

quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

LA 551 Regional Landscape Assessment I (4)

Definition, research and filing of data covering the biological, cultural and physical resources of a specific region. Concepts of regionalism, land planning, reclamation and preservation are integral to the course. Utilization of mainframe and microcomputer facilities and software. 4 laboratories. Prerequisite: Graduate standing or consent of instructor.

LA 552 Regional Landscape Assessment II (4)

Application of data manipulation techniques in order to model both impacts on natural systems and land development potentials. Use of planning strategies to predict outcomes resulting from the land use decision process. Utilization of mainframe and microcomputer facilities and software. 4 laboratories. Prerequisite: LA 551 and graduate standing.

LA 585 Cooperative Education Experience (6) (CR/NC)

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

LA 595 Cooperative Education Experience (12) (CR/NC)

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

LIB—LIBRARY

LIB 101 Library Instruction (1)

Instruction and practice in the use of the on-line catalog, reference books, periodical indexes, government documents, and other library materials. Development of student independence and initiative in using the library as a source of information. 1 lecture.

LIB 301 Library Resources in Biology and Agriculture (1)

Sources of information pertaining to biology and agriculture and closely related disciplines. Use of abstracts and indexes for journal articles, reviews, proceedings, dissertations, and government documents. Bibliographic database searching. Search strategy, reference books introduced, bibliographic techniques. 1 lecture. Prerequisite: ENGL 114, junior standing or consent of instructor.

LIB 302 Library Resources and Literature Searches (1–4)

Sources of information and search strategies in major subject fields. Reference materials, bibliographic aids, indexing and abstracting tools, and Internet sources. Evaluation of sources. *Class Schedule* will list major subject area covered. Total credit limited to 4 units. 1–4 lectures. Prerequisite: ENGL 114, junior standing or consent of instructor.

LIB 303 Library and Internet Computer Searching (1)

Instruction and practice in use of computerized information retrieval systems including CD-ROM, local and Internet sources, and vendor services. Emphasis on efficient searching skills utilizing controlled and/or keyword searching, limiters, Boolean logic, truncation, proximity operators, field searching, etc. 1 lecture. Prerequisite: ENGL 114, junior standing or consent of instructor.

LS—LIBERAL STUDIES

LS 101 Orientation to Liberal Studies (1) (CR/NC)

Exploration of the Liberal Studies Program as preparation for the Multiple Subjects Credential and for alternate career objectives. To be taken during the first quarter in attendance at Cal Poly as a Liberal Studies major. Credit/No Credit grading only. 1 lecture.

LS 211 The American Enterprise: The Birth of a Nation to the 1876 Centennial (4) GE D1a

The first Americans. The Americas "discovered." Storytellers of the time—Native American oral tradition. The American Revolution—birth of a nation. A nation expands. A family struggles—the Civil War. Reconstruction. 3 lectures, 1 activity. Prerequisite: ENGL 114.

LS 212 The American Enterprise: The 1876 Centennial to the 21st Century (4) GE D1b

Manifest Destiny. Evolution of our government institutions—parallels between the past and present. The new immigrants. The Nation steps into a larger world—World Wars. Civil Rights—equity for all. 3 lectures, 1 activity. Prerequisite: ENGL 114, LS 211 or consent of instructor.

LS 230 Community-Based Field Experience (1–3)

Community service such as tutoring and aiding in a school setting or volunteering to work for a public service or non-profit group. Explore careers while putting academic experience to work. Offered in conjunction with Cal Poly Community Service Center. Total credit limited to 5 units.

LS 310 Storytelling: The Oral Tradition (4) (Also listed as SPC 310)

Techniques for performing traditional folktales and myths in primary and secondary teaching situations. Selection, preparation and presentation of folklore for an audience; lectures on function of folk literature and mythology in modern society. 4 lectures. Prerequisite: SPC 201 or SPC 202.

LS 461, LS 462 Senior Project (3) (3)

Selection and completion of a project or report under faculty supervision. Topic must be chosen with departmental approval. Results must be presented in a formal, written report. Prerequisite: Senior standing and consent of Liberal Studies Coordinator.

MATE—MATERIALS ENGINEERING

MATE 110 Introduction to Materials Engineering (1)

A lecture series involving materials engineers from industry as well as Cal Poly faculty. 1 lecture.

MATE 120 Introduction to Materials Engineering Analysis (1)

Introduction to materials engineering laboratory practices through demonstrations of laboratory equipment for evaluation of material properties. 1 activity.

MATE 140 The Way Things Work (4)

Designed for students of all disciplines to learn the science behind technology. Learn how and why basic technology functions. Examples include: silicon's chemical structure used to make computers; the theory behind radio; thermodynamics and the four-stroke engine; how electricity is generated and delivered. 4 lectures.

MATE 200 Special Problems for Undergraduates (1-4)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter. Prerequisite: Consent of department head.

MATE 210 Materials Engineering (3)

Structure of matter. Physical and mechanical properties of materials including metals, polymers, ceramics, composites, and electronic materials. Equilibrium diagrams. Heat treatments, materials selection and corrosion phenomena. 3 lectures. Prerequisite: CHEM 111, CHEM 124 or CHEM 127.

MATE 215 Materials Engineering Laboratory (1)

Laboratory experiments on the heat treatment and resulting properties of metals. Effects of cold deformation of metals. Brittle-ductile fracture behavior, equilibrium phase relationships, corrosion. Mechanical behavior of polymers. Properties of semiconductor devices. 1 laboratory. Prerequisite or concurrent: MATE 210.

MATE 220 Structure of Materials (3)

Foundations of material structure: solid state bonding, major crystal structures, important crystal defects (vacancies, dislocations, grain boundaries). Application of structure to control material properties. 3 lectures. Prerequisite: MATE 210. Concurrent: MATE 225.

MATE 225 Structure of Materials Laboratory (1)

Relationship of atomic bonding to material properties. Building physical models of crystal structures; crystallographic calculations. Basic techniques of structure analysis: x-ray diffraction, qualitative and quantitative metallography. 1 laboratory. Prerequisite: MATE 210. Concurrent: MATE 220.

MATE 230 Metals (4)

Physical metallurgy of major ferrous and nonferrous alloy systems. Mineral resources and economics of metal production. Introduction to equilibrium diagrams, phase transformations and heat treatment. Casting, working and joining of metals. 4 lectures. Prerequisite: MATE 210. Concurrent: MATE 235.

MATE 235 Metals Laboratory (1)

Interpretation of microstructures in metals and alloys and laboratory methods for revealing and documenting such microstructures. Miscellaneous course fee required—see *Class Schedule*. 1 laboratory. Prerequisite: MATE 225; MATE 230 should be taken concurrently.

MATE 240 Additional Materials Laboratory (1)

Special assignments undertaken by students who need or wish to acquire abilities supplementary to their required course work. Assignments must be of a laboratory nature. Work is done by the student with a minimum of faculty supervision. 1 laboratory. Prerequisite: Consent of department head.

MATE 310 Polymers (4)

Molecular structures of polymers and polymer systems. Synthesis, processing techniques, properties and fabrication methods of polymeric materials. 4 lectures. Prerequisite: MATE 210.

MATE 320 Ceramics (4)

Development, utilization, and control of properties in ceramic materials (inorganic-nonmetallic solids). Structure of crystalline ceramics and of glasses. Mechanical, thermal, optical, magnetic, and electrical properties. Physical chemistry of ceramics. 4 lectures. Prerequisite: MATE 210, CHEM 305.

MATE 330 Composites (4)

Fundamentals of polymer-matrix, ceramic-fiber composites from materials engineering and applied mechanics viewpoints. Materials (matrices, fibers) and manufacturing methods treated in detail. Beginning applied mechanics of continuous and discontinuous fiber-reinforced composites covered including properties of an orthotropic lamina; behavior of laminated plates. 4 lectures. Prerequisite: MATE 210, MATE 350, CE 204 or consent of instructor.

MATE 340 Electronic Properties of Materials (3)

Basic concepts in electron theory of solids (quantum mechanics, energy band theory, Fermi energy, distribution and density of states), electrical properties and conduction in metals, semiconductors, polymers, ceramics, and superconductors, magnetic phenomena and optical properties in materials with applications in recording media. 3 lectures. Prerequisite: MATE 210, PHYS 133.

MATE 345 Electronic Properties of Materials Laboratory (1)

Exploration of electrical, optical and magnetic properties of materials. Optical absorption, electrical conductivity, ferromagnetism, superconductivity. 1 laboratory. Concurrent or prerequisite: MATE 340.

MATE 350 Mechanical Behavior of Materials (3)

Fundamental behavior, emphasis on the relationship between microstructure and mechanical properties. Continuum mechanics—stress, strain, elasticity, anelasticity, plasticity. Detailed treatment of the mechanical behavior of (1) crystalline materials (metals, ceramics)—dislocation dynamics, slip, strengthening mechanisms; (2) non-crystalline materials (polymers). 3 lectures. Prerequisites: MATE 210, CE 204; MATE 355 should be taken concurrently.

MATE 355 Mechanical Behavior of Materials Laboratory (2)

Additional meaning to major concepts in MATE 350. Mechanical properties of materials. Major concepts in stress, strain, elasticity, and plasticity in a range of engineering materials. Multiple session laboratories. Significant component of technical writing. Prerequisite: MATE 210, CE 204. Concurrent: MATE 350.

MATE 360 Thermodynamics of Materials (4)

Material and energy balances, phase equilibria of condensed systems, statistical thermodynamics, transport phenomena (mass and heat transfer), defects in solids, reaction kinetics, phase transformations. 4 lectures. Prerequisite: MATE 210, CHEM 305.

MATE 400 Special Problems for Advanced Undergraduates (1-4)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter. Prerequisite: Consent of department head.

MATE 405 Kinetics of Materials (5)

Basis of kinetic theory, solid-state diffusion (steady-state and non-steady-state), nucleation and growth kinetics, solid state phase transformations. Laboratory emphasizes practical applications of kinetics: carburization, annealing cycle, sintering. 4 lectures, 1 laboratory. Prerequisite: MATE 360.

MATE 410 Materials Inspection (2)

Special physical and mechanical techniques for non-destructive and destructive examination of materials, to determine their fitness for service. Topics include: statistical methods and control charts, hardness testing, quantitative metallography, grain size measurement and analysis, ultrasonics, liquid penetrant, magnetic particle, radiography, and eddy current. 2 lectures. Prerequisite: MATE 210; MATE 415 should be taken concurrently. *Materials analysis and characterization course.*

MATE 415 Materials Inspection Laboratory (2)

Special physical and mechanical techniques for non-destructive and destructive examination of materials, to determine their fitness for service. Laboratory topics include: hardness testing, quantitative metallography, grain size determination, and various NDT methods. Miscellaneous course fee may be required—see *Class Schedule*. 2 laboratories. Prerequisite: MATE 235, MATE 410 as corequisite. *Materials analysis and characterization course.*

MATE 425 Corrosion Engineering (4)

Galvanic corrosion, thermodynamics of corrosion, polarization curves, corrosion testing, corrosion control, cathodic protection systems. 3 lectures, 1 laboratory. Prerequisite: CHEM 125 or CHEM 128, MATE 210. *Materials analysis and characterization course or Special topics course.*

MATE 430 Microelectronic Materials Processing (3)

Introductory microelectronics materials processing, including integrated circuit fabrication, assembly and packaging. Crystal growth, epitaxial layer growth, diffusion, ion implantation, oxidation, chemical and plasma assisted etching, photolithography. 3 lectures. Prerequisite: MATE 210. Prerequisite or concurrent: MATE 360 or permission of instructor. *Materials processing course.*

MATE 435 Microelectronics Processing Laboratory (2)

Basic processes involved in making I.C.'s; material preparation and handling, oxidation, diffraction and photolithographic and chemical etching processes, sputtering and thin film evaporation, device testing and evaluation. Cleanroom protocol including safety procedures. Each student will be part of a 4-6 person interdisciplinary team that will make and test transistors and simple integrated circuits. Miscellaneous course fee may be required—see *Class Schedule*. 2 laboratories. Prerequisite or concurrent: MATE 430. *Materials processing course.*

MATE 440 Welding Metallurgy and Joining of Advanced Materials (3)

Principles, primary variables, and microstructural changes associated with the joining process. Physics of energy transfer. Heat and mass balances in joining, thermodynamic and kinetic justification of solidification and near interface microstructures. Heterogeneous interfaces, adhesion, wetting. Relation between process selection, interface design, microstructure, and properties, weldability. 3 lectures. Prerequisite: MATE 210. *Materials processing course.*

MATE 445 Joining of Advanced Materials Laboratory (2)

Laboratory to accompany MATE 440. Illustration of principles, primary variables, and microstructural changes associated with the joining process. Physics of energy transfer. Heat and mass balances in joining, thermodynamic and kinetic justification of solidification and near interface microstructures. Heterogeneous interfaces, adhesion, wetting. Relation between process selection, interface design, microstructure, and properties, weldability. Miscellaneous course fee may be required—see *Class Schedule*. 2 laboratories. Prerequisite: MATE 210. *Materials processing course.*

**MATE 446 Surface Chemistry of Materials (3)
(Also listed as CHEM 446)**

Surface energy, capillarity, solid and liquid interface. Adsorption, surface areas of solids, contact angles and wetting. Friction, lubrication and adhesion. Relationship of surface to bulk properties of materials. Applications. 3 lectures. Prerequisite: CHEM 306 or consent of instructor. *Special topics course.*

MATE 450 Failure Analysis (3)

Procedures for analyzing failed materials. Actual failure analysis of a failed component by each student. Involves fracture, fatigue, corrosion, overload, using metallography, electron microscopy, energy-dispersive x-ray spectroscopy, chemical analysis and heat treatments. Miscellaneous course fee required—see *Class Schedule*. 1 lecture, 2 laboratories. Prerequisite: MATE 220, MATE 230, MATE 350, MATE 410, MATE 450 and MATE 455 should be taken concurrently. *Materials analysis and characterization course.*

MATE 460 Materials Selection in Mechanical Design (4)

Materials-based approach to mechanical design. Using mechanical and physical properties of materials (performance indices) to select them for design needs (Materials Selection Charts). Detailed background of material properties – information from materials and mechanics. Numerous case studies highlight the concepts covered. 4 lectures. Prerequisite: MATE 210, CE 204, or consent of instructor. *Special topics course.*

MATE 461, 462 Senior Project (1) (4)

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time.

