ACCOUNTING (009)

451 Operational Auditing and Consulting (3) Approaches to evaluate an entity’s efficiency and effectiveness in a variety of settings and techniques used in consulting to provide entity competitive advantage.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

507 Financial Reporting Research and Contemporary Issues (3) Theory and practice of contemporary financial reporting issues are covered with an emphasis on researching the authoritative accounting literature. Specific contemporary issues covered vary each semester. Prereq: Admission to MAcc program or consent of instructor.

518 Professional Standards (3) Basic standards and contemporary issues relevant to assurance providers. Actual practice cases are used to illustrate application. Prereq: Admission to MAcc program or consent of instructor.

519 Seminar in Business Risk and Assurance Methodology (3) Business risk and emerging methodology used by assurance providers. Prereq: Admission to graduate programs or consent of instructor.

521 Advanced Management Accounting (3) Analysis of management accounting and cost management practices and models. Topics include cost behavior, strategies and models for decision making, and performance measurement issues. Prereq: Management Accounting, and either admission to a graduate business program or consent of instructor.

531 Tax Strategy, Tax Research, and Entity Taxation (3) Current issues in tax strategy including investment models, implicit taxes, tax arbitrage, organizational form, and other selected topics. Methods of researching tax issues within the U.S. federal tax system with emphasis on Web-based research tools. Income taxation of business entity operations. Prereq: Admission to MAcc program or consent of instructor.

532 Corporate Taxation and Reorganizations (3) Current issues in corporate taxation including organization and capital structure, distributions, liquidations, acquisitions, and reorganizations. Course emphasizes group projects and presentations. Web-based research tools used extensively. Prereq: Admission to MAcc program or consent of instructor. Prereq/Coreq: 531.

533 Taxation of Partnerships and S Corporations (3) Current issues in partnership and S corporation taxation including partner- ship formation, operations, allocations, and distributions; LLCs; S corporation election and operations; and comparisons of different flow-through entities. Course emphasizes group projects and presentations. Web-based research tools used extensively. Prereq: Admission to MAcc program or consent of instructor. Prereq/Coreq: 531.

534 Family Tax Planning (3) Methods used to value closely-held business, the law and planning strategies related to inter vivos and post-mortem property transfers and the taxation of estates, and financial planning techniques used to meet family tax planning objectives. Prereq: Admission to MAcc program or consent of instructor. Prereq/Coreq: 531.

539 Multi-Jurisdictional Tax Planning and Policy (3) International and state tax law as it pertains to business transactions. Particular emphasis is placed on identifying tax planning opportunities and designing tax strategies to meet planning objectives. Prereq: 531 and either admission to MAcc program or consent of instructor.
592 Graduate Internship in Accounting (3) Full-time resident professional employment for one academic semester involving qualified job experience, written report of responsibilities, and evaluation of student performance. Prereq: Admission to MAcc program or consent of MAcc advisor.

593 Individual Research in Accounting (3) Directed research in topic of mutual interest. Prereq: Admission to MAcc program or consent of MAcc advisor. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

611-612 Doctoral Seminar in Accounting (3,3) Analysis of issues reflected in accounting literature. Prereq: Consent of PhD program advisor.

619 Doctoral Research in Accounting (3) Study of research methodology and application of various research methods in accounting literature. Prereq: Consent of PhD program advisor.

621-622 Accounting Colloquium (1,1) Research and discussion of contemporary issues in practice of accountancy. Prereq: Consent of PhD program advisor. May be repeated. Satisfactory/No Credit grading only.

693 Independent Study (3) Directed research in topic of mutual interest. Prereq: Admission to doctoral program with concentration in accounting. May be repeated. Maximum 6 hours.

ADVERTISING (012)

490 Special Topics (3) Topics vary: advanced media strategy, advanced creative strategy, direct marketing, and advertising and social issues.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Advertising and Society (3) Analysis of advertising as institution in a free-enterprise democratic society and its relation to social, legal, cultural, and economic institutions.

