND-YEAR ELECTIVE, MEDICAL MICROBIOLOGY AND IMMUNOLOGY. (1-4)
With the advice and approval of his or her faculty adviser, the second-year student may choose approved electives offered by the Department of Medical Microbiology and Immunology. The intent is to provide the student an opportunity for exploration and study in an area which supplements and/or complements required course work in the second-year curriculum. Pass-fail only. Prereq: Admission to second-year medical curriculum and approval of adviser.

#MI 828 IMMUNITY, INFECTION AND DISEASE FOR THE STUDENT DENTIST. (11)
The course provides basic concepts of immunology and bacterial, viral, fungal and protozoal biology. It focuses on mechanisms of human immunity, immunologically mediated disease, and pathogenesis in infectious disease. The material covered includes relevant pathologies associated with both immunologic and infectious diseases, and a summary of infectious diseases from a clinical perspective. Lecture: 20 hours per week. Prereq: Admission to the second year of dental curriculum or permission of course director. (Same as OBI 828.)

M1 850-899 FOURTH-YEAR ELECTIVE FOR MEDICAL STUDENTS. (1-6)
With the advice and approval of the faculty adviser and the Student Progress and Promotions Committee, the fourth-year student may choose approved electives offered by the various departments in the College of Medicine. The intent is to provide the student an opportunity to develop his fund of knowledge and clinical competence. Prereq: Admission to the fourth year, College of Medicine and/or permission of the Student Progress and Promotions Committee.

MKT Marketing

MKT 300 MARKETING MANAGEMENT. (3)
The literature and problems in the retail distribution of consumers’ goods, wholesale distribution of consumers’ goods, industrial goods, sales organizations, sales promotion and advertising, and price policies. Prereq: ECO 202 or consent of instructor.

MKT 310 CONSUMER BEHAVIOR. (3)
The application of psychology, sociology, and anthropology to marketing. Includes such topics as consumer decision process, communications, interpersonal behavior, innovation. Prereq: MKT 300.

MKT 320 RETAIL AND DISTRIBUTION MANAGEMENT. (3)
Analysis of the functions, structure, policies, and performance of distribution channels and institutions. The course objective is to provide students with an understanding of concepts and decision making tools useful in managing manufacturer-retailer relationships and distribution costs at both the channel and retail level. The course is also concerned with the legal and socio-economic impact of distribution trends and practices. Prereq: MKT 300.

MKT 330 PROMOTION MANAGEMENT. (3)
The objectives of the Promotion Management course are to develop awareness and understanding of the role and functions of promotion within firms and within society and to explicitly attempt to develop student thinking skills, i.e., problem identification, problem analysis, and problem solving, in the area of promotion. Prereq: MKT 300 and MKT 310 or permission of instructor.

MKT 340 INTRODUCTORY MARKETING RESEARCH. (3)
Managerial applications of research in marketing decision making. The course objective is to provide students with expertise in defining information needs, selecting information sources and organizing information in decision-making contexts. Application of major concepts will be illustrated in marketing policy areas. Prereq: MKT 300, ECO 391.

MKT 390 SPECIAL TOPICS IN MARKETING (Subtitle required). (1-3)
Readings, projects, lecture and/or discussion to illuminate current topics of special interest or concern in marketing. May be repeated to a maximum of six credits. May not be repeated under the same title. A particular topic may be offered at most twice under the MKT 390 number. Prereq: Consent of instructor.

MKT 395 INDIVIDUAL WORK IN MARKETING. (1-6)
Student develops a specific program with instructor. One or more papers is typically expected. May be repeated to a maximum of six credits. Prereq: GPA of 3.0 in major, approval of instructor and chairperson.

MKT 410 PERSONAL SELLING. (3)
A detailed exposure to personal selling techniques. Emphasis placed on sales process, especially planning and delivery of sales presentations. Selected sales management topics include recruiting, training, motivating and evaluating sales people, as well as ethical and legal issues. Prereq: MKT 300 and marketing majors only.

#MKT 415 INTERNET MARKETING. (3)
The purpose of the course is to introduce the business functions of the Internet including E-mail, Discussion Groups, and the World Wide Web (WWW) to the students. This rapidly evolving technology is changing every facet of how companies market their products and how they do business. The Internet is also opening up the global market to companies of all sizes. The importance of integrating this technology into the strategic marketing process will be emphasized in this course. Prereq: MKT 300 and Marketing Majors only.

#MKT 425 FRANCHISING. (3)
The purpose of the course is to provide an understanding of franchising and the various business components that affect its success. Franchising issues are considered from a strategic marketing perspective. Issues such as branding, promotion, distribution, financing, and service delivery are considered as they pertain to franchising. Prereq: MKT 300 and Marketing Majors Only.
MKT 430 SERVICES MARKETING MANAGEMENT. (3)
This course addresses marketing and management issues and problems faced by service organizations. Marketing and management concepts are broadened and applied to the service organizations. Topics related to service quality, the marketing mix, and service delivery are covered. Prereq: MKT 300, MGT 301. (Same as MGT 430.)

MKT 435 INTERNATIONAL MARKETING. (3)
The primary objectives of this course are to: 1) familiarize the student with selected strategic marketing issues in a multinational environment, 2) examine alternative ways by which a firm can expand internationally, and 3) help the student develop a systematic approach for dealing with global and international marketing issues. Prereq: MKT 300.

#MKT 445 SPORTS MARKETING. (3)
The purpose of the course is to develop an understanding of strategic marketing concepts and activities as they apply to the context of sports. Marketing concepts and activities related to the marketing mix, consumer/fan behavior, and business organization-sport organization relationships will be examined. Prereq: MKT 300 and Marketing majors only.

MKT 450 MARKETING STRATEGY AND PLANNING. (3)
An examination of and participation in analytical processes for managerial marketing decisions. Topics will include such problem areas as product planning, distribution systems, advertising strategies, information systems, pricing decisions and buying behavior. Prereq: MKT 300 and two other marketing courses.

MKT 600 MARKETING MANAGEMENT. (3)
This course is designed to provide students with an understanding of: the role of marketing function in an organization; the types of marketing decisions and analytical procedures involved in making each decision; the overall marketing planning process; and, the impact of the social, economic, and legal environment on marketing decisions. Prereq: Completion of first semester of MBA program, graduate standing, MGT 611, ECO 610, ACC 628, MGT 650.

MKT 601 MARKETING RESEARCH. (3)
MKT 601 entails a vigorous examination of research methodology applicable to marketing situations. Emphasis is placed on 1) experimental design, 2) survey design and administration, and 3) analytical procedures. Practical application of market research is stressed. Legal and social issues are also examined. Prereq: MKT 600, MGT 650, and MGT 651.

MKT 621 PRODUCT MANAGEMENT. (3)
Examines the analytical, decision-making, and planning concepts and tools available to market/product/brand managers. Specific decisions to be addressed include: product policy formulation, the selection of product market strategies, new product development, product-line modifications and deletions, and organizational implications. Prereq: Completion of first year of MBA program or permission of instructor.

MKT 622 SALES MANAGEMENT. (3)
MKT 622 entails a comprehensive examination of the planning, implementing, and control of personal contact programs designed to achieve the sales objectives of the firm. Managerial decision-making is emphasized through the application of lecture material, readings, and case studies. Prereq: Completion of first year of MBA program or permission of instructor.

MKT 623 MARKETING IN SERVICE AND NONPROFIT ORGANIZATIONS. (3)
The purpose of the course is to broaden and apply the conceptual system of marketing to the marketing problems of service and nonprofit organizations. Concepts such as marketing mix, marketing segmentation, market positioning, channels of distribution and others will be applied to the problems of service and nonprofit organizations. Prereq: MKT 600 or permission of the instructor.

MKT 624 INTERNATIONAL MARKETING MANAGEMENT. (3)
Examines the broad implications for marketing strategy and decision making of the firm in an international context. Addresses comprehensive survey of firm entry strategies, marketing mix decisions, product policies, and environmental factors in a global context. Context-based problems such as implicit barriers to entry through distribution channel management will also be addressed. Prereq: MKT 600 or permission of instructor.

MKT 695 INDIVIDUAL WORK IN MARKETING. (1-6)
Students confer individually with the instructor. May be repeated to a maximum of six credits. Prereq: Consent of instructor.