MATE 463 Undergraduate Seminar (1)

Developments, policies, practices and procedures discussed through regular seminar. 1 seminar. Prerequisite: Senior standing.

MATE 485 Cooperative Education Experience (6) (CR/NC)

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

MATE 495 Cooperative Education Experience (12) (CR/NC)

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor

required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

MATE 500 Individual Study (1–4)

Advanced study planned and completed under the direction of a member of department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 12 units. Prerequisite: Consent of department head, graduate adviser, or supervising faculty member.

MATE 510 Scanning Force Microscopy (3)

Theory and application of scanning force microscopy, including scanning tunneling microscopy, atomic force microscopy, lateral force microscopy. Interpretation of scanning force images. 3 lectures. Prerequisite: MATE 340 or PHYS 412 or consent of instructor. *Materials analysis and characterization or Special topics course.*

MATE 515 Scanning Force Microscopy Laboratory (2)

Application of scanning force microscopy, including scanning tunneling microscopy, atomic force microscopy, lateral force microscopy. Interpretation of scanning force images. Considerations in sample preparation, artifacts in scanning force images. 2 laboratories. Prerequisite: MATE 510 or consent of instructor. *Materials analysis and characterization or Special topics course.*

MATE 518 Special Topics in Superconductivity (2)

Basic concepts in the theory of superconductivity and current and potential applications of high-temperature superconducting materials. 2 lectures. Prerequisite: MATE 340 or PHYS 412, graduate standing in engineering or science or instructor's permission. *Special topics course.*

MATE 520 X-Ray Diffraction (2)

Theory and application of x-ray diffraction as applied to advanced materials problems such as crystal quality and identification, thin film applications and structural transformations at high and low temperatures. Course will cover techniques in sample preparation, operation of equipment and interpretation of diffraction data. 2 lectures. Prerequisite: Graduate status or instructor's permission. *Materials analysis and characterization or Special topics course.*

MATE 522 Advanced Ceramics (5)

Development, utilization, and control of properties in ceramic materials (inorganic-nonmetallic solids). Emphasis on application on processing to achieve structure and properties. Structure of crystalline ceramics and of glasses. Mechanical, thermal, optical, magnetic, and electrical properties. Application of ceramics in technology. Physical chemistry of ceramics. 4 lectures, 1 seminar. Prerequisite: Graduate standing or permission of instructor.

MATE 525 X-Ray Diffraction Laboratory (2)

X-ray diffraction laboratory experiments of advanced materials problems such as crystal quality and identification, thin film applications and structural transformations at high and low temperatures. Radiation safety training, techniques in sample preparation, operation of equipment and interpretation of diffraction data. 2 laboratories. Prerequisite: Graduate standing in engineering or science or instructor's permission. Concurrent: MATE 520. *Materials analysis and characterization or Special topics course.*

MATE 530 Biomaterials (4)

Structures of biological materials - plant/animal. Biomimetics. Structure-function relationships for materials in contact with biological systems. Interactions of materials implanted in the body. Histological and hematological considerations including foreign body responses, inflammation, carcinogenicity, thrombosis, hemolysis, immunogenic and toxic properties. Microbial interaction with material surfaces, degradation. 4 lectures. Prerequisite: BIO 220, MATE 210 and graduate standing or permission of instructor. *Special topics course.*

MATE 560 Thin-Film Processing (3)

Thin film science and technology: deposition techniques, surface crystal notation, energy and kinetic processes, epitaxy. Schottky barriers and surface states, stress analysis, characterization techniques, electronics devices incorporating thin films. *Class Schedule* will list topics for selection. Total credit limited to 6 units. 3 lectures. Prerequisite: Graduate standing or permission of instructor. *Materials processing course.*

MATE 562 Mechanical Behavior of Materials (4)

Complex stress analysis, dislocation theory, fracture mechanisms, introductory fracture mechanics. Fatigue, creep, brittle-ductile transition, environmental embrittlement. Special project assignment. 4 seminars. Prerequisite: Graduate standing. *Special topics course.*

MATE 565 Thin-Film Processing Laboratory (2)

Thin film processing and analytical techniques: direct current and radio frequency magnetron sputtering, reactive sputtering, co-evaporation, epitaxy, grazing incidence x-ray diffraction, magnetic force imaging. *Class Schedule* will list topics for selection. Total credit limited to 6 units. 2 laboratories. Prerequisite: MATE 560. Concurrent: MATE 520 or consent of instructor. *Materials processing course.*

MATE 570 Advanced Engineering Materials (4)

An advanced treatment of the structure of matter. Physical and mechanical properties of materials including metals, alloys, ceramics, insulating materials, semiconductors, super semiconductors, polymers and composites based on detailed theoretical understanding of material microstructures. Discussions of Equilibrium diagrams, processing approaches, material selection based on thermodynamic and kinetic arguments. Degradation and failure, fitness for purpose. 4 lectures. Prerequisite: Graduate standing or permission of instructor. *Special topics course.*

MATE 580 Fracture and Fracture Mechanics of Materials (4)

Fracture modes and mechanisms in engineering materials, fracture mechanics fundamentals (stress analysis of cracks, energy analysis of fracture process). Use of fracture mechanics in design. Laboratory gives concentrated exposure to fracture development in materials, fracture surface evaluation, fracture toughness testing. 3 lectures, 1 laboratories. Prerequisite: MATE 350, MATE 355, or graduate standing. *Special topics course.*

MATE 590 Solidification and Densification (4)

Thermodynamics, kinetics and morphologies of solid-liquid interfaces. Heat flow in castings, crystal growth. Solidification mechanics, solute redistribution. Production, characterization and testing of metal powders. Compacting of powder. Sintering with/without liquid phase. Hot pressing, properties of sinterings as a function of processing conditions. Application of theory to

the production of useful materials. 4 lectures. Prerequisite: Graduate standing or permission of instructor. *Materials processing or Special topics course.*

MATE 599 Design Project (Thesis) (2) (2) (5)

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis. Prerequisite: Graduate standing.

MATH–MATHEMATICS

Satisfactory completion of the Entry Level Mathematics (ELM) requirement is a prerequisite for enrollment in all mathematics courses except MATH 100 and MATH 104.

MATH 100 Beginning Algebra Review (3) (CR/NC)

Review of basic algebra skills at the beginning algebra level intended primarily to prepare students for MATH 104. Course open only to students who have taken the ELM examination and are not qualified for MATH 104. Not for baccalaureate credit. Credit/No Credit grading only. Miscellaneous course fee may be required—see *Class Schedule*. 3 lectures. Prerequisite: Two years of high school algebra.

MATH 104 Intermediate Algebra (3) (CR/NC)

Review of basic algebra skills at the intermediate algebra level intended primarily to prepare students for MATH 116. Not for baccalaureate credit. Credit/No Credit grading only. Miscellaneous course fee may be required—see *Class Schedule*. 3 lectures. Prerequisite: Two years high school algebra and appropriate score on the ELM examination, or credit in MATH 100.

MATH 112 The Nature of Modern Mathematics (4) GE B2

Topics from contemporary mathematics, their development, applications, and role in society. Some typical topics, to be chosen by the instructor, are: graph theory, critical path analysis, statistical inference, coding, game theory, and symmetry. 4 lectures. Prerequisite: Appropriate score on ELM examination or an ELM exemption or credit in MATH 104, and 3 years high school mathematics, including two years of high school algebra or equivalent.

MATH 114 Intermediate Algebra Laboratory (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of intermediate algebra. Not for baccalaureate credit. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 104.

¹ MATH 116, 117 Pre-Calculus Algebra I, II (2) (4) MATH 117: GE B2

Pre-calculus college algebra without trigonometry. Topics in algebra and coordinate geometry. Functions and applications, polynomial and rational functions, exponential and logarithmic functions, systems of equations and analytic geometry. Additional topics. MATH 116 and MATH 117 are equivalent to MATH 118, but are taught at a slower pace. Not open to students with credit in MATH 118 or MATH 120.

MATH 116: 2 lectures. Prerequisite: appropriate score on ELM examination or an ELM exemption, or credit in MATH 104, and 3 years of high school math including 2 years of high school algebra, or equivalent.

MATH 117: 4 lectures. Prerequisite: MATH 116.

MATH 118 Pre-Calculus Algebra (4) GE B2

Pre-calculus college algebra without trigonometry. Special products and factoring, exponents and radicals, partial fractions. Fractional and quadratic equations, determinants, systems of equations. Graphing, inequalities and absolute value, mathematical induction. Binomial theorem, logarithms, complex numbers. MATH 118 is equivalent to MATH 116 and MATH 117. Not open to students with credit in MATH 117 or MATH 120. 4 lectures. Prerequisite: Appropriate score on ELM examination, or an appropriate ELM exemption, and 3 years high school math including 2 years high school algebra, or equivalent.

MATH 119 Pre-Calculus Trigonometry (4) GE B2

Rectangular and polar coordinates. Trigonometric functions, fundamental identities. Inverse trigonometric functions and relations. Vectors, complex numbers, conic sections. Not open to students with credit in MATH 120. 4 lectures. Prerequisite: Appropriate score on ELM examination or an appropriate ELM exemption, and MATH 117 or MATH 118 or equivalent.

MATH 120 Pre-Calculus Algebra and Trigonometry (5) GE B2

An integrated review course in college algebra and trigonometry covering function concepts and symbols, rectangular coordinates, trigonometric functions, linear and quadratic functions, inequalities, analysis of trigonometric functions, inverse trigonometric functions, exponential and logarithmic functions, systems of equations and complex numbers. MATH 120 is equivalent to MATH 118 and MATH 119. Not open to students with credit in MATH 117, MATH 118, or MATH 119. 5 lectures. Prerequisite: Appropriate score on ELM examination, or an appropriate ELM exemption, and 3 years high school math including 2 years high school algebra, and trigonometry, or equivalent.

MATH 126 Pre-Calculus Algebra I Laboratory (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of pre-calculus algebra. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 116.

MATH 127 Pre-Calculus Algebra II Laboratory (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of pre-calculus algebra. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 117.

MATH 128 Pre-Calculus Algebra Laboratory (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of pre-calculus algebra. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 118.

MATH 129 Pre-Calculus Trigonometry Laboratory (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of pre-calculus trigonometry. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 119.

¹ Each course in a combined listing of sequentially numbered courses is a prerequisite to its successor in the same listing.

¹ MATH 131, 132, 133 Technical Calculus (4) (4) (4) GE B2

Functions, their graphs and limits; techniques and applications of differential and integral calculus; introduction to applied differential equations. Designed principally for technology students and others interested in an applied three-quarter calculus sequence. Not open to students with credit in MATH 142, MATH 143, MATH 318 (respectively) or equivalents. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: ELM requirement, and passing score on Mathematics Placement Examination, or MATH 118 and MATH 119, or equivalent.