520 Advertising and Communications Theory (3) Application of contemporary communications theories of attitude change, information-processing, and persuasion as applied to creative strategy decisions. Prereq: Consent of instructor or admission to program.

530 Advertising and Public Relations Research (3) Nature, scope, and application of research function to advertising and public relations decisions. Prereq: Statistics 531 or equivalent.

540 Advertising Decision Making (3) Analysis of decision-making in budgeting, creative strategy, media strategy, research, evaluation, and agency-client relationships. Advertising response functions. Prereq: Consent of instructor or admission to program.

590 Project (3) Capstone project under guidance of faculty. Application of principles from previous coursework. Satisfactory/No Credit grading only.

597 Independent Study (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

AEROSPACE ENGINEERING (018)

NOTE: Not all the courses listed below are available at both the University of Tennessee, Knoxville, and UTSI campuses.

422 Aerodynamics (3) Theory and design of aerodynamic bodies for desired characteristics. Potential flow theory; viscous effects, compressibility effects. Subsonic, transonic, and supersonic airfoils. Prereq: 351, 370.

424 Astronautics (4) Solar system, orbital mechanics, propulsion, atmospheric entry including thermal protection materials, human factors in space flight, the space environment, and current topics. Prereq: 351. Coreq: Mechanical Engineering 331.


429 Aerospace System Design (3) Synthesis and design of complete aerospace system. Participation in team design effort: formal presentations and design report. Prereq: 422, 425, 426.


494-495 Selected Topics in Aerospace Engineering (1-4,1-4) Problems and topics related to developments and practice in aerospace engineering. Prereq: Consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

509 Multidisciplinary Project (1) (See Industrial Engineering 509.)

511 Inviscid Flow (3) Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping. Prereq: 422 or 541, Mathematics 425 or equivalent.

512 Viscous Flow (3) Derivation of fundamental equations of compressible viscous flow; boundary conditions for viscous heat-conducting flow; exact solutions for Newtonian viscous flow (Navier-Stokes) equations for special cases; similarity solutions. Thermal boundary layers, stability of laminar flows, transition to turbulence, 2-D turbulent boundary layer equations. Incompressible-turbulent mean flow, and compressible boundary layer flow. Prereq: Consent of instructor.

513 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments; representative experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, water table experiments, supersonic flow experiments, boundary layer measurements, laser-optical measurements. Prereq: 423 or 541.

515-516 Air Vehicle Aerodynamics and Performance (3,3) Application of aerodynamics principles to air vehicles to provide estimates of performance, stability, and control characteristics for subsonic to hypersonic speeds. Relations among thrust, drag, lift and attitude, propulsion systems, vehicle performance characteristics, and trajectory optimization. Prereq: 422; 515 for 516.

521-522 Aerodynamics of Compressible Fluids (3,3) One-dimensional internal and external flow; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics. Prereq: 422 for 521; 521 for 522.

525 Hypersonic Flow (3) Slender body flow; similitude; Newtonian theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow. Prereq: 512.
527-528 Aerospace Ground Test Facilities (3,3) Atmospheric models and similarity considerations; aerodynamic test facilities: continuous and intermittent wind tunnels and ballistic ranges; propulsion test facilities or air breathing and rocket engines; space environment and space vehicle test facilities. Prereq: 521, 541 and Mechanical Engineering 522.

529 Rarefied Gasdynamics (3) Binary elastic collisions; kinetic theory; flow regimes; Boltzmann and model equations, transfer equation, gas-surface interactions; slip boundary conditions, free molecule, slip and transition flow; Monte Carlo simulation; experimental techniques; introduction to hypersonic real gas flows. Prereq: 522, Mechanical Engineering 522.

531 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics; thermodynamic and thermophysical properties of gas plasmas; governing equations and applications. Prereq: 422 and Mathematics 471.

532 Introduction to Turbulence (3) Macroscopic effects, analogies, statistical treatment, correlation functions, energy spectra, diffusion; application of turbulent jets and pipe flow. Prereq: 511-512.