MKT 700 SEMINAR IN MARKETING MANAGEMENT. (3)
A doctoral seminar directed toward the basic decision areas of marketing management. Emphasis is on traditional, classic, and contemporary literature that presents important conceptualizations of marketing practices and empirical research in marketing management. Prereq: Consent of instructor.

MKT 710 SEMINAR IN CONSUMER BEHAVIOR. (3)
The seminar is specifically designed for the needs of doctoral students in marketing in that it emphasizes empirical research, theory and methodology as they relate to consumer behavior. The objectives of the seminar are (1) to familiarize the students with the literature of consumer behavior, (2) to stimulate critical thinking about existing research, and (3) to evaluate existing theories, conceptualizations, and models of buyer behavior. Prereq: Consent of instructor.

MKT 720 SEMINAR IN MARKETING THEORY. (3)
A survey, analysis and evaluation of the current research in marketing theory. Detailed attention is given to problems of determining the meaning and boundaries of marketing theory. Emphasis is placed on introducing the student to the substantive content of marketing theories and their methodologies. Prereq: MKT 600 or consent of instructor.

MKT 763 RESEARCH, DESIGN AND ANALYSIS. (3)
This course deals with the design and analysis of business research. Emphasizes the practical application of analysis of variance and correlational techniques to problems in business research. Focus will be on design, implementation, and interpretation of research. Prereq: MGT/MKT/FIN 762. (Same as MGT/FIN 763.)

MKT 771 SEMINAR IN BUSINESS ADMINISTRATION. (3)
Each semester some topic currently discussed in scholarly journals in business administration will be studied intensively. May be repeated to a maximum of nine credits. Prereq: Consent of instructor.

MKT 781 INDEPENDENT WORK IN MARKETING. (1-6)
Designed for advanced students who undertake research problems to be conducted in regular consultation with the instructor. May be repeated to a maximum of six credits. Prereq: Consent of instructor.

MNG 101 INTRODUCTION TO MINING ENGINEERING. (2)
Orientation to the mining engineering profession; introduction to key mining engineering activities and functions; mining methods and equipment; health and safety subsystems.

MNG 211 SURVEYING. (4)
A comprehensive course in the art and science of surveying as applied to civil and mining engineering, including the use and care of surveying instruments; measurement of horizontal and vertical distances, angles and directions; collection of ground and underground data for the design and layout of roads, buildings; various mineral workings and other structures; and some aspects of the precise determination of position and direction for survey control. Lecture, three hours; laboratory, three hours per week. Prereq: CE 106, CE 121 or MNG 101, MA 114. (Same as CE 211.)

MNG 264 UNDERGROUND MINING OPERATIONS. (2)
A study of the principal underground mining methods practiced in coal and hard rock mines; method classification and selection; support and equipment requirements; general mine planning, sequence of development, cycle of operations, production estimates, and method application and variations. Prereq: MNG 101.

MNG 301 MINERALS PROCESSING. (3)

MNG 302 MINERALS PROCESSING LABORATORY. (1)
Application of the principles studied in MNG 301. Laboratory, two hours. Prereq or concur: MNG 301.

MNG 303 DEFORMABLE SOLIDS LABORATORY. (1)
Experimental studies of the mechanical properties of materials and structural elements. Laboratory, four hours per week for three-fourths of the semester. Prereq or concur: EM 302.

MNG 332 MINE PLANT MACHINERY. (3)
Theory and practice of mine haulage, hoisting, and drainage and pumping. Application of engineering principles to the analysis and selection of materials handling mediums for the minerals industry. Prereq: MNG 101, MNG 264, PHY 231; concur: EM 221.

MNG 341 MINE VENTILATION. (3)
Hazards of dust and gaseous contamination of mine atmosphere, air dilution requirements, flow distribution in mine network, computer analysis of the ventilation network, natural ventilation and fans. Lecture, two hours; laboratory; three hours. Prereq: PHY 231, CE 341 and engineering standing.
MNG 363 SURFACE MINING OPERATIONS. (3)

MNG 371 PROFESSIONAL DEVELOPMENT OF MINING ENGINEERS. (3)
Development of professional skills important to the practice of mining engineering. Topics include written and oral communication skills, understanding ethical responsibility and appropriate ethical conduct, real world problem formulation and solution skills, exercise of abilities important to lifelong learning, knowledge of contemporary issues important to mining engineering. Prereq: COM 199, Engineering standing.

MNG 374 MINE VALUATION AND INVESTMENT ANALYSIS. (3)
Economic evaluation methods and applications to economic decision problems encountered in the mining industry, including the mine valuation problem. Prereq: MNG 264, MNG 301, STA 381, engineering standing.

MNG 395 INDEPENDENT WORK IN MINING ENGINEERING. (1-6)
Individual work on some selected problem in the field of mining engineering. May be repeated for a maximum of six credits. Prereq: Consent of department chairperson and the instructor, engineering standing.

MNG 431 MINE SYSTEMS ENGINEERING. (3)
Aspects of industrial and geological engineering for mine systems engineering design. Course consists of reserve system engineering, pre-system modeling and interfacing systems to reserves. Prereq: STA 381, MNG 332, engineering standing.

MNG 511 MINE POWER SYSTEM DESIGN. (3)
A study of mine power distribution systems, major power system components, and techniques of power system analysis. Topics include per-unit analysis; symmetrical component analysis; grounding, including ground-bed design, ground-resistor sizing, and ground wire monitoring; cable and transformer sizing; and load-flow analysis. Course may not be used to satisfy degree requirements in electrical engineering if credit is earned in EE 538. Prereq: EE 306 or equivalent, and engineering standing.

MNG 551 ROCK MECHANICS. (4)
Determination of the physical properties of rocks, rock mass classification, stress around mine openings, strain and displacement of the rock mass, rock reinforcement and support, stress interaction and subsidence, strata control. Lecture, three hours; laboratory, three hours per week. Prereq: EM 302, MNG 363, GLV 240, and engineering standing.

MNG 561 MINE CONSTRUCTION ENGINEERING I. (3)

MNG 563 SIMULATION OF INDUSTRIAL PRODUCTION SYSTEMS. (3)
Discrete event simulation and its application to performance analysis of industrial production systems. Topics include concepts for characterizing production systems, approaches to structuring simulation models, instruction in a simulation language, and techniques for comparing alternative system designs and control strategies. Applications to manufacturing, commercial and mining production systems are considered. Prereq: CS 221 or 270, STA 281 or 381, engineering standing. (Same as MFS 563.)

MNG 572 ADVANCED COAL PREPARATION. (3)
Design a coal preparation plant by integrating unit operations preceded by certain back-up laboratory experiments. Cost sensitivity analysis of competing design schemes will be determined on a selected coal. Lecture: two hours; laboratory: three hours per week. Prereq: MNG 301 or equivalent, engineering standing.

MNG 581 GEOSTATISTICS. (3)
The geostatistics approach for estimating the spatial distribution of rock and mineral properties. Topics include treatment of the spatial distribution of ore grade as regionalized variables, covariance stationary processes, variograms, volume/variance relations, ordinary kriging, block grade distributions, and nonlinear kriging approaches. Prereq: STA 381, engineering standing.

MNG 591 MINE DESIGN PROJECT I. (1)
Students will undertake a design project consisting of reserve analysis on a given mine property. They will calculate mineable reserves and analyze mining and quality properties of coal. Each student will write a report supported by maps and will present it orally before a group of peers and invited experts. Lecture, one hour; laboratory, one hour per week. Prereq: MNG 332, engineering standing.

MNG 592 MINE DESIGN PROJECT II. (3)
Students will undertake a major design project such as the overall design of a mining system, including design of major components of the system and economic evaluation. Students will write reports documenting this design, which will also be presented orally before a group of peers and invited experts. Lecture, two hours; laboratory, two hours per week. Prereq: MNG 341, MNG 551, MNG 591 and engineering standing.

MNG 599 TOPIC IN MINING ENGINEERING. (2-3)
A detailed investigation of a topic of current significance in mining engineering. May be repeated to a maximum of six credits, but only three credits can be earned under the same title. A particular topic may be offered at most twice under the MNG 599 number. Prereq: Engineering standing and consent of instructor.