**¹ MATH 141, 142, 143 Calculus I, II, III (4) (4) (4) GE B2
(also listed as HNRS 141, 142, 143)**

Limits, continuity, differentiation, integration. Techniques of integration, applications to physics, transcendental functions. Infinite sequences and series, vector algebra, curves. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: ELM requirement, and passing score on Mathematics Placement Examination, or MATH 118 and MATH 119, or equivalent.

MATH 151, 152, 153 Calculus Laboratories I, II, III (1) (1) (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of calculus. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 141, MATH 142, or MATH 143.

MATH 202 Orientation to the Mathematics Major (1) (CR/NC)

Career opportunities in the field of mathematics, preparing a field of study, and a survey of departmental facilities and procedures related to research, study and graduation. Credit/No Credit grading only. 1 lecture. Corequisite: Sophomore standing or consent of instructor.

MATH 206 Linear Algebra I (4) GE B2

Matrices, inverses, linear systems, determinants, eigenvalues, eigenvectors, vector spaces, linear transformations, applications. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 143 or consent of instructor.

MATH 221 Calculus for Business and Economics (4) GE B2

Polynomial calculus for optimization and marginal analysis, and elementary integration. Not open to students with credit in MATH 142, MATH 132 or equivalent. 4 lectures. Prerequisite: ELM requirement, and passing score on Mathematics Placement Examination, or MATH 118, or equivalent.

MATH 231 Calculus for Business and Economics Laboratory (1) (CR/NC)

Facilitated study and discussion of the theory, problems, and applications of business calculus. Credit/No Credit grading only. 1 laboratory. Corequisite: Concurrent enrollment in the associated section of MATH 221.

MATH 241 Calculus IV (4) GE B2

Partial derivatives, multiple integrals, introduction to vector analysis. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 143.

MATH 242 Differential Equations (4) GE B2

Ordinary differential equations: introduction with applications in engineering and science; classification of equations and their analytic solutions; study of interrelationships between differential systems, graphs, and physical problems. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 241.

MATH 248 Methods of Proof in Mathematics (4) GE B2

Methods of proof (direct, contradiction, conditional, contraposition); valid and invalid arguments. Examples from set theory. Quantified statements and their negations. Functions, indexed sets, set functions. Proofs in number theory, algebra, geometry and analysis. Proof by induction. Equivalence and well-defined operations and functions. The axiomatic method. 4 lectures. Prerequisite: MATH 143 or consent of instructor.

MATH 300 Microcomputers in Mathematics Education (3)

Examination of existing hardware and software designed for educational uses. Mathematical topics appropriate for computer enhancement. Special methods and techniques for educational uses of computers. Emphasis on activity learning and applications. Computer as a classroom management device. 2 lectures, 1 activity. Prerequisite: MATH 118, and CSC 101 or CSC 110 or CSC 113, or consent of instructor.

MATH 304 Vector Analysis (4) GE B2

Algebra of free vectors with applications. Differential and integral calculus of vectors. Development of theory and application of vector operations. Green's Theorem, Stokes' Theorem, and the Divergence Theorem. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 241 or consent of instructor.

MATH 306 Linear Algebra II (4) GE B2

Inner product spaces, orthogonality, Fourier series and orthogonal bases, linear transformations and similarity, eigenvalues and diagonalization. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 206, MATH 242, and MATH 248, or consent of instructor.

MATH 317 Topics in Engineering Mathematics (4) GE B2

Fourier series, Fourier transforms and their properties. Introduction to generalized functions. Introductory probabilistic concepts encountered in data analysis and engineering. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 242.

MATH 318 Advanced Engineering Mathematics (4) GE B2

Power series solutions of differential equations and Bessel functions. Fourier series and transforms; matrices. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 242.

¹ MATH 327, 328 Introduction to Modern Mathematics (4) (4) 328: GE B2

Introduction to set theory, logic and proof, number theory, real numbers, geometry and trigonometry, probability and statistics. 4 lectures. Prerequisite: ELM requirement, and passing score on

¹ Each course in a combined listing of sequentially numbered courses is a prerequisite to its successor in the same listing.

Mathematics Placement Examination, or MATH 118, or equivalent.

MATH 329 Mathematical Applications to Elementary Teaching (3)

Mathematical concept development in elementary school mathematics. Emphasis on activity learning and problem solving. Computer applications. 2 lectures, 1 activity. Prerequisite: MATH 328.

MATH 333 Numerical Analysis I (4)

Topics in interpolation and approximation methods, initial value problems, and boundary value problems of ordinary differential equations. 4 lectures. Prerequisite: MATH 242 or equivalent.

MATH 335 Graph Theory (4)

Introduction to graph theory and its applications: isomorphism, paths and searching, connectedness, trees, tournaments, planarity, graph colorings, matching theory, network flow, adjacency and incidence matrices. Further topics to be selected from the theory of finite state machines, Ramsey theory, extremal theory, and graphical enumeration. 4 lectures. Prerequisite: Junior standing or consent of instructor.

MATH 336 Combinatorial Mathematics (4)

Methods of enumerative combinatorics: sum, product, and division rules, bijective and recursive techniques, inclusion and exclusion, generating functions, and the finite difference calculus. Advanced topics to be selected from the theory of partitions, Polya theory, designs, and codes. 4 lectures. Prerequisite: Junior standing or consent of instructor.

MATH 341 Theory of Numbers (4)

GE B2

Properties of numbers. Euclid's Algorithm, greatest common divisors, diophantine equations, prime numbers, congruences, number theoretic functions, the quadratic reciprocity laws, primitive roots and indices. Miscellaneous course fee may be required—see *Class Schedule*. 4 lectures. Prerequisite: MATH 248 or consent of instructor.

MATH 350 Mathematica (4)

Problem-solving using Mathematica in a UNIX environment. 4 lectures. Prerequisite: MATH 241.

MATH 370 Putnam Exam Seminar (2)

Directed group study of mathematical problem solving techniques. Open to undergraduate students only. Class members are expected to participate in the annual William Lowell Putnam Mathematical Competition. Course may be repeated up to eight units. 2 seminars. Prerequisite: Consent of instructor.

MATH 371 Math Modeling Seminar (2)

Directed group study of mathematical modeling techniques. Open to undergraduate students only. Class members are expected to participate in the annual Mathematical Competition in Modeling. Total credit limited to 8 units. 2 seminars. Prerequisite: Consent of instructor.

MATH 400 Special Problems for Advanced Undergraduates (1-4)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units. Pre-requisite: Junior standing and consent of department chair.

MATH 404 Introduction to Differential Geometry and Topology (4)

Theory of curves and surfaces in space. Topics such as curvature, geodesics, Gauss map, Gauss-Bonnet Theorem, combinatorial topology, point set topology. 4 lectures. Prerequisite: MATH 206 and MATH 304.

MATH 406 Linear Algebra III (4)

Complex vector spaces, unitary and self-adjoint matrices, Spectral Theorem, Jordan canonical form. Selected topics in linear programming, convexity, numerical methods, and functional analysis. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 306 or consent of instructor.

MATH 408 Functions of a Complex Variable (4)

Elementary analytic functions and mapping; Cauchy's Integral Theorem; Power series; theory of residues and evaluation of integrals; harmonic functions. 4 lectures. Prerequisite: MATH 242.

MATH 409 Complex Analysis (4)

Further development of analytic function theory. Additional topics in calculus of residues, conformal mapping and the Poisson Integral. 4 lectures. Prerequisite: MATH 408.

MATH 412 Introduction to Analysis I (4)

Introduction to concepts and methods basic to real analysis. Topics such as the real number system, sequences, continuity, uniform continuity and differentiation. 4 lectures. Prerequisite: MATH 248 or consent of instructor.

¹ MATH 413, 414 Introduction to Analysis II, III (4) (4)

A continuation of Introduction to Analysis I covering such topics as integration, infinite series, uniform convergence and functions of several variables. Highly recommended for students planning to enter graduate programs or secondary teaching and those interested in applied mathematics. 4 lectures. Prerequisite: MATH 206 and MATH 412, or consent of instructor.

MATH 417 Introduction to Dynamical Systems (4)

Theory of dynamical systems in one and two dimensions. Topics such as bifurcation theory, chaos, attractors, limit cycles, nonlinear dynamics. 4 lectures. Prerequisite: MATH 242.

MATH 418 Partial Differential Equations (4)

Mathematical formulation of physical laws. Separation of variables. Orthogonal functions and generalized Fourier series. Bessel functions, Legendre polynomials. Sturm Liouville problem. Boundary value problems; nonhomogeneous techniques. Applications to heat flow, potential theory, vibrating strings and membranes. Miscellaneous course fee may be required in sections with a computer component—see *Class Schedule*. 4 lectures. Prerequisite: MATH 318 or equivalent, or MATH 306 or MATH 317 with consent of instructor.

MATH 419 Introduction to the History of Mathematics (4)

Evolution of mathematics from earliest to modern times. Major trends in mathematical thought, the interplay of mathematical and technological innovations, and the contributions of great mathematicians. Appropriate for prospective and in-service

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teachers. 4 lectures. Prerequisite: MATH 248 and at least one upper division course in mathematics, or consent of instructor.

MATH 424 Organizing and Teaching Mathematics (4)

Organization, selection, presentation, application and interpretation of subject matter in mathematics. Introduction to current issues in mathematics education. For students who will be teaching in secondary schools. 4 lectures. Prerequisite: Senior standing or consent of instructor.

¹ MATH 431, 432 Mathematical Optimization I, II (4) (4)

Classical optimization. Maximum/minimum of functions, linear and nonlinear optimization problems, duality, constrained optimization. Model building and applications to various fields. 4 lectures. Prerequisite: MATH 206 and MATH 241 or consent of instructor.

MATH 433 Numerical Analysis II (4)

Numerical techniques for solving partial differential equations of the parabolic, hyperbolic and elliptic type. 4 lectures. Prerequisite: MATH 333 or equivalent.

MATH 437 Game Theory (4)

Development of the mathematical concepts, techniques, and models used to investigate optimal strategies in competitive situations; games in extensive, normal, and characteristic form, Nash equilibrium points and Nash Bargaining Model. 4 lectures. Prerequisite: MATH 206 or consent of instructor. MATH 335 and MATH 431 are recommended.

MATH 442 Euclidean Geometry (4)

Foundations of Euclidean geometry, finite geometries, congruence, similarities, polygonal regions, circles and spheres. Constructions, mensuration, the parallel postulate. Appropriate for prospective and in-service mathematics teachers. 4 lectures. Prerequisite: MATH 248.

MATH 443 Modern Geometries (4)

Non-Euclidean and projective geometries. Properties of parallels, biangles, Saccheri and Lambert quadrilaterals, angle-sum and area. Limiting curves, hyperbolic trigonometry, duality, perspectivity, quadrangles, fundamental theorems of projective geometry, conics. 4 lectures. Prerequisite: MATH 442.

MATH 459 Undergraduate Seminar (4)

Written and oral analysis and presentations by students on topics from mathematical modeling. 4 seminars. Prerequisite: MATH 206 and MATH 242.

¹ MATH 461, 462 Senior Project (2) (2)

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time. Prerequisite: MATH 459.

MATH 470 Selected Advanced Topics (1-4)

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. *Class Schedule* will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Junior standing and consent of instructor.

¹ MATH 481, 482 Abstract Algebra I, II (4) (4)

Fundamental algebraic structures and types of algebras, including operations within them and relations among them. Groups, rings and fields. 4 lectures. Prerequisite: MATH 248.

MATH 485 Cooperative Education Experience (6) (CR/NC)

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

MATH 495 Cooperative Education Experience (12) (CR/NC)

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

MATH 500 Individual Study (1-4)

Individual research or advanced study planned and completed under the direction of a departmental faculty member. Open only to graduate students demonstrating ability to do independent work. Prerequisite: Graduate standing and consent of department chair.

¹ MATH 501, 502 Methods of Applied Mathematics I, II (4) (4)

Introduction to advanced methods of mathematics useful in the analysis of engineering problems. Theory of vector fields, Fourier analysis, Sturm-Liouville theory, functions of a complex variable. Selected topics in asymptotic analysis, special functions, perturbation theory. Not open to students in major or master's degree program in mathematics. MATH 501: Miscellaneous course fee and/or Distance Learning Lab fee may be required—see *Class Schedule*. 4 lectures. Prerequisite: MATH 318 or equivalent, and graduate standing or consent of instructor.

MATH 510 Survey of Modern Mathematics (4)

Selected topics from the field of modern mathematics. Projective and synthetic geometry, topology, logic, matrices, vectors. Theory of games, probability, linear and modern algebra and convex sets. Boolean algebras, graph theory, Lattice theory, geometry of complex numbers. 4 seminars. Prerequisite: Graduate standing or consent of instructor.