533 Dynamics (3) (See Mechanical Engineering 533.)

534 Atmospheric Entry (3) Reentry trajectories; lift and drag during reentry; vehicle motion and stability during reentry; aerodynamic heating and heat protection systems. Prereq: 522. Recommended prereq: 512.

535 Mechanical Vibrations (3) (See Mechanical Engineering 534.)

539 Continuum Mechanics (3) (See Engineering Science 539.)

541 Fluid Mechanics I (3) (See Mechanical Engineering 541.)

542 Fluid Mechanics II (3) (See Mechanical Engineering 542.)

544 Transonic Flow (3) Nature of flow at transonic speeds; small disturbance theory; shock wave properties; shock-free flows; strong viscous interaction phenomena; solution techniques. Prereq: 522.


554 Aerospace Vehicle Stability and Control (3) Static and dynamic longitudinal directional and lateral stability and control. Coupled modes. Motion with free and fixed flight control surfaces. Automatic control systems. Prereq: 423, 551.

555 Human Vibrations Analysis and Protection (3) (See Biomedical Engineering 555.)

556 Vertical or Short Take Off and Landing Aircraft (3) Performance, stability, control of rotary wing, tilt wing, vectored lift and jet vertical riser type aircraft. Vertical and transition flight modes. High lift airfoils. Automatic controls. Simulation facility types and flight testing. Prereq: 555.


559 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 559.)

561 Fundamentals of Aeroacoustics (3) Generation, propagation and absorption of sound in static and moving media. Prereq: Consent of instructor.

564 Spacecraft Attitude Dynamics and Control (3) Rotational attitude dynamics of space vehicles. Gyroscopic instruments; passive and active attitude control devices. Linear control theory and attitude stabilization. Prereq: 551, Mathematics 471.

571 Finite Elements for Engineering Applications (3) (See Engineering Science 551.)

572 Computational Fluid Dynamics (3) (See Engineering Science 552.)

573 Computational Solid Mechanics (3) (See Engineering Science 553)

574 Space Engineering: Satellite Technology (3) Satellites and rockets (orbit, launch vehicles and launching), spacecraft structure, power systems, attitude control system, telemetry/tracking/command, and communication systems, spacecraft testing, reliability, and application of satellites (communication, weather, Earth observation, and future applications). Prereq: 425, Mathematics 471, 404.

590 Selected Engineering Problems (2-6) Enrollment limited to students in programs problem. Prereq: Consent of advisor. May be repeated. Maximum 6 hours.

595 Seminar (1) All phases of aerospace engineering, reports on current research at the University of Tennessee, Knoxville, and UT-SI. May be repeated. Satisfactory/No Credit grading only.

599 Special Topics in Aerospace Engineering (1-3) May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

642 Physical Gas Dynamics (3) High speed, high temperature gas flow from molecular point of view. Kinetic theory, statistical mechanics, equilibrium flow, vibrational and chemical rate processes, non-equilibrium vibrational and chemical flow, non-equilibrium kinetic theory, flow with transalional non-equilibrium. Prereq: 522, Mechanical Engineering 522.

645 Theory of Turbulence (3) (See Engineering Science 645.)

659 Advanced Mechanics of Materials II (3) (See Mechanical Engineering 659.)

661-662 Advanced Topics in Computational Fluid Dynamics (3,3) (See Engineering Science 651-652.)

663-664 Advanced Topics in Computational Solid Mechanics (3,3) (See Engineering Science 653-54.)


690 Advanced Topics in Aerospace Engineering (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

AFRICAN AND AFRICAN-AMERICAN STUDIES (022)


443 Topics in Black Literature (3) (See English 443.)

450 Issues and Topics in African-American Studies (3) Topics vary but include a variety of problems, issues, and individuals from the field of African-American studies. May be repeated. Maximum 6 hours.

452 Black African Politics (3) (See Political Science 452.)

461 Art of Southern and Eastern Africa (3) (See Art History 461.)

462 Art and Archaeology of Ancient Africa (3) (See Art History 462.)

463 Arts of the African Diaspora (3) (See Art History 463.)

483 African-American Women in American Society (3) Historical and contemporary socio-eco-political factors in American society as related to black women. (Same as Women’s Studies 483.)