MNG 611 MINE POWER SYSTEM PROTECTION. (3)
A study of components and methods for providing protection to mine electrical systems. Review topics include power distribution arrangements, per-unit system, and symmetrical components. Course topics include sources of transient and faults, protective equipment, phase overcurrent relaying, and ground fault protection. Lecture, two and one-half hours; lab, one and one-half hours per week. Prereq: MNG 511.

MNG 634 ADVANCED MINING ENGINEERING. (3)
Procedures and methods of obtaining data and analyzing mine systems for efficient development and exploitation of a mining property. Course includes applications of operation research techniques. Prereq: CE 555, CS/MA/STA 482G.

MNG 637 ROCK SLOPE STABILITY AND DESIGN. (3)
Design and stability analysis of rock slopes using analytical, empirical, and numerical approaches, engineering geological data, groundwater pressure, blasting, and remedial measures. Prereq: MNG 551.

MNG 641 ADVANCED MINE VENTILATION. (3)
Planning, designing and redesigning the ventilation systems using computers; data acquisition (ventilation survey); non-steady state flow in mine openings; influence of the ventilation conditions upon the dynamics of the methane concentration; automation of the ventilation system. Lecture, two hours; laboratory, two hours. Prereq: MNG 341.

MNG 681 GEOSTATISTICS II. (3)
A second course in geostatistics for mine planning and geotechnical applications. Topics include co-regionalized variables and cokriging, non-parametric geostatistics (indicator, probability, and soft kriging), loss functions and optimum predictors for ore selection decisions, conditional simulation—techniques and applications. Prereq: MNG 581.

MNG 690 ADVANCED MINERAL BENEFICIATION ENGINEERING. (3)

MNG 691 SIMULATION OF MINERAL PROCESSING CIRCUITS. (3)
Flowsheet modeling and analysis for coal preparation and ore dressing plants. Topics include unit models for comminution, gravity separation, and froth flotation; relevant techniques for solving systems of nonlinear equations; convergence acceleration techniques; sequential modular, simultaneous modular, and equation-solving flow-sheeting frameworks; flowgraph techniques for analysis of certain classes of mineral processing circuits. Prereq: MNG 575.

MNG 699 TOPICS IN MINING ENGINEERING
(Subtitle required). (3)
A detailed investigation of a topic of current interest in mining engineering. May be repeated to a maximum of six credits, but only three credits may be earned under the same subtitle. A particular topic may be offered only twice under the MNG 699 number. Prereq: Consent of instructor.

MNG 748 MASTER’S THESIS RESEARCH. (0)
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

MNG 749 DISSERTATION RESEARCH. (0)
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.

MNG 768 RESIDENCE CREDIT FOR THE MASTER’S DEGREE. (1-6)
May be repeated to a maximum of 12 hours.

MNG 769 RESIDENCE CREDIT FOR DOCTOR’S DEGREE. (0-12)
May be repeated indefinitely.

2001-2002 Course Descriptions – M
MNG 771 SEMINAR IN MINING ENGINEERING. (1)
Review of current research in specific areas of mining engineering. Required of all graduate students. Prereq: Graduate classification.

MNG 780 SPECIAL PROBLEMS IN MINING ENGINEERING. (1-6)
Individual work on some selected design problems in one area of mining engineering. May be repeated to a maximum of six credits. Prereq: Approval of the chairperson of the department.

MNG 790 SPECIAL RESEARCH PROBLEMS IN MINING ENGINEERING. (1-9)
Individual work on some selected problems in one of the various fields of mining engineering. Laboratory and field measurements, six hours. May be repeated to a maximum of nine credits. Prereq: Approval of the Director of Graduate Studies.

MSE 101 MATERIALS ENGINEERING. (1)
An introduction to the materials engineering profession. Professional growth, conduct, ethics and organizations. Introduction to the techniques of materials engineering.

MSE 102 METALS TECHNOLOGY. (1)
A laboratory course introducing students to basic materials characterization laboratory techniques. Laboratory, three hours per week.

MSE 201 MATERIALS SCIENCE. (3)
Microscopic and macroscopic structure as related to the properties of materials with engineering applications. Prereq or concur: MA 114 and freshman chemistry.

MSE 212 ELECTRONIC PROPERTIES OF MATERIALS. (3)
Modern ideas on the engineering properties of solids, crystallographic properties; relationship of properties to structure and electronic properties of materials. Prereq: PHY 232 and 242, MA 214 concurrent.

MSE 301 MATERIALS SCIENCE II. (3)
Introduction to processing of ceramic, polymer and composite materials; relating the structure and bonding in these materials to their properties; considerations in choosing appropriate materials for engineering applications. Prereq: MSE 201, or consent of instructor.

MSE 351 MATERIAL THERMODYNAMICS. (3)
Solution thermodynamics; partial molal quantities; ideal and non-ideal solutions; application of thermodynamics to phase equilibria; heterogeneous equilibria; free energy-composition relationships; temperature-pressure relationship. Prereq: CME 200 and MSE 201.

MSE 395 INDEPENDENT WORK IN MATERIALS ENGINEERING. (1-3)
Research for undergraduate departmental students. May be repeated to a maximum of 12 credits. Prereq: Department major and approval of chairperson.

MSE 401G METAL AND ALLOYS. (4)
Crystal structures, phase diagrams, diffusion, nucleation and growth, deformation, recovery, recrystallization and grain growth are discussed to understand the structure-property relations in metals and alloys. Lecture, three hours; laboratory, three hours per week. Prereq: MSE 102 and MSE 301 and Engineering standing.

MSE 402G ELECTRONIC MATERIALS AND PROCESSING. (3)
Electrons in metals, alloys, semiconductors and insulators, semiconductor devices, methods to produce and process electronic materials; solidification of electronic materials, defect control, diffusion of dopants, oxidation and methods of structural, electronic and chemical characterization. Prereq: MSE 102, MSE 301, Engineering standing or graduate level.

MSE 403G CERAMIC ENGINEERING. (4)
Relating the structure and bonding in ceramic materials to their mechanical, electrical, magnetic, optical, and thermal properties; processing, shape-forming, densification and machining of ceramic; design considerations. Prereq: MSE 201 and MSE 301 or consent of instructor, Engineering standing.

MSE 404G POLYMERIC MATERIALS. (3)
Relating properties to structure; properties of polymer materials; mechanical, electrical and thermal properties of amorphous and crystalline polymers, molding and fabrication, polymers as additives, biomedical application, selection of polymers, design. Prereq: Engineering standing, CHE 230 or CHE 236, MSE 301, or consent of instructor. (Same as CME 404G.)
MSE 561 ELECTRIC AND MAGNETIC PROPERTIES OF MATERIALS. (3)
Study of dielectric and magnetic materials. Topics include dielectric relaxation, conduction and breakdown mechanisms, liquid crystals, ferroelectrics, magnetic resonance and relaxation, measurement techniques. Prereq: MSE 212 and PHY 361 or EE 461G or consent of instructor. (Same as EE 561.)

MSE 566 HYBRID MICROELECTRONICS.

MSE 568 FIBER OPTICS. (3)
The course presents theory and practice related to (a) fiber optic cable and their fabrication, (b) fiber optic transmitters and detectors, (c) fiber optic communication systems and (d) fiber optic remote sensors. Prereq: EE 468G. (Same as EE 568.)

MSE 569 ELECTRONIC PACKAGING SYSTEMS AND MANUFACTURING PROCESSES. (3)
Study of packaging systems which interconnect, support, power, cool, protect, and maintain electronic components. The course will address systems at the chip, board, and product levels. Topics include design, properties, materials, manufacture, and performance of various packaging systems. Laboratory will provide familiarity with design software and production equipment and processes. Prereq: EE 211 or EE 305 or EE 307. (Same as EE 569.)

MSE 580 MATERIAL SELECTION AND FAILURE ANALYSIS.

MSE 581 QUALITY CONTROL. (3)
The purposes and goals of quality control, economies of quality control, quality engineering, statistics and probability in quality control and the functions of a quality control/assurance program in a manufacturing setting. Prereq: STA 381, Engineering standing, MSE 301 or consent of instructor. (Same as MFS 581.)

MSE 585 MATERIALS CHARACTERIZATION TECHNIQUES. (4)
This course will present the fundamentals of x-ray and electron beam interactions with solid-state materials. Both elastic and inelastic interactions will be treated, with emphasis on elastic diffraction effects. The laboratory component of the class will provide hands-on learning of the practical aspects of x-ray diffraction, electron diffraction and imaging, and x-ray energy-dispersive spectroscopy. Lecture, three hours; laboratory, three hours per week. Prereq: MSE 301 and Engineering standing or graduate status or consent of instructor.