¹ MATH 520, 521 Applied Analysis I, II (4) (4)

Advanced mathematical methods of analysis in science and engineering, integrated with modeling of physical phenomena. Topics include applications of complex analysis, Fourier analysis, ordinary and partial differential equations. Additional topics to be drawn from perturbation methods, asymptotic analysis, dynamical systems, numerical methods, optimization, and the calculus of variations. 4 lectures. Prerequisite: MATH 408, MATH 412, MATH 418 and graduate standing, or consent of the instructor.

MATH 522 Applied Analysis III (4)

Selected topics in applied analysis. 4 lectures. Prerequisite: MATH 521 and graduate standing, or consent of the instructor.

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¹ MATH 530, 531 Discrete Mathematics with Applications I, II (4) (4)

Advanced mathematical methods of discrete mathematics with applications. Topics will include probability theory with generating functions, difference equations and number theory. Additional topics to be drawn from the theory of algorithms, coding theory, set theory, and the relation of discrete mathematics to complex analysis. 4 lectures. Prerequisite: MATH 481, MATH 306 and graduate standing, or consent of instructor.

MATH 532 Discrete Mathematics with Applications III (4)

Selected advanced topics in discrete mathematics. These topics may include foundations, numerical and computational methods of discrete mathematics, finite geometries or current problems in discrete mathematics. 4 lectures. Prerequisite: MATH 531 and graduate standing, or consent of the instructor.

MATH 540 Introduction to Topology (4)

Basic ideas of general topology, metric spaces, homeomorphisms and the separation axioms. 4 seminars. Prerequisite: Satisfactory completion of the Graduate Written Examination in Analysis or consent of the Graduate Committee.

MATH 550 Real Analysis (4)

Introduction to Lebesgue measure and integration, convergence theorems, L_1 spaces, Radon-Nikodym theorem and Fubini's theorem. 4 seminars. Prerequisite: Satisfactory completion of the Graduate Written Examination in Analysis or consent of the Graduate Committee.

MATH 560 Field Theory (4)

Polynomial rings, field extensions, normal and separable extensions, automorphisms of fields, fundamental theorem of Galois theory, solvable groups, solution by radicals, insolvability of the quintic. 4 lectures. Prerequisite: Satisfactory completion of the Graduate Written Examination in Algebra or consent of the Graduate Committee.

MATH 580 Seminar (1-4)

Built around topics in advanced mathematics chosen according to the common interests and needs of the students enrolled. Each seminar will have a subtitle according to the nature of the content. Total credit limited to 12 units. 1-4 seminars. Prerequisite: Graduate standing and consent of instructor.

MATH 596 Thesis (3) (3)

Serious research endeavor devoted to the development, pedagogy or learning of mathematics. Prerequisite: Graduate standing and consent of instructor.

MCRO-MICROBIOLOGY**MCRO 221 Survey of Microbiology (4) GE B1b, E2**

Morphology, metabolism, classification and identification; bacteriology of air, soil, water, and foods with applications to industry, agriculture, medicine, and public health. Not open to students with credit for MCRO 224. 2 lectures, 2 laboratories. Prerequisite: One quarter of chemistry.

MCRO 224 General Microbiology I (5) GE B1b, E2

Microbial taxonomy and classification, cellular structure/function relationships, metabolism, microbial growth dynamics and control, microbial genetics and viruses. Prokaryotic and eukaryotic microorganisms. 3 lectures, 2 laboratories. Prerequisite: BIO 151 and CHEM 128. Recommended: CHEM 129.

MCRO 225 General Microbiology II (5) GE B1b

Structure, physiology, reproduction, genetics, metabolism, ecology, and diversity of yeasts, fungi and other eukaryotic microorganisms. Topics include prokaryotic gene regulation, viruses, host-parasite relationships, immunology, epidemiology and the uses of microorganisms in industry. 3 lectures, 2 laboratories. Prerequisite: MCRO 224.

MCRO 342 Sanitary Microbiology (4) GE B1b

Principles of disease prevention and control. Water-, food-, and air-borne microbial contaminations and epidemiology of ensuing diseases. Laboratory techniques in detection and control of wastes and disease-causing microorganisms. 2 lectures, 2 laboratories. Prerequisite: MCRO 221 or MCRO 224.

MCRO 402 General Virology (5)

Infective macromolecules (prions, viroids, and viruses) associated with microbes, plants, and animals. Epidemiology, immune responses, pathogenicity, pathogenesis, prevention, diagnoses and treatments. 5 lectures. Prerequisite: BIO 351 or CHEM 373.

MCRO 404 Microbial Diversity and Evolution (4)

Diversity, taxonomy, systematics, and molecular evolution of microorganisms. Fundamentals of microbial classification, molecular evolution, and tools used in evaluating phylogenetic relationships among microbial groups. 3 lectures, 1 laboratory. Prerequisite: MCRO 225.

MCRO 421 Food Microbiology (4)

Physiological activities of microorganisms involved in the preparation, preservation, deterioration and toxicity of foods and related products. 2 lectures, 2 laboratories. Prerequisite: MCRO 221 or MCRO 224. Recommended: CHEM 212.

MCRO 423 Medical Microbiology (5)

Microorganisms as agents of disease in humans. Epidemiology, host-parasite relationships, and chemotherapy. The compromised host and opportunistic disease. Laboratory safety. Procedures for laboratory diagnosis of human diseases. Rapid miniaturized methods of identification. 3 lectures, 2 laboratories. Prerequisite: MCRO 225. Recommended: Organic Chemistry.

MCRO 424 Microbial Physiology (5)

Cellular structure and life processes of bacteria; chemical composition, growth and metabolism. General biological and evolutionary considerations. 3 lectures, 2 laboratories. Prerequisite: MCRO 225 and CHEM 313.

MCRO 430 Medical Mycology (4)

Morphology, physiology, infectivity, and immunogenicity of fungi pathogenic for man and other mammals. Host-parasite interactions. Demonstration and isolation of pathogenic fungi from clinical material. 2 lectures, 2 laboratories. Prerequisite: MCRO 225 and MCRO 423.

MCRO 433 Industrial Microbiology and Biotechnology (5) GE B1b

Principles and methods used for production of enzymes, pharmaceuticals, chemicals and food additives using microorganisms. Topics include screening and strain improvement, regulation of metabolite production, genetic engineering,

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heterologous gene expression systems, large-scale production and intellectual property. 3 lectures, 2 laboratories. Prerequisite: MCRO 221 or MCRO 224, BIO 351 or equivalent, CHEM 212 or equivalent.

MCRO 436 Microbial Ecology (5)

Ecology and interactions of prokaryotic and eukaryotic microorganisms in natural environments. Fundamentals of microbial ecology, microbial evolution, microbes and ecosystem function (bioremediation), practical aspects of microbial interactions, and microbial systematics. 3 lectures, 2 laboratories. Prerequisite: MCRO 221 or MCRO 224.

MCRO 444 Dairy Microbiology (4)

Microorganisms involved in the fermentation and ripening processes in the dairy industry, as well as those involved in spoilage of milk and dairy products, in the transmission of disease through these products, and indicator systems used to determine sanitary quality of these products. 2 lectures, 2 laboratories. Prerequisite: MCRO 221 or MCRO 224.

ME—MECHANICAL ENGINEERING

ME 134 Mechanical Systems (3)

An introduction to analysis, synthesis, design, and testing of mechanical systems, their components and instruments. 2 lectures, 1 laboratory.

ME 151 Engineering Design Communication I (2)

Communication of designs to manufacturing using basic definitions of points, lines and planes in space. Creative projects involving mechanical devices described in a manner required by appropriate manufacturing processes. Techniques from geometry, vectors, analysis, and spatial definitions integrated to provide information to both the design and manufacturing processes. 1 lecture, 1 laboratory.

ME 152 Engineering Design Communication II (2)

Use of advanced communication principles to communicate project designs to manufacturing processes. Projects evaluated in terms of meeting design criteria. Techniques of advanced communication methods explored to enhance reliability and quality assurance of products and subsystems. Use of computers to enhance these processes. 1 lecture, 1 laboratory. Prerequisite: ME 151.

ME 211 Engineering Statics (3)

Analysis of forces on engineering structures in equilibrium. Properties of forces, moments, couples, and resultants. Equilibrium conditions, friction, centroids, area moments of inertia. Introduction to mathematical modeling and problem solving. Vector mathematics where appropriate. 3 lectures. Prerequisite: MATH 241 (or concurrently), PHYS 131.

ME 212 Engineering Dynamics (3)

Analysis of motions of particles and rigid bodies encountered in engineering. Velocity, acceleration, relative motion, work, energy, impulse, and momentum. Further development of mathematical modeling and problem solving. Vector mathematics where appropriate. 3 lectures. Prerequisite: MATH 241, ME 211.

ME 221 Solar Energy (4)

Methods of utilizing solar energy. Energy concepts, collection and storage systems; greenhouse effect. Commercial and residential building applications. Solar power generation and recent technical

developments. International achievements in solar energy with emphasis on solar energy application in developing countries for water purification and other life support functions. 4 lectures. Prerequisite: PHYS 131, or PHYS 122, PHYS 123 or equivalent.

ME 234 Philosophy of Design (3)

General approach to the meaning of engineering design. Conceptual blocks, creativity, design process, design considerations and elements. Intended for transfer students as a substitution for ME 134. 3 lectures.

ME 236 Thermal Systems (3)

Fundamentals of measuring temperature, pressure, and other thermal-fluid parameters. Measurement principles including error analysis. Theory and practice of writing lab reports. 2 lectures, 1 laboratory. Prerequisite: CHEM 125, ENGL 114, PHYS 132.

ME 240 Additional Engineering Laboratory (1) (CR/NC)

Special assignments undertaken by students who need or wish to acquire abilities supplementary to their standard pattern of courses. Assignments must be primarily of shop or laboratory nature. Work is done by the student with a minimum of faculty supervision. Credit/No Credit grading only. 1 laboratory. Prerequisite: Consent of department head.

ME 302 Thermodynamics (3)

Properties and fundamental relations for processes involving substances and the transfer of energy. First and second laws of thermodynamics, irreversibility and availability. 3 lectures. Prerequisite: PHYS 132, ME 212.

ME 313 Heat Transfer (3)

Basic principles of heat transfer. Conduction, radiation, convection, and combined modes. 3 lectures. Prerequisite: ME 302 or CHEM 305, MATH 242, CSC 231.

ME 318 Mechanical Vibrations (4)

Free vibration, damping, transient and steady state response to forced vibrations. Engineering methods, single and multiple degrees of freedom. Experimental studies of the dynamic behavior of structures and machines. Instrumentation methods utilized in field and laboratory. 3 lectures, 1 laboratory. Prerequisite: MATH 318, ME 326, EE 201.

ME 326 Intermediate Dynamics (4)

Continuation of ME 212. Additional analysis of planar motion of rigid bodies with particular attention to the kinematics of mechanisms. Rotating reference frames. Introduction to three dimensional dynamics. 4 lectures. Prerequisite: MATH 242 (or concurrent), ME 212, CSC 231.

ME 328 Introduction to Design (4)

Design of machine parts by stress and deflection. Effects of fluctuating stresses and stress concentration. Design of shafts and other machine parts. Modern industrial design practice using standard components and design layout drawings. 3 lectures, 1 laboratory. Prerequisite: CE 205, ME 152, MATE 210, CSC 231, ME 212.

ME 329 Intermediate Design (4)

Design of mechanical equipment and systems using various machine elements and components such as threaded fasteners, power screws, springs, gears, bearings, clutches, etc. Decision modeling based on technical and economic feasibility. 3 lectures, 1 laboratory. Prerequisite: ECON 201, ME 318 (or concurrent), ME 328.

GE F2

ME 341, 342 Fluid Mechanics (3) (3)

Fluid statics. Conservation equations of fluid dynamics. Viscous flow, boundary layer concepts, lift and drag, compressible flow, turbomachinery. ME 341: 3 lectures. Prerequisite: ME 212. ME 342: 3 lectures. Prerequisite: ME 341, CSC 231 or equivalent.

ME 344 Thermal Engineering (4)

Power and refrigeration cycles. Ideal gas mixtures, psychrometry, combustion. Convection, condensation, boiling heat transfer. 4 lectures. Prerequisite: ME 313, ME 341.

ME 345 Fluid Mechanics Laboratory (1)

Planning, execution and reporting of fluid mechanics experiments involving flow measurement and control, conservation equations, pressure and velocity distributions, performance of turbomachines, dimensional analysis for lift and drag on airfoils or bearings. 1 laboratory. Prerequisite: ME 236, ME 342.