510 Special Topics (3) May be repeated. Maximum 6 hours.

AGRICULTURAL AND EXTENSION EDUCATION (042)

440 Communication Techniques in Agriculture (3) Elements of effective use of mass media in Agricultural and Extension Education. Effective technical writing and presentation strategies for agricultural audiences. Prerequisite for undergraduate students: English 101 and 102, junior standing. Prerequisite for graduate students: none.

450 Agricultural Leadership Development (3) Identification of styles required in working with organizations and youth groups, methods of resolving conflict, of communicating, of guiding and evaluating; ethical considerations for leaders. Prerequisite for undergraduate students: Junior standing. Prerequisite for graduate students: none.

500 Thesis (1-15) P/NP only.

501 Creative Component in Lieu of Thesis (3) Capstone experience completed under supervision of major professor and committee. Individual project: literature survey; development of teaching software; development of curriculum materials; development of white paper; or other suitable project. Prerequisite: Consent of major professor. Non-thesis majors only. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

511 Extension History, Philosophy and Objectives (3) Historical and philosophical foundation of adult education in American agriculture, key figures, issues, legislative movement, farmer organizations and programs. Cooperative Extension Service, origin, legislation and growth, and nature of present-day objectives and programs. Prerequisite: 211 or consent of instructor.

521 Extension Program Planning and Evaluation (3) Theories and models of program development and evaluation and their use in extension education: planning and conducting needs assessments; planning, organizing, implementing and evaluating extension educational program content and learning activities; development and interaction of county, state and federal extension plans of work; and principles, techniques and instruments used to identify, gather and analyze information to evaluate extension programs. Prerequisite: 211, 511, or consent of instructor.

522 Educational Technology in Agricultural and Extension Education (3) Advanced concepts and methods relevant to both formal and non-formal instructional methodologies. Processes by which professional change agents influence the introduction, adoption, and diffusion of technological change. Prerequisite: 435, 436, or consent of instructor.

524 Research Methodology (3) Social science research methods related to research in agricultural and extension education. Issues: research design, reliability and validity in measurement, sampling procedures, logic of analysis, scaling and measurement, and selection and interpretation of appropriate inferential tests of significance. Prerequisite: 436, 511, or consent of instructor.

525 Curriculum Development in Agricultural and Extension Education (3) Models, principles, and procedures for developing curricula in agriculture and extension education programs and scheduling learning activities used to implement these planned programs. Prerequisite: 435, 436, or consent of instructor.

526 Agricultural Education for First-Year Teachers (2) Developing competencies needed by first-year teachers for planning, organizing and conducting program of vocational agriculture in local community. Group meetings in selected centers and visits by instructor. Prerequisite: 435, 436.

527 Adult Education Strategies in Agricultural and Extension Education (3) Methods of developing and implementing educational programs for adults in agricultural and extension education and related contexts: different learning of adults and children (andrology vs. pedagogy); understanding and determining adult needs, priorities and motivation for participating in educational programs; adoption of new ideas by adult learners; methods and materials effective in teaching adults; developing favorable attitudes toward post-secondary education and life-long learning. Prerequisite: 211, 511, or 346 or consent of instructor.

530 Special Topics in Agricultural and Extension Education (1-3) Current issues. Prerequisite: Consent of instructor. May be repeated. Maximum 9 hours.

532 Managing Organizations, Programs and Personnel (3) Theory and principles of management for individual and organizational effectiveness of agricultural organizations. Prerequisite: 511, 521, or consent of instructor.

592 Internship in Agricultural and Extension Education (1-3) Practical field experience in selected setting under supervision of local practitioner and departmental representative. Prerequisite: Consent of instructor. Maximum 3 hours. Satisfactory/No Credit grading only.

593 Special Problems in Agricultural and Extension Education (1-4) Special research and/or special reports based on supervised independent study. Prerequisite: Consent of instructor. May be repeated. Maximum 6 hours.