MSE 599 TOPICS IN MATERIALS SCIENCE AND ENGINEERING (Subtitle required). (1-4)
A detailed investigation of a topic of current significance in engineering and materials science such as: biomedical synthetics, electronic properties of materials, advances in metal working, history of materials technology, quantitative metallurgy. Theory of disclinations, scanning electron microscopy. May be repeated to a maximum of eight credits, but only four credits can be earned under the same title. A particular topic may be offered at most twice under the MSE 599 number. Prereq: Variable; given when topic identified.

PREREQUISITE FOR GRADUATE WORK: Students desiring to take any of the following courses should have a thorough working knowledge of chemistry, physics and mathematics.

MSE 607 ANALYSIS OF METAL CUTTING PROCESSES. (3)
Advanced study of metal cutting involving the mechanics of metal cutting including cutting forces, tool-wear/tool-life and temperature analysis, surface finish and integrity, chip control, machinability assessments and advances in cutting tool technology. Prereq: ME 505. (Same as ME/MFS 607).

MSE 620 COMPUTATIONAL MATERIALS SCIENCE ENGINEERING. (3)
The effective use of existing computer software in the area of materials science engineering. Use of computers to model processes and examine and predict materials properties at the macroscopic and atomistic level. Prereq: Graduate standing in physical sciences and engineering, strong background in material properties and structure similar to the material covered in MSE 401G, MSE 403G, and MSE 404G, and some programming experience in C or FORTRAN; or consent of instructor.

MSE 632 ADVANCED MATERIALS SCIENCE. (3)
Classification of solids, atomic structure and bonding, relation of structure to properties, deformation behavior and failure. Prereq: Consent of instructor.

MSE 633 ADVANCED MECHANICAL METALLURGY. (3)
Theory of dislocations in crystals and their role in strength, plasticity, work hardening and fracture of crystalline solids. Prereq: Consent of instructor.

MSE 636 DISLOCATION THEORY. (3)
Fundamentals of elastic theory of dislocations and the kinematics of dislocation motion: straight dislocations, curved dislocation, self-energies, interactions with other crystal defects, dislocation multiplication. Prereq: MSE 535 or EM 531 or equivalent.

MSE 650 ADVANCED MATERIALS THERMODYNAMICS. (3)
Study of reactions of materials with chemical environments. Introduction to irreversible thermodynamics. Emphasis on current literature. Prereq: Consent of instructor.

MSE 659 ADVANCED PHASE DIAGRAMS.

MSE 661 ADVANCED PHYSICAL METALLURGY I. (3)
Study of the theory of phase transformations in metallic systems. Analysis of rate controlling processes for nucleation and growth controlled phase changes and for order-disorder reactions. Prereq: MSE 362 and 412 or consent of instructor.

MSE 662 ADVANCED PHYSICAL METALLURGY II. (3)
Solidification theory and mechanisms. Diffusion in solids. Prereq: MSE 661 or consent of instructor.

MSE 665 CRYSTALLOGRAPHY AND X-RAY ANALYSIS.

MSE 666 DIFFRACTION METHODS IN MATERIALS SCIENCE.

MSE 699 ADVANCED TOPICS IN MATERIALS SCIENCE AND ENGINEERING (Subtitle required.) (3)
A detailed investigation of an advanced topic of current significance in materials science and engineering such as (1) nanometer materials, (2) structures of superconductors and (3) materials characterization under high rates of deformation. May be repeated under different subtitles to a maximum of nine credits, but only three credits can be earned under the same title. A particular topic may be offered at most twice under the MSE 699 number. Prereq: Variable, given when topic is identified.

MSE 748 MASTER’S THESIS RESEARCH. (0)
Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

MSE 749 DISSERTATION RESEARCH. (0)
Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.

MSE 768 RESIDENCE CREDIT FOR THE MASTER’S DEGREE. (1-6)
May be repeated to a maximum of 12 hours.

MSE 769 RESIDENCE CREDIT FOR THE DOCTOR’S DEGREE. (0-12)
May be repeated indefinitely.

MSE 771 SEMINAR. (0)
Review of current literature in the field of metallurgical engineering and presentation of papers thereon. Presentation of talks on departmental research. Group and panel discussions. Required of all graduate students every semester. Lecture, one hour per week.

MSE 781 SPECIAL PROBLEMS, LITERATURE AND LABORATORY. (1-3)
Literature research and planning of research programs; shop problems and technical writing, including a term paper, are required. Consultation and lecture by appointment. May be repeated to a maximum of nine credits.

MSE 782 SPECIAL PROBLEMS, LITERATURE AND LABORATORY. (3)
A continuation of MSE 781. Laboratory, six hours; consultation and lecture by appointment. May be repeated to a maximum of nine credits.

MSE 790 RESEARCH IN MATERIALS SCIENCE. (3-9)
Active research (experiments, library work, theory) toward Ph.D. degree. May be repeated indefinitely.
MUC 150 CLASS INSTRUCTION IN PIANO. (1)
A beginning course in the fundamentals of playing the piano. Lecture, two hours. Prereq: For music majors; other students by consent of instructor.

MUC 151 CLASS INSTRUCTION IN PIANO. (1)
A beginning course in the fundamentals of playing the piano. For music majors; other students by consent of instructor. Lecture, two hours. Prereq: MUC 150.

MUC 152 CLASS INSTRUCTION IN PIANO. (1)
A course in the fundamentals of playing the piano. For music majors; others by consent of instructor. Lecture, two hours. Prereq: MUC 151.

MUC 153 CLASS INSTRUCTION IN PIANO. (1)
A course in the fundamentals of playing the piano. For music majors; others by consent of instructor. Instruction, two hours. Prereq: MUC 152.

MUC 154 CLASS INSTRUCTION IN VIOLIN. (1)
A beginning course in the fundamentals of playing the violin. Lecture and laboratory, three hours per week. Prereq: Consent of instructor.

MUC 155 VOICE CLASS FOR NON-MUSIC MAJORS. (1)
Applied voice group instruction for non-music majors with emphasis on basic breathing and vocal technique, elements of music notation, and diction. May be repeated to a maximum of two credits with consent of instructor.

MUC 156 CLASS INSTRUCTION IN WOODWIND INSTRUMENTS. (1)
A beginning course in the fundamentals of playing and teaching woodwind instruments. May be repeated to a maximum of two credits. Prereq: For music majors; others by consent of instructor.

MUC 157 CLASS INSTRUCTION IN PERCUSSION INSTRUMENTS. (1)
A beginning course in the fundamentals of playing and teaching percussion instruments. Instruction, three hours. Prereq: For music majors only; others by consent of instructor.

MUC 158 CLASS INSTRUCTION IN WOODWIND INSTRUMENTS. (1)
A beginning course in the fundamentals of playing and teaching woodwind instruments. May be repeated to a maximum of two credits. Prereq: For music majors; others by consent of instructor.

MUC 159 CLASS INSTRUCTION IN STRING INSTRUMENTS. (1)
A beginning course in the fundamentals of playing and teaching violin, viola, cello and string bass. May be repeated to a maximum of two credits. Prereq: For music majors; others by permission of instructor. For non-string majors who take this course for two semesters, it must be taken sequentially beginning in the fall semester.

MUC 160 CLASS INSTRUCTION IN BRASS INSTRUMENTS. (1)
A beginning course in the fundamentals of playing and teaching brass instruments. Lecture, three hours per week. May be repeated to a maximum of two credits. Prereq: For music majors; others by consent of instructor.

MUC 161 CLASS INSTRUCTION IN STRING INSTRUMENTS. (1)
A beginning course in the fundamentals of playing and teaching violin, viola, cello, and string bass. May be repeated to a maximum of two credits. Prereq: For music majors; others by consent of instructor.

MUC 162 CLASS INSTRUCTION IN PIANO. (1)
A large concert band primarily for the general student desiring continuation of instrumental music experience. Laboratory, two hours. Prereq: Consent of instructor.

MUC 163 CLASS INSTRUCTION IN ORCHESTRA. (1)
The course offers students the opportunity to learn and perform the best choral literature in the repertoire. Laboratory, three hours per week. May be repeated to a maximum of six credits. Prereq: Audition and consent of instructor.