ME 346 Thermal Science Laboratory (1)

Heat transfer and thermodynamic experiments covering combined free convection and radiation, forced convection, heat exchanger, polytropic blowdown, steam turbine, and refrigeration system. 1 laboratory. Prerequisite: ME 236, ME 313, ME 341.

ME 400 Special Problems for Advanced Undergraduates (1–2)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

ME 401 Stress Analysis (4)

Advanced strength of materials: behavior of disks, plates, and shells. Theory of elasticity. Energy methods. 3 lectures, 1 laboratory. Prerequisite: CE 206, MATH 318, ME 328 or consent of instructor.

ME 405 Mechatronics (4)

Microprocessor applications in machine control and product design. Applied electronics. Drive technology; transducers and electromechanical systems. Real-time programming. Mechatronic design methodology. 3 lectures, 1 laboratory. Prerequisite: EE 321, EE 361, ME 329.

ME 406 Mechatronics Design (4)

Application of micro-controllers and programmable logic controllers in the design of mechatronic products and automation systems. Digital feedback motion and process control. Modern industrial mechatronics applications. 3 lectures, 1 laboratory. Prerequisite: ME 329 and ME 405 or consent of instructor.

ME 410 Experimental Methods in Mechanical Design I (4)

Bonded resistance strain gages for static and dynamic measurements; rosettes, bridge circuits, lead wire effects, special gages. Photoelastic and moiré fringe methods including birefringent coatings, shadow, and projection moiré. Applications in mechanical design and metrology. 3 lectures, 1 laboratory. Prerequisite: ME 328.

ME 412 Composite Materials Analysis and Design (4)

Behavior of unidirectional fiber composites. Properties of short-fiber composites, and orthotropic lamina. Analysis of laminated composites. Strength and hygrothermal behavior of composite materials. Structural optimization. 3 lectures, 1 laboratory. Prerequisite: AERO 330 or ME 328.

ME 415 Energy Conversion (4)

Engineering aspects of energy sources, conversion and storage. Topics selected from fossil fuel systems, nuclear power, thermoelectric systems, thermionic converters, fuel cells, magnetohydrodynamic generators, and geothermal, tidal, wind and ocean temperature energy conversion systems. 4 lectures. Prerequisite: ME 302.

ME 416 Ground Vehicle Dynamics and Design (4)

Design of ground vehicles for directional stability and control. Tire mechanics and their effects on vehicle performance. Simulation of vehicle dynamics using digital computer. Synthesis of steering mechanism and suspension system. 2 lectures, 2 laboratories. Prerequisite: ME 318, ME 328.

ME 418 Machinery Vibration and Rotordynamics (4)

Vibrations relating to rotating machinery. Modeling of structural rotordynamic phenomena induced by shaft flexibility, bearings, and seals. Laboratory measurement of rotor system dynamic response and interpretation of machinery diagnostic information. 3 lectures, 1 laboratory. Prerequisite: ME 318.

ME 422 Mechanical Control Systems (4)

Modeling and analysis of mechanical control systems. Design of mechanical, hydraulic and fluid systems using block diagrams, root locus, Bode diagrams, and the digital computer. 3 lectures, 1 laboratory. Prerequisite: ME 318.

ME 423 Robotics: Fundamentals and Applications (4)

Introduction to robots and their types. Homogeneous transformations. Kinematic equations and their solutions. Motion trajectories, statics, dynamics, and control of robots. Robot programming. Actuators, sensors and vision systems. 3 lectures, 1 laboratory. Prerequisite: ME 326, ME 422.

ME 424 Design of Piping Systems (4)

Pipe specifications and pertinent codes. Valves, fittings, pumps and compressors. The transportation function of piping as related to power plants, refineries, slurry systems, pumping systems and drainage. Philosophy of system design. 3 lectures, 1 laboratory. Prerequisite: CE 205, CE 206, ME 342, CSC 231, MATE 210.

ME 428 Design (4)

Component and system design from global integration point of view of various design parameters, using real life problems. Techniques of brainstorming, decision making, PERT, feasibility studies. Industrial participation design program. Subsystem design involving gears, bearings, etc. 2 lectures, 2 laboratories. Prerequisite: ME 313, ME 329, ME 342, ENGL 218.

ME 431 Mechanical Design Techniques (4)

Comprehensive study of various design methods and techniques. Techniques used to explore various structural concepts such as prestressing, shaping, sizing, etc. Simulation of systems using digital computer. Design criteria identification of design parameters and constraints. 3 lectures, 1 laboratory. Prerequisite: ME 329.

ME 432 Petroleum Reservoir Engineering (4)

Types of reservoirs and reservoir rocks. Measurement and interpretation of physical properties of reservoir rocks and fluids porosity, permeability, compressibility, electrical resistivity, fluid saturation, viscosity, solution gas. Introduction to flow in porous media, reserve calculations and computer applications. 3 lectures, 1 laboratory. Prerequisite: ME 341.

ME 434 Enhanced Oil Recovery (4)

Primary, secondary, and tertiary (enhanced) oil recovery methods. Waterflooding, gas injection, steam injection, in-situ combustion, chemical flooding, miscible flooding. Performance calculations and computer applications in EOR. 4 lectures. Prerequisite: ME 342, ME 344.

ME 435 Drilling Engineering (4)

Theory and practice of oilwell planning, drilling, well logging, and completion applied to the development of new oil and gas production, from onshore and offshore fields. 4 lectures. Prerequisite: ME 329, ME 342.

ME 436 Petroleum Production Engineering (4)

Design and operation of surface and subsurface equipment required in oil production. Processes and systems involved are well pumping, gas lifting, acidizing, hydraulic fracturing, fluid gathering and storage, separation of oil, gas, water and sediment from produced fluid. Includes equipment used in enhanced oil recovery processes. 4 lectures. Prerequisite: ME 329, ME 342.

ME 438 Heat Exchanger Design (4)

Theory and application of numerical, analytical, and experimental methods to selected heat transfer problems. Application of principles of conduction, convection, condensation, and boiling heat transfer, stress, and vibrations to design of heat exchange equipment. 4 lectures. Prerequisite: ME 313, ME 342.

ME 440 Thermal System Design (4)

Design and optimization of thermal systems. Engineering economics, thermal component sizing, steady-state simulation, and optimization techniques applied to the design and performance analysis of thermal systems. 3 lectures, 1 laboratory. Prerequisite: ME 342, ME 344.

ME 441 Single Track Vehicle Design (4)

Handling qualities of two-wheeled vehicles, and the application to vehicle design. Modeling of single-track vehicles begins with the complete free body diagram of the steerable section and the dynamics of the vehicle. Laboratory demonstrations of geometry changes to the control spring and control authority. Determination of vehicle geometry values of cg position, longitudinal radius of gyration, headtube angle, etc. as their effect on handling qualities. 3 lectures, 1 laboratory. Prerequisite: ME 318, ME 326, ME 422 or consent of instructor.

ME 443 Turbomachinery (4)

Performance characteristics of various types for liquids and for gases. Criteria for proper selection of type and main dimensions. Cavitation criteria. Gas turbine cycles and performance. Two-dimensional cascades. Axial flow turbines and compressors. Centrifugal compressors and radial-inflow turbines. 4 lectures. Prerequisite: ME 342, ME 344, MATH 318.

ME 444 Combustion Engine Design (4)

Application of design parameters to the various engine cycles. Aspects of the combustion processes. Energy conversion including losses and cooling. Static and dynamic loading. 3 lectures, 1 laboratory. Prerequisite: ME 344.

ME 445 Convective Heat and Mass Transfer (4)

Forced convection in laminar and turbulent flow, free convection, diffusion, combined heat and mass transfer. 4 lectures. Prerequisite: ME 342, ME 344.

ME 450 Solar Power Systems (4)

High and intermediate temperature systems for conversion of solar energy to mechanical power and heat. Thermal energy storage and total thermal energy system design. Recommended as a complement to ME 415. 3 lectures, 1 laboratory. Prerequisite: ME 313.

ME 456 Ventilation Principles and Design (4)

Individual and team project work (including computer simulation) in designing systems, selecting equipment, estimating energy consumption and operating costs for applications in industrial ventilation, exhaust and pollution control. 3 lectures, 1 laboratory. Prerequisite: ME 341, ME 344 or ENVE 304, EE 201.

ME 457 Refrigeration Principles and Design (4)

Basic engineering principles of refrigeration processes including: vapor compression cycles, multipressure systems, absorption systems, steam jet cooling, air cycles, and low temperature refrigeration. 3 lectures, 1 laboratory. Prerequisite: ME 313, ME 341.

ME 458 Air Conditioning Principles and Design (4)

Individual and team projects in designing systems, using psychometrics and load calculations for selecting equipment, estimating energy consumption and operating costs for air conditioning systems. 3 lectures, 1 laboratory. Prerequisite: ME 313, ME 341 and ME 344.

ME 459 Advanced Thermal Environmental Engineering (4)

Advanced topics in environmental control including psychrometric chart construction, direct contact transfer processes, heat exchangers, and refrigeration fundamentals. 4 lectures. Prerequisite: CSC 231, ME 313, ME 344.

ME 461, 462 Senior Project (2) (3)

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time. Prerequisite: Senior standing, ME 344 and ME 329 (or concurrent).

ME 463 Undergraduate Seminar (1)

New developments, policies, practices, and procedures discussed through seminar mode. Codes of ethics and case studies interpretations through panel discussions by students. 1 seminar. Prerequisite: Senior standing, ME 344 and ME 329 (or concurrent).

ME 470 Selected Advanced Topics (1-4)

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. *Class Schedule* will list topic selected. Total credit limited to 9 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

ME 471 Selected Advanced Laboratory (1-3)

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. *Class Schedule* will list topic selected. Total credit limited to 6 units. 1 to 3 laboratories. Prerequisite: Consent of instructor.

ME 485 Cooperative Education Experience (6) (CR/NC)

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No

Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

ME 495 Cooperative Education Experience (12) (CR/NC)

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 16 units. Credit/No Credit grading only. Prerequisite: Sophomore standing and consent of instructor.

ME 500 Individual Study (1–3)

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Prerequisite: Consent of department head, graduate adviser and supervising faculty member.

ME 502 Stress Analysis (4)

Approximate methods of stress analysis with emphasis on the theory of the Finite Element Method. Rayleigh-Ritz approximate energy minimizations applied to one- and two-dimensional stress fields. 3 lectures, 1 laboratory. Prerequisite: ME 401, graduate standing or consent of instructor.

ME 517 Advanced Vibrations (4)

Vibration of complex engineering systems. Inertia and stiffness matrices. Natural frequencies and normal modes. Approximate solutions and computer techniques. Response to transient and periodic inputs. 3 lectures, 1 laboratory. Prerequisite: ME 318, graduate standing or consent of instructor.

ME 531 Acoustics and Noise Control (3)

Description of sound using normal modes and waves. Interaction between vibrating solids and sound fields. Sound absorption in enclosed spaces. Sound transmission through barriers. Applications in acoustic enclosures, room enclosures, room acoustics. Design of quiet machinery and transducers. 3 lectures. Prerequisite: ME 318, MATH 318.

ME 541 Advanced Thermodynamics (4)

Selected modern applications of thermodynamics which may include topics from: 1) equilibrium and kinetics as applied to combustion and air pollution, analysis and evaluation of techniques used to predict properties of gases and liquids, and 2) improvement of modern thermodynamic cycles by second law analysis. 4 lectures. Prerequisite: ME 342, ME 344 and graduate standing or consent of instructor.

ME 542 Dynamics and Thermodynamics of Compressible Flow (4)

Control volume analysis of fluid-thermo equations for one-dimensional, compressible flow involving area change, normal shocks, friction, and heat transfer. Two-dimensional supersonic flow including linearization, method of characteristics, and oblique shocks. One-dimensional constant area, unsteady flow, 4 lectures. Prerequisite: ME 342, ME 344, MATH 242, and graduate standing or consent of instructor.

ME 551 Mechanical Systems Analysis (4)

Various system modeling methods applied to mechanical systems. System stability studies and system optimization methods. 3 seminars, 1 laboratory. Prerequisite: Graduate standing or consent of instructor.

ME 552 Conductive Heat Transfer (3)

Theory of steady-state and transient conduction in isotropic and anisotropic media. Development of differential equations, solutions by series, transforms, Duhamel's Method, variational methods. 3 seminars. Prerequisite: ME 342, ME 344, MATH 318, and graduate standing or consent of instructor.

ME 553 Convective Heat Transfer (3)

Conservation of mass, momentum, and energy applied to laminar forced and free convection and turbulent flows. Differential, integral, and scale analysis solutions. 3 seminars. Prerequisite ME 342, ME 344, MATH 318, and graduate standing or consent of instructor.