AGRICULTURAL ECONOMICS (047)

412 Agricultural Finance (3) Macro-finance, financial objectives, acquisition of debt and equity funds, capital investments, capital allocation, credit analysis, borrower and lender loan application analysis, insurance strategies, computer applications, kinds and sources of agricultural credit, and financial intermediation. Prerequisite: 212, Economics 201.

420 International Agricultural Trade and Marketing (3) Real and monetary aspects of international trade and effect on agricultural commodity flows; partial equilibrium analysis of international trade in agricultural products; institutional aspects of international marketing of agricultural products. Prerequisite: 320 or consent of instructor.

430 Agricultural Policy (3) Values, goals and policy process. Economic rationale and effects of policy. Historical development and current characteristics of commodity, credit, food, and trade policy. Prerequisite: 320 or consent of instructor.

442 Agribusiness Management (3) Applications of advanced decision analysis concepts and tools to analyze management decision problems in farm and non-farm agribusiness settings. Case study work on strategic planning; assessing cost structure using budgeting and break-even analysis; evaluating profitability, liquidity, and solvency using financial statements; analyzing investments using capital budgeting. Prerequisite: 342 or consent of instructor.
450 Agricultural Industry Analysis and Forecasting (3)
Analytical tools for decision making in agricultural sector; analysis of commodity supply and demand conditions; economic modeling; market forecasting, analysis of temporal and spatial patterns. Prereq: 320, Statistics 201, or consent of instructor.

470 Natural Resource Economics (3)
Nature of natural resources; economic efficiency as basis for natural resource use; externalities in natural resource use; factors influencing environmental quality; alternative public policy tools for influencing natural resource use or improving environmental quality. Prereq: Economics 201.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15)
Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Managerial Economics for Agribusiness (3)
Practical application of economic concepts to agribusiness management and marketing decisions. Topics include supply and demand analysis, demand estimation, production economics, cost analysis, pricing decisions, break-even analysis, capital budgeting, time value of money, and risk and uncertainty. Students will use Microsoft Excel to analyze managerial economic questions.

505 Microeconomic Analysis (3)
Theory of utility maximization and demand, production, cost, firm behavior, and supply; price in product and factor markets; efficiency and welfare. Prereq: Calculus, Intermediate Microeconomics, or equivalent.

520 Research Methods in Agricultural Economics (1)
An overview of the logic and process of economic inquiry. Topics covered include the relationship between theory and applied research, problem formulation, definition of research problems, development of research problem statements with goals and objectives, and presentation and interpretation of results. Prereq: Graduate standing or consent of instructor.

524 Econometric Methods in Agricultural Economics (3)
Application of statistical methods to agricultural economic models; estimation of supply, demand and production functions; microeconomic forecasting models; interpretation of results. Prereq: Regression and Correlation Methods or consent of instructor.

525 Agribusiness Operations Research Methods (3)
Applications of operations research methods and concepts for agribusiness. Theoretical background and applied considerations of each technique with emphasis on applications. Computer and other applications of each technique for relevant agribusiness problems. Prereq: Basic Calculus, 524.

530 Agricultural Policy Analysis (3)
Evaluation of public policy as related to agricultural industry and rural areas. Prereq: 505 and Economics 513 or consent of instructor.

542 Advanced Agribusiness Production Decisions (3)
Decision theory concepts and tools for analyzing agribusiness decision problems; modeling choices using decision trees and sensitivity analysis; incorporating uncertainty into decision models using probability theory and simulation; modeling preferences using utility theory and risk attitudes. Prereq 505 or equivalent.

550 Advanced Agribusiness Marketing (3)
Use of economic concepts in agribusiness marketing decisions. Analysis of agricultural markets; buyer behavior in food and fiber markets; competitive environment. Profitability analysis of marketing and distribution decisions; market planning and strategy; product evaluation and new product introduction; pricing decisions. Prereq: 505 or equivalent.