MUC 164 CLASS INSTRUCTION IN GUITAR. (1)
A select band engaged in preparation and performance of a variety of music composed for this medium. May be repeated to a maximum of four credits. Prereq: Audition and consent of instructor.

MUC 165 ORCHESTRA (1)
The University’s select band for performance of challenging literature in the wind repertoire. Laboratory, four hours. Prereq: Consent of instructor.

MUC 166 SYMPHONIC BAND. (1)
A course in the fundamentals of playing and teaching brass instruments. Lecture, three hours per week. May be repeated to a maximum of two credits. Prereq: Consent of instructor.

MUC 167 PIANO ENSEMBLE. (1)
Study of piano ensemble chamber music through performance. May be repeated to a maximum of six credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 168 GUITAR ENSEMBLE. (1)
Study of guitar ensemble music through performance. May be repeated to a maximum of six credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 169 WIND ENSEMBLE. (1)
The University’s select band for performance of challenging literature in the wind repertoire. May be repeated to a maximum of eight credits. Prereq: Audition and consent of instructor.

MUC 170 STRING ENSEMBLE. (1)
A beginning course in the fundamentals of playing the piano. Lecture, two hours. Prereq: Consent of instructor.

MUC 171 BRASS ENSEMBLE. (1)
The study of brass instrument chamber music through performance. May be repeated to a maximum of eight credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 172 WOODWIND ENSEMBLE. (1)
The study of woodwind instrument chamber music through performance. May be repeated to a maximum of eight credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 173 PERCUSSION ENSEMBLE. (1)
The study of percussion instrument chamber music through performance. May be repeated to a maximum of eight credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 174 UNIVERSITY CHORALE. (1)
An auditioned choral ensemble for the study of choral literature through performance. Class will meet for five weekly rehearsals per week. May be repeated to a maximum of six credits. Prereq: Audition and consent of instructor.

MUC 175 JAZZ ENSEMBLE. (1)
Study of jazz through performance. May be repeated to a maximum of eight credits. Laboratory, three hours. Prereq: Consent of instructor.

MUC 176 PIANO ENSEMBLE. (1)
Study of piano ensemble chamber music through performance. May be repeated to a maximum of eight credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 177 GUITAR ENSEMBLE. (1)
The study of guitar ensemble music through performance. May be repeated to a maximum of six credits. Laboratory, two hours. Prereq: Consent of instructor.

LARGE MUSICAL ORGANIZATIONS

MUC 178 SYMPHONY. (1)
A beginning course in the fundamentals of playing and teaching percussion instruments. Laboratory, two hours per week. May be repeated to a maximum of two credits with consent of instructor.

MUC 179 SYMPHONIC BAND. (1)
A large concert band primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 180 OPERA WORKSHOP. (1)
Study of opera production and direction through class presentation of scenes and complete works. May be repeated to a maximum of four credits. Prereq: Consent of instructor.

MUC 181 OPERA WORKSHOP. (1)
Study of opera production through class presentation of scenes and complete works. May be repeated to a maximum of six credits. Laboratory, two hours. Prereq: Consent of instructor.

MUC 182 OPERA WORKSHOP. (1)
Study of the principles and techniques of opera production through class presentation of scenes and complete works. May be repeated to a maximum of six hours. Prereq: Consent of instructor.

MUC 183 OPERA WORKSHOP. (1)
Study of the principles and techniques of opera production through class presentation of scenes and complete works. May be repeated to a maximum of six hours. Prereq: Consent of instructor.

MUC 184 OPERA WORKSHOP. (1)
Study of the principles and techniques of opera production through class presentation of scenes and complete works. May be repeated to a maximum of six hours. Prereq: Consent of instructor.

MUC 185 OPERA WORKSHOP. (1)
Study of the principles and techniques of opera production through class presentation of scenes and complete works. May be repeated to a maximum of six hours. Prereq: Consent of instructor.

MUC 186 OPERA WORKSHOP. (1)
Study of the principles and techniques of opera production through class presentation of scenes and complete works. May be repeated to a maximum of six hours. Prereq: Consent of instructor.

MUC 187 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 188 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 189 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 190 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 191 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 192 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 193 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 194 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 195 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 196 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 197 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 198 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 199 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.

MUC 200 SYMPHONY. (1)
A large symphony orchestra primarily for the general student desiring continuation of instrumental music experience. Laboratory, three hours. Prereq: Consent of instructor.
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<th>Undergraduate Courses</th>
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<td>Numbered 500 and above (1-4)</td>
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<td>Voice MUP 102, 202, 302, 402, 502, 602, 702</td>
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<td>Organ MUP 103, 203, 303, 403, 503, 603, 703</td>
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<td>Violin MUP 104, 204, 304, 404, 504, 604, 704</td>
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<td>Viola MUP 105, 205, 305, 405, 505, 605, 705</td>
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<td>Flute MUP 108, 208, 308, 408, 508, 608, 708</td>
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<td>Oboe MUP 109, 209, 309, 409, 509, 609, 709</td>
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<td>Clarinet MUP 110, 210, 310, 410, 510, 610, 710</td>
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<td>Bassoon MUP 111, 211, 311, 411, 511, 611, 711</td>
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<td>French Horn MUP 113, 213, 313, 413, 513, 613, 713</td>
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<td>Trombone MUP 114, 214, 314, 414, 514, 614, 714</td>
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<td>Euphonium MUP 115, 215, 315, 415, 515, 615</td>
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<td>Tuba MUP 116, 216, 316, 416, 516, 616, 716</td>
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<td>Saxophone (alto) MUP 117, 217, 317, 417, 517, 617, 717</td>
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<td>Percussion MUP 118, 218, 318, 418, 518, 618, 718</td>
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<td>Harp* MUP 119, 219, 319, 419, 519, 619</td>
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<tr>
<td>Harpsichord MUP 120, 220, 320, 420, 520, 620, 720</td>
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<td>English Horn MUP 321, 521</td>
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<tr>
<td>Historical Instruments MUP 322, 422, 522, 622</td>
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</tbody>
</table>

**Classical Guitar**

MUP 123, 223, 323, 423, 523, 623

*Consult the School of Music before enrolling.

**MUP 330 VOCAL COACHING FOR SINGERS.** (1-3)

A course to prepare the vocal student for performance in concert, recital, and opera. Materials to be covered include style, performance practices, diction, interpretation, and audition preparation. Course will include preparation of operatic as well as art song literature. Repertoire suitable for the individual student will be assigned by the voice teacher and prepared in this course by the vocal coach only after the music has been technically prepared by student’s individual voice teacher. May be repeated to a maximum of six credits. Prereq: Permission of vocal instructor.

**MUP 430 VOCAL COACHING FOR SINGERS.** (1-3)

A course to prepare the vocal student for performance in concert, recital, and opera. Materials to be covered include style, performance practices, diction, interpretation, and audition preparation. Course will include preparation of operatic as well as art song literature. Repertoire suitable for the individual student will be assigned by the voice teacher and prepared in this course by the vocal coach only after the music has been technically prepared by student’s individual voice teacher. May be repeated to a maximum of six credits. Prereq: Permission of vocal instructor.

**MUP 530 VOCAL COACHING FOR SINGERS.** (1-3)

A course to prepare the vocal student for performance in concert, recital, and opera. Materials to be covered include style, performance practices, diction, interpretation, and audition preparation. Course will include preparation of operatic as well as art song literature appropriate to designated course level. May be repeated to a maximum of six credits. Prereq: Permission of vocal/opera instructors.

**MUP 558 CONDUCTING.** (1-4)

Private instruction in advanced conducting. Prereq: MUS 358 or MUS 364 or MUS 365 or consent of instructor.

**MUP 630 VOCAL COACHING FOR SINGERS.** (1-3)

A course to prepare the vocal student for performance in concert, recital, and opera. Materials to be covered include style, performance practices, diction, interpretation, and audition preparation. Course will include preparation of operatic as well as art song literature appropriate to designated course level. May be repeated to a maximum of six credits. Prereq: Permission of vocal/opera instructors.

**MUP 658 CONDUCTING.** (1-4)

Private instruction in advanced conducting. Prereq: MUS 358 or MUS 364 or MUS 365, or consent of instructor.