ME 554 Computational Heat Transfer (3)

Numerical solutions of classical, industrial, and experimental problems in conduction, convection, and radiation heat transfer. 3 seminars. Prerequisite: ME 552, ME 553, graduate standing or consent of instructor.

ME 563 Graduate Seminar (1)

Current developments in mechanical engineering. Participation by graduate students, faculty and guests. 1 seminar. Prerequisite: Graduate standing in mechanical engineering program.

ME 585 Cooperative Education Experience (6) (CR/NC)

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

ME 595 Cooperative Education Experience (12) (CR/NC)

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

ME 599 Design Project (Thesis) (2) (2) (5)

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis. Prerequisite: Graduate standing.

MSC—MILITARY SCIENCE

MSC 111 Orienteering (2)

Principles of orienteering, basic map reading and compass skills; course running techniques applied in field orienteering events. Open to all freshmen and sophomores. 1 lecture, 1 activity.

MSC 112 Survival Training—Wilderness (2)

Techniques of survival in a wilderness environment. Traps and snares, building fires, preparing plant and animal food, locating water, and first aid. Open to all freshmen and sophomores. 1 lecture, 1 activity.

MSC 116 Basic Military Skills (2)

Conducting and evaluating individual, squad, platoon, and company drill and ceremony skills. Conducting manual of arms,

evaluating physical fitness principles. Conducting and evaluating physical fitness program. Techniques of rifle marksmanship. Open to all freshmen and sophomores. 1 lecture, 1 activity.

MSC 211 Current Military Affairs (2)

Organization and functions of the Department of Defense. Issues related to U.S. military affairs: selective service, arms control, nuclear weapons and alliances. Purpose of ROTC, military customs, the military as a profession. Open to all students. 2 lectures.

MSC 212 Basic Camp (1–7)

One to seven units of credit may be granted depending upon successful completion of training. Six weeks of training, Fort Knox, Kentucky. Travel pay and salary provided through the Military Science Department. No obligation. Camp graduates eligible to enroll in ROTC Advanced Program.

MSC 213 Mountaineering (2)

Techniques of survival in a mountainous environment. Rappelling, hot and cold weather survival, basic mountaineering, and rope bridges. Open to all freshmen and sophomores. 1 lecture, 1 activity.

MSC 215 Leadership/Management Seminar (2)

Exploration of key, basic managerial and leadership concepts/techniques. Emphasis is on practical application with experiential learning situations demonstrating key leadership and management principles. Open to all students. 2 seminars.

MSC 225 Advanced Survival Techniques (2)

Mastery of advanced survival skills including water survival, water crossings, expedient tools, weapons, and shelters. Signaling, weather forecasting and survival medicine. 2 activities. Prerequisite: MSC 112, MSC 213 or consent of instructor. Must be able to swim.

MSC 226 Advanced Orienteering (2)

Continuation of MSC 111. Skills will be enhanced with emphasis placed on practical application. 2 activities. Prerequisite: MSC 111 or consent of instructor.

MSC 229 Ranger Challenge (2) (CR/NC)

Selection and preparation of the Ranger Challenge Team which will represent Cal Poly in military tactical skills competition. Includes rope bridging, orienteering, weapons knowledge, hand grenade accuracy, 10K road march with equipment, first aid, marksmanship, physical fitness and tactics. Credit/No Credit grading only. 2 activities.

MSC 311 Leadership and Management (3)

Descriptive model of platoon leadership including personnel within a platoon and tasks of platoon leaders; major theories of leadership; instruction and practice in communication, human relations, organizational structure, power and influence, and management. 3 lectures.

MSC 312 Leader Communication Skills (3)

Principles and usage of verbal, nonverbal, and symbolic communications. Preparing, conducting, and evaluating training. Principles and techniques of meeting management; leadership counseling techniques; proper radio procedures. 3 lectures.

MSC 313 Tactical Military Operations (3)

Organization of the United States Army land combat forces including tactical doctrine and equipment; organization of the

modern battlefield; fundamentals of small unit tactics; planning, organizing and conducting small unit operations; fundamentals of land navigation. 3 lectures.

MSC 314 ROTC Advanced Camp (6) (CR/NC)

Six week summer training program required to achieve an Army commission. Testing and training as functional Army officers and determination of potential for service. Travel pay, room and board, and salary are provided by the U.S. Army. Held at Fort Lewis, Washington. Credit/No Credit grading only. Prerequisite: MSC 311, MSC 312, MSC 313, and consent of instructor.

MSC 400 Special Problems for Advanced Undergraduates (1–2)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

MSC 411 Military Professionalism and Ethics (3)

Professional knowledge subjects including command and staff functions, personnel, training and logistics management, military correspondence and leadership counseling. Discussion of moral philosophy and values essential to the military profession. 3 lectures.

MSC 412 Military Justice (2)

Uniform code of military justice, including the court martial system, disciplinary measures, military crimes, search and seizure, apprehension and safeguarding evidence. Overview of the laws of war. 2 lectures.

MSC 413 Military Organizations and Management (2)

Planning and organizing military functions. Managing staff positions of responsibility. Cadets will be responsible for all coordination and execution of assigned projects. 2 lectures. Prerequisite: MSC 411, MSC 412 and consent of instructor.

MSC 470 Selected Advanced Topics (1–3)

Directed group study of selected topics for advanced students. *Class Schedule* will list topic selected. Total credit limited to 6 units. 1–3 lectures. Prerequisite: Consent of instructor.

MU–MUSIC

MU 100 Music Fundamentals (4)

Traditional music notation. Use of treble and bass staff for pitch and rhythm, harmonization using principal triads, major and minor, and common seventh chords. Performance of simple pieces individually and in groups using common classroom instruments. 3 lectures, 1 activity.

MU 101 Introduction to Music Theory (4) GE C2

Introduction to the elements of music and their use by composers and performers. Notation of pitch and rhythm, scales, key signatures, intervals and chords. 3 lectures, 1 activity.

MU 103 Music Theory I (4)

Structure of tonality, four-part writing of root position and inverted triads, cadences and melodic structure, harmonic progressions, harmonization of a melody and nonharmonic tones. Composition project. 4 lectures. Prerequisite: MU 101 or permission of instructor.

MU 104 Musicianship I (2)

Introductory sight-singing; rhythmic performance and dictation in simple meters; identification and performance of melodic and

harmonic intervals and triads; dictation of major diatonic melodies. 2 activities. Prerequisite: Previous or current enrollment in MU 101; Music major or minor status.

MU 106 Musicianship II (2)

Sightsinging in all forms of the minor mode; rhythmic performance and dictation in compound meters and syncopation; identification of triad inversions and cadence formulas; dictation of minor diatonic melodies; interval identification in multiple timbres. 2 activities. Prerequisite: MU 104 or consent of instructor.

MU 114 Introduction to Composing (4)

Fundamental concepts in music composition. Creative projects. Compositional techniques, development, and structure. Analysis of examples from the literature. 3 lectures, 1 activity. Prerequisite: MU 101 or consent of instructor.

MU 120 Music Appreciation (4) GE C2

Explores the world of music with emphasis on Western tradition. Language of music, the role of music in society. Historical context and major composers from the Middle Ages to the present. 3 lectures, 1 activity.

MU 121 Introduction to Non-Western Musics (4)

Survey of selected non-Western music cultures. Emphasis on listening and understanding the ensemble type, aesthetic principle, musical style, and performance practice of each. 3 lectures, 1 activity. Prerequisite: Music major, minor, or consent of instructor.

MU 150 Applied Music (1)

Individual instruction in performance with emphasis on repertoire, technical skills, style, and interpretation. Total credit limited to 6 units. Specific areas of study are listed in the *Class Schedule*. Prerequisite: Consent of instructor.

MU 151 Beginning Piano (2)

Beginning piano for student with no background in keyboard instruments. Includes fundamentals of notation, keyboard techniques, tone production, sightreading and facility. 1 lecture, 1 activity.

MU 152 Elementary Class Piano (1)

Continuation of MU 151. Piano for students with the ability to play a simple Bach or Mozart Minuet. Total credit limited to 3 units. 1 activity. Prerequisite: MU 151 or equivalent. For non-music majors.

MU 153 Intermediate Class Piano (1)

Continuation of MU 152. Students are expected to play at the level of the easier Clementi Sonatinas. Total credit limited to 3 units. 1 activity. Prerequisite: MU 152 or one year of piano instruction. For non-music majors.

MU 154 Beginning Voice (2)

Beginning study of vocal and performance technique for the untrained singer. Includes the beginning study of the vocal mechanism and the fundamentals of notation. 1 lecture, 1 activity.

MU 155 Guitar I (1)

Fundamentals of guitar technique and performance. Elements of classical, pop, and folk styles. Basics of staff and chord notations. No previous experience necessary. 1 activity.

MU 161 Piano Skills I (1)

Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization or a melody, accompanying, improvisation of a melody. 1 activity. Prerequisite: Consent of instructor.

MU 162 Piano Skills II (1)

Continuation of MU 161. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody. 1 activity. Prerequisite: MU 161 or consent of instructor.

MU 163 Piano Skills III (1)

Continuation of MU 162. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody. 1 activity. Prerequisite: MU 162 or consent of instructor.

MU 170 University Jazz Band (1)

Study and public performance of music written for big band jazz. Limited to those who have had considerable experience playing musical instruments. The band performs concerts on campus and makes at least one tour annually. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 171 Instrumental Ensembles (1)

Open to qualified musicians. Rehearsal and public performances in large and small ensembles. Total credit limited to 6 units. 1 activity. Prerequisite: Consent of instructor.

MU 172 Wind Orchestra (1)

Study and public performance of music written for large wind bands (woodwinds, brass, and percussion). Limited to those students who have had experience with wind and percussion instruments. The band performs concerts on campus and makes at least one tour annually. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 173 Wind Ensemble (1)

Study and public performance of music written for wind ensembles (woodwinds, brass and percussion). Limited to those students who have had experience with wind and percussion instruments. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 174 Orchestra (1)

Preparation and performance of orchestral music including both the standard repertoire and rarely performed works. Open to all students whose technique is adequate. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 175 Contemporary Music Ensemble (1)

Open to all instrumentalists who are interested in performing 20th-century classical literature. Limited to students who are proficient on their instrument. Total credit limited to 6 units. 1 activity. Prerequisite: By audition or consent of instructor.

MU 176 Mustang Band (1)

Public performance of music and specially-designed shows written for marching band (woodwinds, brass, percussion, and flag team auxiliary). Limited to those students who have had marching experience with wind and percussion instruments, or flag, rifle or dance lines. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 180 Men's Chorus (1)

Study and public performance of music composed for men's voices. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 181 PolyPhonics (1)

Study and public performance of music for mixed voices. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 182 Women's Chorus (1)

Study and public performance of music composed for women's voices. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 183 Vocal Ensemble (1)

Open to qualified singers. Rehearsal and performance of specialized vocal music. Total credit limited to 6 units. 1 activity. Prerequisite: Consent of instructor.

MU 184 Music Production Workshop (2)

Preparation of a musical theatre production for public presentation. Includes acting and stage management. Total credit limited to 6 units. 2 laboratories. Prerequisite: By audition or consent of instructor.

MU 185 University Singers (1)

Study and public performance of music for large mixed chorus. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 187 Vocal Jazz Ensemble (1)

Study and performance of vocal jazz, including ensemble performance as well as solo performance and improvisation. Total credit limited to 6 units. 1 laboratory. Prerequisite: Consent of instructor.

MU 200 Special Problems for Undergraduates (1)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

MU 207 Music Theory II (4)

Construction and resolution of seventh chords, secondary dominants, nondominant seventh chord, basic modulation, change of mode. Augmented sixth chord and Neapolitan sixth chord. Binary and ternary form. Composition project. 4 lectures. Prerequisite: MU 103.

MU 208 Musicianship III (2)

Sightsinging in all modes in two or more parts; rhythmic dictation in 2 parts; identification of triadic chord progressions and root position seventh chords; dictation of two-part melodies in all modes. 2 activities. Prerequisite: MU 106 or consent of instructor.

MU 210 Musicianship IV (1)

Continuation of MU 208. Sightsinging with chromatic tones; rhythmic performance in irregular meters; chord progressions with triads and dominant seventh chords; seventh chord inversions; and 2-part diatonic dictation. 1 activity. Prerequisite: MU 208 or consent of instructor.

MU 211 Musicianship V (1)

Continuation of MU 210. Sightsinging with non-diatonic tones; rhythmic dictation in irregular meters; chord progressions with secondary dominant chords; modulatory progressions and

dictations. 1 activity. Prerequisite: MU 210 or consent of instructor.