570 Advanced Natural Resource Economics (3)
Analysis of natural resource allocation issues; applied welfare economics, external effects and evaluation of public policy. Prereq: 470, Economics 511, or consent of instructor.

593 Special Topics in Agricultural Economics (1-3)
Topics to be assigned. Prereq: Consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

595 Professional Internship (6)
Supervised internship experience with appropriate agribusiness firm.

670 Advanced Topics in Natural Resource Economics (3)
Applications of microeconomic theory to the use, allocation and control of scarce, exhaustible, and renewable natural resources, including soil, water, minerals, forests, and fish, in both static and dynamic contexts. Optimal control theory, dynamic programming, supply of, and demand for, natural resources, social versus private decisions, market and non-market considerations, regulation, uncertainty, property rights, equity considerations, and landscape pattern and change. Prereq: 505 or equivalent, or consent of instructor.

Agriculture and Natural Resources (088)

491 International Experience in Agriculture and Natural Resources (1-15)
Credit for formalized international experiences related to agricultural sciences and natural resources. Determination of credit based on nature of the proposed experience. Student should discuss the opportunity with their faculty advisor prior to the trip to determine if it is appropriate for credit. Credit hours will be determined by the department and college depending on the extent of activity and types of projects and/or presentations to be completed by the student upon return. Satisfactory/No Credit or letter grade.

507 Professional Development Seminar (1)
Planning and executing graduate research programs; ethics and professionalism; graduate program procedures and resources. Satisfactory/No Credit grading only. (Same as Animal Science 507; Entomology and Plant Pathology 507; Food Science and Technology 507; Plant Sciences 507.)

512 Teaching Internship in Agriculture and Natural Resources (1)
Supervised experience in teaching: test preparation and evaluation of agriculture students. May be repeated. Maximum 2 hours for MS students; 4 hours for PhD students.

American Studies (099)

423 Geography of American Popular Culture (3)
(See Geography 423.)

510 Special Topics (3)
May be repeated. Maximum 6 hours.

Animal Science (113)

420 Advanced Reproduction (3)
Collection, evaluation, and preservation of ova, spermatozoa and embryos; application of methods of natural breeding and techniques of artificial insemination and embryo transfer; herd sire and dam evaluation; pregnancy determination; gestation and parturition; infertility; recent advances in theriogenology. 1 hour and 2 labs. Prereq: 320 or equivalent.

430 Nutrient Evaluation and Ration Formulation (3)
Ration nutrient analysis and formulation for beef and dairy cattle, sheep, horses, swine, poultry, laboratory, zoo, and companion animals. Mathematical and computer solutions and applications to formulating complex rations with constraints. 2 hours and 1 lab. Prereq: 330 or equivalent and introductory computer science course.

481 Beef Cattle Production and Management (3)
Integration of principles of nutrition, breeding, physiology, and marketing into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production response and economic returns. Comparisons made to small ruminant, forage-based production systems. 2 hours and 1 lab. Prereq: Completion of Animal Science sophomore and junior core courses or consent of instructor.
482 Dairy Cattle Production and Management (3) Integration of principles of nutrition, breeding, physiology, and marketing into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. 2 hours and 1 lab. Prereq: Completion of 300-level core courses or equivalent or consent of instructor.

483 Pork Production and Management (3) Integration of principles of nutrition, breeding, physiology, and marketing into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. 2 hours and 1 lab. Prereq: Completion of 300-level core courses or equivalent or consent of instructor.

484 Poultry Production and Management (3) Integration of principles of nutrition, breeding, physiology, and marketing into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. 2 hours and 1 lab. Prereq: Completion of 300-level core courses or equivalent or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

507 Professional Development Seminar (1) (See Agriculture and Natural Resources 507.)

511 Special Problems in Animal Science (1-4) Prereq: Consent of instructor and department head. May be repeated. Maximum 9 hours.


530 Animal Nutrition and Metabolism (4) Comparative digestive physiology, digestion, absorption and metabolism of nutrients in ruminant and nonruminant species. Concepts and methodologies of animal growth and nutrient requirements; interrelationships, availability and deficiencies of nutrients. Prereq: Animal Nutrition, Feeds, and Ration Formulation or consent of instructor.