**MUP 730 VOCAL COACHING FOR SINGERS.** (1-3)

A course to prepare the vocal student for performance in concert, recital, and opera. Materials to be covered include style, performance practices, diction, interpretation, and audition preparation. Course will include preparation of operatic as well as art song literature appropriate to designated course level. This course may only be taken after all applied vocal lesson requirements have been met. Prereq: Permission of vocal/opera instructors.

**MUP 758 CONDUCTING.** (1-4)

Private instruction in advanced conducting. May be repeated to a maximum of six credits. Prereq: Consent of instructor.

**One-Hour Credit**

The following may register for one-hour credit performance courses:

1. Music majors electing a secondary instrument or a major instrument credit by direction of the adviser to fulfill degree performance requirements.

2. Students from other divisions of the University desiring elective credit but only upon approval of the School of Music.

Students in one-hour credit performance courses for secondary instrument credit may be taught in studio groups of four or less. Each undergraduate one-hour course may be repeated twice for credit. Each graduate one-hour course may be repeated three times for credit.
Ability to read music is not a prerequisite. Composition and improvisation exercises are used to approach much of this material.

MUS 174 THEORY FOR NONMUSIC MAJORS. (3)
The continuation of the work of MUS 171. Lecture, three hours. Prereq: MUS 171.

MUS 201 MUSIC IN WESTERN CULTURE TO 1700. (3)
Music from Ancient Greece to the end of the 17th century, as seen against a background of artistic, cultural, religious, and political change in Western Europe. Music majors may not use this course to fulfill either the University Studies or music history requirements.

MUS 202 MUSIC IN WESTERN CULTURE, 1700-PRESENT. (3)
A survey of music from 1700 (Vivaldi, Bach, Handel) to the present, in the context of artistic, cultural, political, and social changes in the Western cultural community. Music majors may not use this course to fulfill either University Studies or degree requirements.

MUS 203 HISTORY OF MUSIC I. (3)
Survey of the history of music from the Medieval through the Baroque period (approximately 800 - 1750). Required of all music majors. Prereq: For music majors, sophomore standing; non-music majors, consent of instructor.

MUS 206 AMERICAN MUSIC. (3)
A history of music in America from c. 1620 to the present. Will require listening to recordings, reading the primary text and suggested readings in books, periodicals and documents. Students should become aware of important names, places, events and styles in music as well as important historical trends and movements.

MUS 220 SYMPHONIC MUSIC. (3)
A survey of the symphonic repertoire from the Classical through the Contemporary Periods. Emphasis will include the development of listening skills and an awareness of musical styles. Music majors may not use this course to fulfill University Studies or degree requirements.

MUS 221 SURVEY OF VOCAL MUSIC: OPERA, ART SONG, CHORAL MUSIC. (3)
A survey of vocal genres: opera from the Baroque; the Art Song from the Renaissance; and choral music from the Baroque to the present. Significant attention will be given to texts set and to poets and playwrights. Music majors may not use this course to fulfill University Studies or major requirements.

MUS 222 HISTORY AND SOCIOLOGY OF ROCK MUSIC. (3)
A listening survey course, with a chronological approach, covering the years 1950-present. Emphasis will be on both the music and the sociological climate reflected and advocated by the music.

MUS 260 TEACHING MUSIC IN THE ELEMENTARY GRADES I. (2)
Together with MUS 261, this course is designed to develop musicianship, skills, and techniques teachers need to direct musical activities effectively in the elementary classroom. Music fundamentals and teaching materials are introduced through active participation in musical activities. Focus is on the music education in the lower elementary grades. For nonmusic majors or classroom teachers. Lecture, one hour; laboratory, two hours per week.

MUS 261 TEACHING MUSIC IN THE ELEMENTARY GRADES II. (2)
Continuation of MUS 260. Focus is on the music education in the upper elementary grades. This course must be taken immediately following completion of MUS 260. For nonmusic majors or classroom teachers. Lecture, one hour; laboratory, two hours per week. Prereq: MUS 260.

MUS 262 VOCAL MUSIC METHODS AND MATERIALS SEMINAR I. (3)
Development of personal philosophy of music education. Elements of singing posture, breathing, diction and choral tone. Demonstration of effective choral warm-ups. Beginning conducting and rehearsal keyboard skills. Prereq: MUS 172, 173, or consent of instructor.

MUS 263 INSTRUMENTAL MUSIC METHODS AND MATERIALS SEMINAR I. (3)
Historical and philosophical foundations of music education. Comprehensive study of teaching methods and materials for instrumental music in the elementary and early middle schools. Secondary instrument performance and group teaching. Observations in the public schools with emphasis on the elementary and middle school levels. Prereq: MUS 172 and 173 or consent of instructor.

MUS 264 VOCAL MUSIC METHODS AND MATERIALS SEMINAR II. (3)
Comprehensive study of teaching methods and materials for choral music in the middle school and high school. Study of the changing voice and supervised experimental teaching in middle school. Audition procedures, placement of voices, sight-reading methods and evaluation of repertoire. Beginning to intermediate choral conducting, keyboarding skills. Prereq: MUS 262.
MUS 265 INSTRUMENTAL MUSIC METHODS AND MATERIALS SEMINAR II. (3)
A study of the organization and administration of the school instrumental music program. Repertoire for secondary school bands and orchestras. Study of teaching methods, styles, and music literature for the high school jazz band. Continuation of observations and visitations. Continuation of secondary instrument performance and group teaching. Prereq: MUS 263.

MUS 270 THEORY II—AURAL THEORY. (2)
Development of aural responsiveness to all elements of music, and of sight-singing techniques as an aid to music comprehension and performance. Prereq: MUS 172; prereq or concur: MUS 271.

MUS 271 THEORY II—WRITTEN THEORY. (2)
A continuation of the acquisition of harmonic vocabulary and development of part-writing techniques, elementary counterpoint, free composition, and analysis. Prereq: MUS 171, 173.

MUS 272 THEORY II—AURAL THEORY. (2)
Development of aural responsiveness to all elements of music, and of sight-singing techniques as an aid to music comprehension and performance. Prereq: MUS 270; prereq or concur: MUS 273.

MUS 273 THEORY II—WRITTEN THEORY. (2)
The continuation of the work of MUS 271. Three class hours per week. Prereq: MUS 271.

*MUS 300 HISTORY OF JAZZ. (3)
A listening survey course covering the chronological evolution of jazz from its West African and European roots, through its germination in America, to the present. Emphasis will be on the various styles and functions of jazz, particularly as they have been affected by changing social-cultural patterns during the twentieth century. (Same as AAS 300.)

MUS 301 APPALACHIAN MUSIC. (3)
A survey of musical genre and styles in the Southern Appalachian region. Vocal and instrumental, sacred and secular materials will be covered, together with the interchanges between black and white contributions. Prereq: MUS 100 or consent of instructor.

MUS 302 HISTORY OF MUSIC II. (3)
A survey of the history of European music during the Classic and Romantic periods of the 18th and 19th centuries. Required of all music majors. Prereq: For music majors, MUS 203 and junior standing; non-music majors, consent of instructor.

MUS 303 HISTORY OF MUSIC III. (3)
A survey of the history of music from the Twentieth century including vernacular and cultivated musical expression of the United States. Required of all music majors. Prereq: Music majors - junior standing; non-music majors - consent of instructor.

MUS 325 SHAKESPEARE AND MUSIC. (3)
The study of music inspired by the plays of Shakespeare, Shakespeare’s use of music in his plays, and an overview of music in Elizabethan times. The course is designed for non-majors.

MUS 330 MUSIC IN THE WORLD (Subtitle required). (3)
This course examines the music of a chosen country or region of the world. The study of the historical, stylistic, theoretical, and functional aspects of the music will be related to the socio-historical, philosophical and other cultural aspects of the people in that country or region. Prereq: Junior standing or permission of the instructor.

MUS 350 MUSIC EDUCATION WORKSHOP. (1-2)
Intensive study of specialized methods and materials in one of the following areas of music education: elementary and general music; piano; orchestra; band; jazz or choral. May be repeated to a maximum of four credits. Prereq: Consent of instructor.

MUS 358 CONDUCTING I. (2)
A study of the technique and practice of fundamentals of conducting. Prereq: Junior standing in music.