MU 212 Musicianship VI (1)

Continuation of MU 211. Emphasis on previously acquired skills, plus performance and dictation of complex beat divisions; identification of augmented and neapolitan 6th chords; and modulatory dictation in 2 parts. 1 activity. Prerequisite: MU 211 or consent of instructor.

MU 221 Jazz Styles (4)**GE C2 USCP**

Survey of Jazz as a significant American art form from 1900 to the present; its historical background and development in the United States; key elements, leading performers, and significant compositions. Listening skills, and aspects of cultural pluralism in various styles. 3 lectures, 1 activity.

MU 250 Applied Music (1)

Individual instruction in performance with emphasis on repertoire, technical skills, style, and interpretation. Total credit limited to 6 units. Specific areas of study are listed in the *Class Schedule*. Prerequisite: 3 units of MU 150 and consent of instructor.

MU 251 Diction for Singers (1)

The study of diction as it applies to singing in English, French, German, Italian and Spanish. *Class Schedule* will list topic elected. Total credit limited to 3 units. 1 activity. Prerequisite: Consent of instructor.

MU 252 Intermediate Voice (1)

Vocal and performance technique for experienced singers. Total credit limited to 3 units. 1 activity. Prerequisite: MU 154 or consent of instructor.

MU 253 Advanced Class Piano (1)

Intermediate level piano techniques with emphasis on style, interpretation, sightreading, basic performance practices and the solution to general musical problems. Total credit limited to 3 units. 1 activity. Prerequisite: MU 153 or consent of instructor. For non-music majors.

MU 255 Guitar II (1)

Develops intermediate guitar techniques and performance. Elements of classical, pop, and folk styles. Intermediate skills, reading notes and chord charts. 1 activity. Prerequisite: MU 155 or permission of instructor.

MU 259 Beginning Jazz Improvisation (1)

Development of improvised melodies in mainstream jazz with play-along recordings. Modal, blues and II-V-I progressions with relevant jazz theory. Swing, eighth-note phrasing, and performance of transcribed solos. Total credit limited to 3 units. 1 activity. Prerequisite: MU 101 or consent of instructor.

MU 260 Intermediate Jazz Improvisation (1)

Further development of improvised melodies in mainstream jazz with play-along recordings. Blues and II-V-I progressions with relevant jazz theory. Swing, eighth-note phrasing, and performance of transcribed solos. Total credit limited to 3 units. 1 activity. Prerequisite: MU 259 or consent of instructor.

MU 261 Piano Skills IV (1)

Continuation of MU 163. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, and improvisation of a melody. 1 activity. Prerequisite: MU 163 or consent of instructor.

MU 262 Piano Skills V (1)

Continuation of MU 261. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody. 1 activity. Prerequisite: MU 261 or consent of instructor.

MU 263 Piano Skills VI (1)

Continuation of MU 262. Successful completion of this course represents fulfillment of the Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody. 1 activity. Prerequisite: MU 262 or consent of instructor.

MU 301 Counterpoint (4)

Counterpoint as a compositional technique. Modal, tonal, and post-tonal practices. Creative project. 4 lectures. Prerequisite: MU 309.

MU 308 Sound Design: Technologies (4)

Fundamental tools of electroacoustic sound design. Concepts and application of music studio procedure, recording, synthesis, and MIDI. Studio projects. 3 lectures, 1 activity. Prerequisite: MU 101, MU 120 or consent of instructor.

MU 309 Music Theory III (4)

Compositional procedures employed by composers of the Classical and Romantic periods. Chromatic third-related harmony, ninth, eleventh and thirteenth chords. Chromatic and enharmonic modulation. Sonata and rondo form. Composition project. 4 lectures. Prerequisite: MU 207.

MU 310 Sound Design: Recording (4)

Exploring creative use of recording technology. Analog and digital equipment for recording music. Analysis and creative projects. 3 lectures, 1 activity. Prerequisite: MU 308 or permission of instructor.

MU 320 Music Research and Writing (4)

Methodology for researching, analyzing, and writing about music. Exploration of investigative tools including library resources, periodicals, bibliographic tools, computerized search methods. Computerized software for text, music notation, facsimile enhancement, and music printing. Formatting music for publication. Performance practice. 4 lectures. Prerequisite: MU 207; ENGL 114 and MU 120 recommended; or permission of instructor.

MU 321 Music History I (4)

Musical literature, styles, composers, theory, genres and notation of the Middle Ages and Renaissance. Relationship to historical trends. 4 lectures. Prerequisite: MU 320; MU 120 recommended; or permission of instructor.

MU 322 Music History II (4)

Musical literature, styles, composers, theory, genres and notation of High Baroque, Classic and early Romantic periods. 4 lectures. Prerequisite: MU 320; MU 120 recommended; or permission of instructor.

MU 323 Music History III (4)

Musical literature, styles, composers, theory, genres and notation of the Romantic and 20th Century periods. 4 lectures. Prerequisite: MU 320; MU 120 recommended; or permission of instructor.

MU 324 Music and Society (4)**GE C3**

Exploration into the role of music historically and culturally. Emphasis on deeper understanding and appreciation of the context of music through topics of special interest. *Class Schedule* will list topics selected. Total credit limited to 12 units. 3 lectures, 1 activity. Prerequisite: Junior standing. MU 120 recommended.

MU 325 America's Music (4)**USCP**

Explorations of the many styles of America's music through lectures, readings, sound recordings, musical scores, and performance. Includes "Native American," "folk," "popular," and "fine art" traditions. How American music reflects the different cultural heritages, social contexts, and philosophies of its creators. 4 lectures. Prerequisite: MU 207; MU 120 recommended.

MU 326 Cultural Concepts and Structures in Music (4)

Exploring the definition, concepts, and structures of music in terms of theory, performance practice, and compositional procedures of selected non-Western cultures. 3 lectures, 1 activity. Prerequisite: Junior standing or consent of instructor.

MU 327 Concert Attendance (London) (1)**GE C3**

Concert attendance for Music and Society (MU 324) course taught in London. Must be taken in conjunction with MU 324. Miscellaneous course fee required—see *Class Schedule*. 1 activity. Prerequisite: Junior standing.

MU 328 Women in Music (4)**GE C3**

Survey of women's contributions as composers and performers of western art and popular music; historical overview of the experiences and perception of women as musicians. 4 lectures. Prerequisite: Junior standing.

MU 329 Music of the 60s: War and Peace (4)**GE C3****USCP**

Explores wide spectrum of rock, folk and pop styles of the 60s. Relates music to social turmoil and historical trends, including Vietnam War, Civil Rights Movement, American Indian Movement, Chicano Movement, Free Speech Movement. 4 lectures. Prerequisite: MU 120 or MU 320 or permission of instructor.

MU 335 Survey of Keyboard Literature (4)

Intensive survey of solo piano literature from early keyboard music through contemporary composers; emphasis upon composers' influences, stylistic characteristics, performance practices, and the development of the pianoforte. 4 lectures. Prerequisite: MU 207 or consent of instructor.

MU 336 Jazz History and Theory (4)

Survey of Jazz theoretical techniques. Emphasis upon historical context and development of Jazz through study and analysis of scores and historical performances. 4 lectures. Prerequisite: MU 207.

MU 337 Survey of Vocal Literature (4)

Comprehensive survey of vocal literature from early to contemporary composers. Emphasis upon composers' influences, style characteristics, and performance practices. 4 lectures. Prerequisite: MU 207 or consent of instructor.

MU 340 Conducting: Fundamentals (2)

Principles and techniques of conducting with experience in score reading. 2 activities. Prerequisite: MU 207 or consent of instructor.

MU 341 Conducting: Choral (2)

Continuation of MU 340. Emphasis on choral literature. Score reading, rehearsal techniques, and musical details associated with vocal music. 2 activities. Prerequisite: MU 340.

MU 342 Conducting: Instrumental (2)

Continuation of MU 340. Emphasis on band and orchestra literature. Score reading, rehearsal techniques, and musical details associated with instrumental music. 2 activities. Prerequisite: MU 340.

MU 350 Applied Music (1)

Individual instruction in performance and composition. Total credit limited to 6 units. Specific areas of study are listed in the *Class Schedule*. Prerequisite: Consent of instructor.

MU 351 Jazz and Popular Music Arranging (2)

Arranging for small and large jazz ensembles. Score and part preparation. 2 activities. Prerequisite: MU 207.

MU 352 Orchestration (4)

Ranges, transposition, technical capabilities, and scoring of vocal ensembles, band, and orchestra instruments. Creative project. 3 lectures, 1 activity. Prerequisite: MU 207.

MU 360 Music for Classroom Teachers (4)

Development of skills for fostering creative music experiences in the classroom. Exploration of various approaches to motivating children musically. Study of folk songs for singing, playing instruments, and learning about music as well as for their ethnic and cultural significance. 3 lectures, 1 activity. Prerequisite: MU 100.

MU 361 Instruments (1)

Fundamentals of playing and teaching woodwind, brass, string, and percussion instruments. Separate sections in specific areas of study are arranged with instructor. Total credit limited to 6 units. 1 activity. Prerequisite: Junior standing and consent of instructor.

MU 365 Music in the Elementary School (4)

Study and application of Orff, Dalcroze, Kodaly, Manhattanville, and Suzuki. Philosophy, objectives and methodologies for implementing an effective school music program. Includes fieldwork. 3 lectures, 1 activity. Prerequisite: MU 207; junior standing.

MU 366 Piano Pedagogy (2)

Survey of elementary, intermediate and advanced teaching methods and literature; private and group instruction; studio policies. 2 activities. Prerequisite: MU 207 or consent of instructor.

MU 367 Vocal Pedagogy (2)

Survey of elementary, intermediate and advanced teaching methods including a comprehensive study of the vocal mechanism. 2 activities. Prerequisite: MU 207 or consent of instructor.

MU 370 University Jazz Band (1)

Study and public performance of music written for big band jazz. Limited to those who have had considerable experience playing musical instruments. The band performs concerts on campus and makes at least one tour annually. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 371 Instrumental Ensemble (1)

Open to qualified musicians. Rehearsal and public performance in large and small ensembles. Total credit limited to 6 units. 1 activity. Prerequisite: Junior standing and consent of instructor.

MU 372 Wind Orchestra (1)

Study and public performance of music written for large wind band (woodwinds, brass and percussion). Limited to those students who have had experience with wind and percussion instruments. The band performs concerts on campus and makes at least one tour annually. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 373 Wind Ensemble (1)

Study and public performance of music written for wind ensemble (woodwinds, brass and percussion). Limited to those students who have had experience with wind and percussion instruments. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 374 Orchestra (1)

Preparation and performance of orchestral music including both the standard repertoire and rarely performed works. Open to all students whose technique is adequate. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 375 Contemporary Music Ensemble (1)

Open to all instrumentalists who are interested in performing 20th-century classical literature. Total credit limited to 6 units. 1 activity. Prerequisite: Junior standing; by audition or consent of instructor.

MU 376 Mustang Band (1)

Public performance of music and specially-designed shows written for marching band (woodwinds, brass, percussion, and flag team auxiliary). Limited to those students who have had marching experience with wind and percussion instruments, or flag, rifle or dance lines. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 380 Men's Chorus (1)

Study and performance of music for men's voices. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 381 PolyPhonics (1)

Study and public performance of music for mixed voices. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 382 Women's Chorus (1)

Study and public performance of music for women's voices. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 383 Vocal Ensemble (1)

Open to qualified singers. Rehearsal and performance of specialized vocal music. Total credit limited to 6 units. 1 activity. Prerequisite: Junior standing and consent of instructor.

MU 384 Music Production Workshop (2)

Preparation of a musical theatre production for public presentation, including acting and stage management. Total credit limited to 6 units. 2 laboratories. Prerequisite: Junior standing and by audition, or consent of instructor.

MU 385 University Singers (1)

Study and public performance of music for large mixed chorus. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 387 Vocal Jazz Ensemble (1)

Study and performance of vocal jazz, including ensemble performance as well as solo performance and improvisation. Total credit limited to 6 units. 1 laboratory. Prerequisite: Junior standing and consent of instructor.

MU 400 Special Problems for Advanced Undergraduates (1–2)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Junior standing and consent of department head.

MU 401 Contemporary Music Theory (4)

Examination of modern compositional practices including impressionism, polytonality, serialism, timbre and form, minimalism, and the new eclecticism. Analysis and creative projects. 4 lectures. Prerequisite: MU 309 or permission of instructor.

MU 404 Composition (2)

Independent creative projects. Exercises in compositional methods designed to increase technical facility. Total credit limited to 6 units. 2 activities. Prerequisite: MU 309 or permission of instructor.

MU 411 Sound Design: Synthesis (4)

Compositional application of sound synthesis techniques. Realization of computer music. Creative projects. 3 lectures, 1 activity. Prerequisite: MU 310.