535 Ruminology (2) Anatomy, physiology, and microbiology of rumen ecosystem: microbial fermentation and metabolism of polysaccharides, lipids and nitrogen. Prereq: 530 or consent of instructor.

571 Design and Analysis of Biological Research (3) Experimental design and procedures; selection of experimental units; analysis and interpretation of data; statistical models and contrasts, analyses of variance: covariates, treatment arrangements, mean separation and regression. Prereq: Plant Sciences 471 or equivalent; knowledge of software package on micro- or mainframe computer. (Same as Plant Sciences 571.)

572 Least Squares Analysis (3) Least squares estimation and hypothesis testing procedures for linear models; mixed model methodology; full rank and non-full rank situations; covariance structures; estimation of variance components. 2 hours and 1 lab. Prereq: 571 or equivalent.

596 Seminar on Advanced Topics in Animal Science (1) Required of all first- and second-year MS students. May be repeated. Maximum 2 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

621 Advanced Topics in Animal Physiology (1-4) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hours.

631 Advanced Topics in Animal Nutrition (1-4) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hours.

651 Advanced Topics in Animal Anatomy (1-4) Current and future research methodology, laboratory situation, recent advances in quantitative techniques for gross and microscopic anatomy. Prereq: Consent of instructor. May be repeated. Maximum 6 hours. (Same as Comparative and Experimental Medicine–Veterinary Medicine 651.)

652 Disorders of the Endocrine System (2) Pathological and physiological aspects of diseases; endocrine glands of various animal species. Prereq: 520 or consent of instructor. (Same as Comparative and Experimental Medicine–Veterinary Medicine 652.)

681 Advanced Topics in Animal Health and Well-Being (1-4) Recent advances and concepts, research techniques, and current problems associated with animal health and behavior. May be repeated. Maximum 6 hours.

696 Seminar (1) Advanced topics in animal science. Required of all first- and second-year PhD students. May be repeated. Maximum 2 hours.

ANTHROPOLOGY (122)

410 Principles of Cultural Anthropology (3) Exploration and illustration of major concepts, theories, and methods in cultural anthropology, with application to analysis of specific ethnographies. Prereq: 130.

411 Linguistic Anthropology (3) Basic linguistic concepts applied to research in cultural anthropology; investigation of relationships between language and culture. Prereq: 130 or Linguistics 200. (Same as Linguistics 411.)

412 Folklore in Anthropology (3) Introduction to anthropological study of folklore, using folklore and folk life materials from various tribal, peasant, and complex societies. Prereq: 130 or consent of instructor.

413 Dynamics of Culture (3) Major forms of culture change, ranging from evolution and diffusion to religious revitalization and political revolt. Continuity and change in diverse cultural settings through use of archaeological, ethnohistoric, and contemporary cases. Prereq: 130 or consent of instructor.

414 Political Anthropology (3) Organization and dynamics of power and politics in both stateless and state-level societies. Role of symbols, rituals, and ideologies in producing and reproducing power relations. Relationship between actors (individuals) and structures. Encapsulation of traditional political forms and systems within modern states. Prereq: 130 or consent of instructor.

416 Applied Anthropology (3) Introduction to principles, practice and ethics of anthropology applied to practical problems in non-academic settings. Overview of career opportunities in various domains of applied anthropology. Prereq: 130 or consent of instructor.

431 Ethnographic Research (3) Conceptual and practical exploration of methods and techniques cultural anthropologists use in fieldwork. Prereq: 130 or consent of instructor.
435 Historical Archaeology Laboratory (3) Laboratory procedures for processing, identification, and interpretation of artifacts from historical sites. Artifactual material from historic East Tennessee sites used for class projects. Recommended prereq: 361.