MUS 360 GENERAL MUSIC I. (3)
A study of the philosophy, the curriculum, and the process involved in promoting musical development of children in the elementary, middle, and high school environment. A field experience is required. Prereq: Junior standing in music.

MUS 361 GENERAL MUSIC II. (3)
Methods, materials and techniques of teaching general music with emphasis on activities for the early childhood and elementary children. A field experience is required. Prereq: MUS 360.

MUS 362 VOCAL MUSIC METHODS AND MATERIALS SEMINAR III. (3)

MUS 363 INSTRUMENTAL MUSIC METHODS AND MATERIALS SEMINAR III. (3)

MUS 365 INSTRUMENTAL MUSIC METHODS AND MATERIALS SEMINAR IV. (3)
Advanced conducting; emphasis on advanced rehearsal techniques with use of instructional materials and advanced music for the high school ensemble. Continuation of secondary instrument performance and group teaching. Continued observation in the public schools with options for teacher-aide assignment. Prereq: MUS 363.

MUS 366 MARCHING BAND TECHNIQUES. (2)
A study of contemporary marching band techniques, styles, and trends with emphasis on drill writing and arranging for the marching band. Two hours lecture per week; one hour laboratory per week. Prereq: Consent of instructor.

MUS 370 THEORY III—ADVANCED HARMONY AND COUNTERPOINT. (2)
A study of the 19th century harmonic idioms through projects in analysis and composition. Lecture, three hours. Prereq: MUS 273.

MUS 371 INSTRUMENTATION AND ARRANGING. (2)
A basic course in instrumentation and arranging for the typical school instrumental and vocal ensembles. Prereq: MUS 273.

MUS 372 MUSICAL ANALYSIS. (2)
A study of musical style through structural, harmonic and melodic analyses. Prereq: MUS 273.

MUS 373 FUNDAMENTALS OF JAZZ THEORY. (2)
A study of the basic theoretical elements of jazz with reference to their use in improvisation. Topics of study will include harmonic, rhythmic, and melodic structure, keyboard application, and a study of styles and improvisation. Prereq: MUS 272 and 273, or consent of instructor.

MUS 390 TOPICS IN MUSIC HISTORY (Subtitle required). (3)
Studies of a specific composer, genre, school of composers, or a topic crossing the traditional boundaries of music history. May be repeated to a maximum of six credits when identified by different course subtitles. Prereq: MUS 203, 302, and 303, or consent of instructor.

MUS 395 INDEPENDENT WORK IN MUSIC. (1-3)
May be repeated to a maximum of six credits. Prereq: Major in music and a standing of 3.0 or consent of instructor.

MUS 400G MUSIC HISTORY REVIEW. (3)
A review of music history from the Medieval period through the twentieth century. May not be used to satisfy major requirements for Bachelors degrees in the College of Fine Arts. Prereq: Provisional graduate standing.

MUS 407G REVIEW OF HARMONY. (1)
A review of common practice diatonic and chromatic harmony, through written work and analysis. May not be used to satisfy major requirements for Bachelors degrees in the College of Fine Arts. Lecture, two hours per week. Prereq: Provisional graduate standing.

MUS 411G REVIEW OF AURAL SKILLS. (1)
A review and continued development of basic listening skills, and the ability to comprehend aurally harmonic function within a tonal framework and musical structures, both micro-structures and macro-structures. May not be used to satisfy major requirements for Bachelors degrees in the College of Fine Arts. Prereq: Two hours per week. Prereq: Provisional graduate standing.

MUS 500 MUSIC OF THE MIDDLE AGES. (3)
The development of Western music through the 14th century. Prereq: MUS 203 or consent of instructor.
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
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<tr>
<td>MUS 502</td>
<td>MUSIC OF THE BAROQUE ERA.</td>
<td>3</td>
<td>The history of vocal and instrumental music in the Baroque style from 1600 to 1750. Prereq: MUS 302 or consent of instructor.</td>
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<tr>
<td>MUS 503</td>
<td>MUSIC OF THE CLASSIC PERIOD.</td>
<td>3</td>
<td>The development of music in the Classic style from the early 18th century to 1800. Prereq: MUS 302 or consent of instructor.</td>
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<td>MUS 504</td>
<td>MUSIC OF THE 19th CENTURY.</td>
<td>3</td>
<td>A study of master works of music composed in the 19th century. Prereq: MUS 303 or consent of instructor.</td>
</tr>
<tr>
<td>MUS 505</td>
<td>MUSIC OF THE 20th CENTURY.</td>
<td>3</td>
<td>A stylistic study of representative compositions of the 20th century. Prereq: MUS 303 or consent of instructor.</td>
</tr>
<tr>
<td>MUS 506</td>
<td>HISTORY OF AMERICAN MUSIC.</td>
<td>3</td>
<td>A survey of cultivated and vernacular musical styles in America from Colonial times to the present. Prereq: MUS 302 and 303 or consent of instructor.</td>
</tr>
<tr>
<td>MUS 520</td>
<td>VOCAL SOLO LITERATURE.</td>
<td>3</td>
<td>A stylistic study of solo vocal music from the Baroque to the present. Prereq: MUS 302 and 303 or consent of instructor.</td>
</tr>
<tr>
<td>MUS 521</td>
<td>ORGAN LITERATURE.</td>
<td>3</td>
<td>A course of study designed to give the organ student a practical knowledge of the development of the organ, its construction, the standard literature, and teaching materials. Prereq: MUS 302 and 303 or consent of instructor.</td>
</tr>
<tr>
<td>MUS 522</td>
<td>PIANO LITERATURE TO 1830.</td>
<td>3</td>
<td>An historical and analytical study of music for piano to 1830, including discussion of the development of the instrument and the emergence of the idiomatic piano writing. Prereq: MUS 302 or consent of instructor.</td>
</tr>
<tr>
<td>MUS 523</td>
<td>PIANO LITERATURE SINCE 1830.</td>
<td>3</td>
<td>A historical and analytical study of music written for the piano from the inception of the Romantic period to the present, from the parallel perspectives of changes in the approach to the instrument and stylistic developments as they are reflected in piano writing. Prereq: MUS 303 or permission of instructor.</td>
</tr>
<tr>
<td>MUS 530</td>
<td>COLLEGIUM MUSICUM.</td>
<td>3</td>
<td>A stylistic study of the development of instrumental chamber music. Prereq: Graduate standing in music or consent of instructor.</td>
</tr>
<tr>
<td>MUS 540</td>
<td>APPLICATIONS OF MUSIC TECHNOLOGY.</td>
<td>3</td>
<td>Applications of music technology as tools for creativity and productivity. Content will be continually updated. No prior computer or MIDI experience assumed; space preference given to music majors. Prereq: Nonmusic majors must obtain permission of instructor; ability to read music required.</td>
</tr>
<tr>
<td>MUS 560</td>
<td>ORFF SCHULWERK.</td>
<td>1-3</td>
<td>The study of the philosophy and the pedagogy of the Orff Schulwerk method through movement, discussion, performance, improvisation, composition, and demonstration. Number of credits awarded will depend on total number of hours of participation and the amount of work in musical arrangement, orchestration, and composition. May be repeated to a maximum of six credits. Prereq: Junior standing in music or approval of instructor.</td>
</tr>
<tr>
<td>MUS 561</td>
<td>ORFF CERTIFICATION: LEVEL I, II, OR III.</td>
<td>2</td>
<td>An intensive and systematic study of the philosophy and the pedagogy of the Orff Schulwerk method based on the curriculum recommended by the American Orff Schulwerk Association. The three main components are ensemble, recorder, and movement. Participants must demonstrate competency in orchestration, recorder, and pedagogy in order to obtain certification. Lecture, two hours; laboratory, two hours per week. May be repeated in sequence to a maximum of six credits. Prereq: Junior standing in music or approval of instructor.</td>
</tr>
<tr>
<td>MUS 566</td>
<td>PIANO PEDAGOGY.</td>
<td>3</td>
<td>Investigation of techniques and materials for teaching piano in groups and to individual students, both children and adults. Prereq: Consent of instructor.</td>
</tr>
<tr>
<td>MUS 570</td>
<td>ORCHESTRATION.</td>
<td>2</td>
<td>This course includes a study of the individual instruments of the orchestra and band with practice in scoring for these instruments. Prereq: MUS 371.</td>
</tr>
<tr>
<td>MUS 571</td>
<td>ORCHESTRATION.</td>
<td>2</td>
<td>A continuation of MUS 570. Prereq: MUS 570.</td>
</tr>
<tr>
<td>MUS 572</td>
<td>COUNTERPOINT.</td>
<td>3</td>
<td>A study of 16th century contrapuntal techniques and of contrapuntal influences in common-practice music. Prereq: MUS 273 or equivalent.</td>
</tr>
<tr>
<td>MUS 573</td>
<td>COUNTERPOINT.</td>
<td>3</td>
<td>A study of 18th century contrapuntal techniques and of contrapuntal influences in Romantic and 20th century music. Prereq: MUS 273 or equivalent.</td>
</tr>
<tr>
<td>MUS 574</td>
<td>COMPOSITION.</td>
<td>2</td>
<td>A basic course in original composition and orchestration. Prereq: MUS 371.</td>
</tr>
<tr>
<td>MUS 575</td>
<td>COMPOSITION.</td>
<td>2</td>
<td>A continuation of MUS 574. Prereq: MUS 574.</td>
</tr>
<tr>
<td>MUS 578</td>
<td>ANALYSIS AND STYLE SURVEY.</td>
<td>3</td>
<td>Studies in analytical terminology and methodology; survey of major stylistic practices of Western music. Prereq: MUS 372 or equivalent.</td>
</tr>
<tr>
<td>MUS 600</td>
<td>RESEARCH I.</td>
<td>3</td>
<td>A course designed to acquaint students with basic techniques and tools used in music education research.</td>
</tr>
<tr>
<td>MUS 601</td>
<td>FOUNDATIONS IN MUSIC EDUCATION.</td>
<td>3</td>
<td>An historical survey of thought concerning the place and significance of music in the education of the individual and the group.</td>
</tr>
<tr>
<td>MUS 618</td>
<td>RESEARCH METHODS.</td>
<td>3</td>
<td>A survey of basic research techniques and materials in musicology and theory. Prereq: A reading knowledge of French or German.</td>
</tr>
<tr>
<td>MUS 620</td>
<td>ADVANCED VOCAL REPERTORY (Subtitle required).</td>
<td>3</td>
<td>An intensive study of the stylistic and interpretive characteristics of solo vocal literature of a specified repertory. May be repeated as desired with different subtitles. Prereq: Graduate standing or consent of instructor.</td>
</tr>
<tr>
<td>MUS 622</td>
<td>SYMPHONIC LITERATURE.</td>
<td>3</td>
<td>An intensive study of orchestral literature from the classical period to the present. Prereq: Graduate standing in music or consent of instructor.</td>
</tr>
<tr>
<td>MUS 624</td>
<td>CHAMBER MUSIC LITERATURE.</td>
<td>3</td>
<td>An intensive study of the development of instrumental chamber music. Prereq: Graduate standing in music or consent of instructor.</td>
</tr>
<tr>
<td>MUS 625</td>
<td>CHORAL LITERATURE.</td>
<td>3</td>
<td>An intensive study of choral literature from the Renaissance period to the present. Prereq: Graduate standing or consent of instructor.</td>
</tr>
<tr>
<td>MUS 650</td>
<td>MUSIC EDUCATION WORKSHOP.</td>
<td>1-4</td>
<td>An in-depth study and analysis of the methodology and materials and their development in music education. May be repeated to a maximum of 12 credits when identified by different course subtitles. Prereq: Graduate standing or consent of instructor.</td>
</tr>
<tr>
<td>MUS 660</td>
<td>ADVANCED MUSIC EDUCATION METHODS AND MATERIALS (Subtitle required).</td>
<td>3</td>
<td>An intensive study of advanced methods and materials in one of the following areas of music education: elementary and general music, the school orchestra, the school band, choral music. May be repeated once for a total of two, three or four credits.</td>
</tr>
<tr>
<td>MUS 664</td>
<td>MUSIC AND SPECIAL LEARNERS.</td>
<td>3</td>
<td>This course is directed toward developing competencies and understandings relating to non-music and music educational objectives in therapy and education. Prereq: Consent of instructor.</td>
</tr>
<tr>
<td>MUS 665</td>
<td>PHYSIOLOGY AND FUNCTIONING OF THE SINGING VOICE.</td>
<td>3</td>
<td>Detailed study of vocal physiology and acoustics of the singing voice. Major historical sources and recent scientific research form the basis of the course. Designed for professional voice teachers and music educators who work with singers. Prior study of acoustics recommended.</td>
</tr>
</tbody>
</table>
MUS 667 MATERIALS, TECHNIQUES AND LITERATURE OF VOICE TRAINING. (3)
Survey of currently published books, anthologies, and other materials for voice teaching.
Various approaches to teaching vocal technique will be examined; other pertinent literature explored. Prereq: MUS 665.