MU 412 Sound Design: Composition and Performance (4)

Performance of electroacoustic music. Program preparation, composition, technical planning. Concert performance. 3 lectures, 1 activity. Prerequisite: MU 411.

MU 420 Music History: Selected Topics (4)

Intensive study of selected topics in music history through the use of readings, recordings, scores, and class presentations. *Class Schedule* will list topics selected. Total credit limited to 8 units. 3 lectures, 1 activity. Prerequisite: MU 321, MU 322, and MU 323, or consent of instructor.

MU 450 Applied Music (1)

Individual instruction in performance and composition. Total credit limited to 6 units. Specific areas of study are listed in the *Class Schedule*. Prerequisite: Consent of instructor.

MU 461 Senior Project (3)

Selection and completion of a project under faculty supervision. Minimum of 90 hours total time. Results presented in a recital, creative work, formal report, or a combination of all three. Prerequisite: Senior standing and consent of department head.

MU 465 Choral Literature and Rehearsal Techniques (4)

Survey of choral literature especially suited for secondary schools. Philosophy and strategy for developing a school program. Musical as well as non-musical techniques for effective rehearsal. 3 lectures, 1 activity. Prerequisite: MU 341, or consent of instructor.

MU 466 Instrumental Literature and Rehearsal Techniques (4)

Survey of instrumental literature especially suited for secondary schools. Philosophy and strategy for developing a school program. Musical as well as non-musical techniques for effective rehearsal. 3 lectures, 1 activity. Prerequisite: MU 342, or consent of instructor.

PE—PHYSICAL EDUCATION

(See also KINE—Kinesiology)

BASIC INSTRUCTIONAL PROGRAM

Enrollment is open to all students except for designated intramural courses. Courses carry 1 unit of credit, meet 2 hours per week, and are designed to develop skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities.

The beginning course or its equivalent is prerequisite to the intermediate, and the intermediate to the advanced. Prerequisite may be waived by consent of the instructor.

No more than two different activity courses nor more than one section of an individual activity course may be taken for credit in any one quarter. A student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course. Any level of an activity course can be repeated only once for credit.

Students not majoring in kinesiology may apply a maximum of 12 units of credit earned in general and intramural activity courses toward the bachelor's degree.

All basic instructional courses (PE 100–176) are evaluated on a Credit/No Credit basis. A miscellaneous course fee may be required—see *Class Schedule*.

Coed

- PE 100 Adaptive Activity
- PE 101 Gymnastics
- PE 102 Tumbling and Vaulting
- PE 103 Archery
- PE 104 Badminton, Beg.
- PE 105 Badminton, Int.—Adv.
- PE 107 Billiards
- PE 108 Basketball
- PE 109 Bowling
- PE 110 Cycling
- PE 111 Fencing
- PE 112 Bowling, Int.
- PE 116 Aerobic Exercise
- PE 121 Golf, Beg.
- PE 122 Golf, Int.—Adv.
- PE 125 Jogging
- PE 126 Judo
- PE 129 Stretch, Flex and Relax
- PE 131 Physical Conditioning
- PE 132 Racquetball, Beg.
- PE 133 Racquetball, Int.—Adv.
- PE 135 Skin Diving
- PE 136 Scuba Diving
- PE 137 Self-Defense
- PE 138 Karate
- PE 139 Soccer

PE 140 Ultimate Disc
 PE 142 Softball
 PE 143 Swimming for Non-Swimmers
 PE 144 Swimming, Advanced Beginner
 PE 145 Swimming, Int.
 PE 146 Swimming, Adv.
 PE 147 Swim Conditioning
 PE 148 Tennis, Beg.
 PE 149 Tennis, Int.–Adv.
 PE 151 Volleyball, Beg.
 PE 152 Volleyball, Int.–Adv.
 PE 154 Weight Training
 PE 156 Aqua-Aerobics
 PE 159 Wrestling
 PE 174 Intramurals
 PE 176 Fitness Walking

COMPETITIVE ATHLETICS

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

Men

PEM 182 Baseball
 PEM 183 Basketball
 PEM 184 Cross Country
 PEM 185 Football
 PEM 189 Soccer
 PEM 191 Swimming
 PEM 192 Tennis
 PEM 193 Track and Field
 PEM 196 Wrestling

Women

PEW 183 Basketball
 PEW 184 Cross Country
 PEW 189 Soccer
 PEW 190 Softball
 PEW 191 Swimming
 PEW 192 Tennis
 PEW 193 Track and Field
 PEW 194 Volleyball

PROFESSIONAL ACTIVITIES – See KINE–Kinesiology

ACADEMIC COURSES – See KINE–Kinesiology

PHIL–PHILOSOPHY

PHIL 125 Critical Thinking (Also listed as ENGL 125 and SPC 125) **GE A2**

Nature of critical thinking. Analysis of inductive and deductive arguments. Practice in the criticism and composing of arguments in English. 3 lectures. Prerequisite: ENGL 114.

PHIL 225 Symbolic Logic (4)

The nature of deductive logical systems. Methods of notation, translation and proof in the sentential, predicate and relational calculi including indirect and conditional methods of proof. 4 lectures. Prerequisite: ENGL 125 or PHIL 125 or SPC 125.

PHIL 230 Philosophical Classics (3) **GE C1**

Readings of various philosophic classics with focus on the identification and evaluation of the central metaphysical and epistemological themes. Various major arguments through a case mode presentation. 3 lectures. Prerequisite: ENGL 125 or PHIL 125 or SPC 125.

PHIL 231 Philosophical Classics (3) **GE C1**

Readings with focus on the identification and evaluation of the central themes of ethics, social and political philosophy. Various major arguments through a case mode presentation. 3 lectures. Prerequisite: ENGL 125 or PHIL 125 or SPC 125.

PHIL 311 Greek Philosophy (3) **GE C3**

Beginnings of Western philosophy and science. Presocratics, Socrates, Plato, and Aristotle. Greek philosophies in the Roman world. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 312 Medieval Philosophy (3) **GE C3**

Development of Western philosophy from Augustine to Ockham, including the philosophies of Anselm, Abelard, Roger Bacon, Bonaventure, Aquinas and Duns Scotus. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 313 Continental Philosophy: Montaigne to Leibnitz (3) **GE C3**

Development of Western philosophy from the Renaissance through Leibnitz with special emphasis upon the philosophies of the Continental Rationalists. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 314 British Philosophy: Bacon to Mill (3) **GE C3**

Development of Western philosophy from the Renaissance through Mill with special emphasis upon the philosophies of the British Empiricists. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 315 German Philosophy: Kant to Nietzsche (3) **GE C3**

Primary issues and concepts found in German philosophy from 1780 to 1900, with emphasis on Kant, Hegel, and Nietzsche. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 316 Contemporary European Philosophy (3) **GE C3**

Recent movements within the Continental tradition, including French and German existentialism, phenomenology, and post-metaphysical philosophy. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 317 Contemporary British and American Philosophy (3) **GE C3**

Distinctly Anglo-American philosophical movements of the twentieth century including pragmatism, realism, relativism, positivism, and various schools of analytic philosophy. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 320 Asian Philosophy (3) **GE C3**

Philosophies developed in India, South Asia, China, and Japan, including the logical and epistemological presuppositions of the Six Schools of Hindu metaphysics; the Six Schools of Chinese philosophy; Confucian moral philosophy and Taoist social ecology. 3 lectures Prerequisite: PHIL 230 or PHIL 231.

PHIL 321 Philosophy of Science (3) **GE C3**

Methods of physics, biology, psychology and other selected sciences, with reference to their presuppositions and general

findings. Relations between the sciences and implications of scientific methods for other fields of inquiry. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 331 Ethics (3) GE C3

Inquiry into the problems of the principles of right action and justice, of moral character and motivation, and of the good life. Examination of traditional and contemporary answers to these problems and the implications of those answers. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 332 History of Ethics (3) GE C3

History of ethics from the Greeks to the 20th Century. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 333 Political Philosophy (3) GE C3

Philosophic foundations of political ideologies. Freedom, state, law, obligation, sanction, and their relation to metaphysics, theory of knowledge, and ethics. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 334 Jurisprudence (3) GE C3
(Also listed as POLS 334)

Normative and analytic questions about law. Nature of law and legal systems. Justification of law. Moral obligation to obey the law. Nature and justification of punishment. Guilt and legal responsibility. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 335 Social Ethics (3) GE C3 USCP

Critical examination of ethical problems connected to issues of social justice for ethnic minorities in contemporary American society. These issues include racial and sexual discrimination, racial and sexual harassment, preferential hiring, and the relation of capital punishment to ethnicity. Related individual rights and public policy issues will also be examined. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 336 Ethics, Gender and Society (3) GE C3 USCP

Critical examination of the relation of gender to moral reasoning and to ethical problems in contemporary American society. Joint focus on theory and application. Consideration given to the connection of gender to race and power, including African-American women's perspectives. 3 lectures. Prerequisite: PHIL 231.

PHIL 337 Business Ethics (3) GE C3

Critical examination of ethical problems arising in business. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 339 Biomedical Ethics (3) GE C3

Critical examination of ethical problems arising in biology, biotechnology and medicine. Concepts of health and disease, ethical issues of human experimentation, informed consent, behavior control, genetic intervention, new birth technologies. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 340 Environmental Ethics (3) GE C3

Ethical analysis of various positions on the status of non-human entities and the most reasonable approaches to environmental problems such as pollution, species preservation, global warming and others. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 342 Philosophy of Religion (3) GE C3

Inquiry into the nature of religious experience and claims, naturalism and supernaturalism, arguments for the existence of God, the problem of evil, miracles, revelation, faith, human nature

and destiny, verification and refutation of religious claims. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 351 Traditional Theories of Aesthetics (3) GE C3

Critical examination of philosophical views of art from Plato through Kant to Collingwood and Dewey. Special emphasis given to the relationship among art, truth and reality, and to the nature of aesthetic experience. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 352 Contemporary Problems in Aesthetics (3) GE C3

Critical examination of philosophical issues related to art, with emphasis on problems affecting aesthetics with the rise of modern art. Topics covered include the problem of defining art, the problem of determining standards for interpreting art, and the relation of aesthetic values to moral, social and political values. 3 lectures. Prerequisite: PHIL 230 or PHIL 231.

PHIL 400 Special Problems for Advanced Undergraduates (1-2)

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of department chair.

PHIL 411 Metaphysics (4)

Traditional and current ideas and arguments about substance, the relation of universals to particulars, space and time, events, causation and necessity, the self and free will. 3 lectures, research paper. Prerequisite: PHIL 230.

PHIL 412 Epistemology (4)

Analysis of the concept of knowledge. Development of competing theories of epistemic justification and truth. Inquiry into relationship between knowledge, belief, justification and truth. Examination of skepticism. 3 lectures, research paper. Prerequisite: PHIL 230.

PHIL 422 Philosophy of Mind (4)

Classic and current work in the problems and issues of the nature and unity of the self, consciousness, mental representations, and action, and of the relation of philosophy of mind to psychology, linguistics and computer science. 3 lectures, research paper. Prerequisite: PHIL 230 or PHIL 231.

PHIL 429 Special Topics in the History of Philosophy (4)

Advanced discussion of selected topics in the history of philosophy. Examination and analysis of important philosophical movements (e.g., positivism, postmodernism) or alternatively, of particular philosophers or philosophical works of exceptional importance (e.g., David Hume; Kant's *Critique of Pure Reason*). *Class Schedule* will list topic selected. Total credit limited to 12 units. 3 lectures, research paper. Prerequisite: PHIL 230.

PHIL 439 Selected Problems in Ethics and Political Philosophy (4)

Advanced discussion of selected topics in ethics and political philosophy. Examination and analysis of significant ethical or political theories (e.g., utilitarianism, contractarianism) or alternatively, of particular philosophers or philosophical works of exceptional importance (e.g., John Stuart Mill; John Rawls' *A Theory of Justice*). *Class Schedule* will list topic selected. Total credit limited to 8 units. 3 lectures, research paper. Prerequisite: PHIL 231 and PHIL 331 or PHIL 333.

PHIL 460, 461 Senior Project (2) (2)

Selection, development and completion of a project under faculty supervision. Results presented in a formal thesis. Minimum of 60 hours per quarter. Requirements for PHIL 460 must be completed before student can enroll in PHIL 461. Prerequisite: Senior standing, consent of instructor.

PHIL 470 Selected Advanced Topics (1-3)

Directed group study of selected topics for advanced students. *Class Schedule* will list topics selected. Total credit limited to 6 units. 1-3 lectures. Prerequisite: Consent of instructor.