MUS 670 MUSICAL STYLE I. (3)
Concentrated study of stylistic aspects, and of analytical methodologies suited to these aspects, in music of antiquity through 1600. Prereq: MUS 578 or equivalent.

MUS 671 MUSICAL STYLE II. (3)
Concentrated study of stylistic aspects, and of analytical methodologies suited to these aspects, in music of the Baroque and Classical periods. Prereq: MUS 578 or equivalent.

MUS 672 MUSICAL STYLE III. (3)
Concentrated study of stylistic aspects, and of analytical methodologies suited to these aspects, in music from 1820 to Bartok, Stravinsky and Schoenberg. Prereq: MUS 578 or equivalent.

MUS 673 ADVANCED COMPOSITION. (2)
May be repeated to a maximum of six credits. Prereq: MUS 575.

MUS 674 PEDAGOGY OF THEORY. (3)
Examination of the resources and techniques of teaching undergraduate music theory (oral and written components). Extensive review of the textbook literature, study of the application of contrasting theoretical approaches, and the examination of relevant Computer Assisted Instruction materials. Requirements to include practice teaching and observation of undergraduate music theory classes (MUS 171-173; 271-273; 170-172; 270-272). Prereq: MUS 578 or equivalent.

MUS 675 INTERNSHIP IN THEORY PEDAGOGY. (1)
An internship providing pedagogical experience in undergraduate music theory (written and oral). Internship is conducted under the supervision of a faculty member who is teaching an undergraduate music theory course (MUS 170, 171, 172, 173, 270, 271, 272, or 273). Internship will be repeated to a maximum of four credits.

MUS 676 ADVANCED ANALYTICAL TECHNIQUES. (3)
Study of the most significant approaches to music analysis of the 20th century, including Schenkerian analysis, Forte set theory, and others. Prereq: MUS 578 or equivalent.

MUS 677 CONTEMPORARY MUSIC IDIOMS. (3)
Survey, with intensive study of representative works, of musical trends since 1935. Prereq: MUS 578 or 671 or 672.

MUS 678 HISTORY OF THEORY. (3)
A survey of theoretical ideas from the Greeks through 19th century English and German theorists. Prereq: MUS 578 or equivalent.

MUS 680 BAND HISTORY AND LITERATURE. (3)
A study of the heritage of the wind band through its leaders and literature, from its earliest roots to the present, with emphasis on the period from 1950 to the present. Prereq: Consent of instructor.

MUS 684 ADVANCED STRING METHODS AND MATERIALS. (3)
The study of string pedagogy through historical perspectives as it relates to the individual instruments as well as to class instruction. Prereq: Graduate standing in music or approval of instructor.

MUS 690 TOPICS IN MUSICOLOGY (Subtitle required). (3)
Investigation of critical and historical problems in musicology; intensive study of a specific composer, genre, or school of composers. May be repeated to a maximum of six credits when identified by different course subtitles. Prereq: Graduate standing and consent of instructor.

MUS 695 INDEPENDENT WORK IN MUSIC. (1-3)
Study of an individually selected topic relevant to a student’s academic development. For work in musicology, theory, music education, or vocal literature, students should enroll in the designated independent work courses listed separately. May be repeated to a maximum of six credits. Prereq: Graduate standing in music and consent of instructor.

*MUS 700 ME Val EN RE NAISSANCE NOTATION. (3)
The study and transcription of the notation of medieval and Renaissance polyphony, and of the various keyboard and lute tablatures of the 16th and 17th centuries. Prereq: Consent of instructor.

†MUS 701 RENAISSANCE NOTATION.