436 Cities and Sanctuaries of the Greek and Roman World (3) (See Classics 436.)

442 Intensive Survey of the Archaeology of the Prehistoric Aegean (3) (See Classics 442.)

443 Intensive Survey of the Archaeology of Greece (3) (See Classics 443.)

444 Intensive Survey of the Archaeology of Etruria and Rome (3) (See Classics 444.)

462 Early European Prehistory (3) Origins and evolution of human culture in Europe through beginnings of settled life. Paleolithic and Mesolithic chronology and lifeways. Prereq: 120 or consent of instructor.

463 Rise of Complex Civilizations (3) Development of complex societies in Old World from origins of agricultural economies to rise of States. Mesolithic, Neolithic, and Metal Age Lifeways in Africa, Europe, and Asia. Prereq: 120 or consent of instructor.

464 Principles of Zooarchaeology (3) Basic osteological studies of major vertebrate groups; aboriginal use of animals in subsistence and culture. Identification and interpretation of archaeologically derived molluscan and vertebrate remains; introduction to laboratory use of comparative collections. Prereq: 120 or consent of instructor.

465 Urban Archaeology (3) Field archaeology and interpretation of archaeological remains on historic urban sites in U.S. Lectures and field and laboratory research on urban sites in East Tennessee. Recommended prereq: 361.

480 Human Osteology (4) Intensive examination of human skeleton. Prereq: 110 or consent of instructor. 3 hours and 1 lab.

481 Museum Studies I: Museums, Purpose and Function (3) (See Art 481.)

482 Museum Studies II: Exhibition, Planning and Installation (3) (See Art 482.)

484 Museum Studies III: Field Projects (1-12) (See Art 484.)


494 Primate Behavior (3) Social organization and behavior of selected primates: group composition, size, and structure; patterns of mating; other social interactions; communication; and cultural behavior. Application of primate studies to human ethology. Prereq: 110 or consent of instructor.

500 Thesis (1-15) P/NP only.

501 Graduate Research (1-9) Independent investigation of special problems in anthropology. May be repeated. Maximum 18 hours.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Method and Theory in Cultural Anthropology (3) Development of primary theoretical orientations by cultural anthropologists; formulation of research problems and methods of collecting, organizing, and utilizing data. Prereq: Consent of instructor.

511 Special Topics in Cultural Anthropology (3) Seminars for advanced students on topics of special interest: ethnomedicine, psychological anthropology, comparative social organization, religion, and art. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

512 Urban Studies in Anthropology (3) Process of urbanization examined cross-culturally; theory and method in researching urban communities; urban problems and applied anthropology.

515 Medical Anthropology (3) Cultural impact on disease patterning, theories of disease causation, and models of therapy. Theoretical and applied aspects of the anthropological study of health and disease. Prereq: Consent of instructor.

517 Forms of Social Inequality (3) Anthropological perspectives on societies stratified along lines of rank, caste, race, ethnicity, and class; inequalities engendered by sex role structure. Construction of social distinctions before and after rise and consolidation of modern world system. Intersections of race and ethnicity with class and gender.

520 Seminar in Zooarchaeology (3) Approaches to analysis and interpretation of archaeological fauna. Intensive reading; evaluation and discussion of major faunal studies, guides to identification, methods of presenting faunal data. May be repeated. Maximum 6 hours.

521 Laboratory Studies in Zooarchaeology (4) Examination and comparison of skeletons of major vertebrate groups, shells of terrestrial and aquatic mollusks, in relation to animal remains from archaeological contexts. Basic osteology and shell characters of species encountered in aboriginal sites; use of comparative collections. May be repeated. Maximum 8 hours.

522 Seminar in Archaeology (3) Theoretical and practical issues in contemporary archaeology: ethnoarchaeology, paleoethnobotany, taphonomy, ceramic analysis, agricultural origins, and regional archaeological cultures. May be repeated. Maximum 9 hours.

530 Fieldwork in Archaeology (3-9) Practicum in surveying, excavating, processing, and analysis of archaeological data. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

550 Contemporary Issues in Anthropology (1-3) Review of recent directions in method and theory in anthropology. May be repeated. Maximum 6 hours.

560 Theory in Archaeology (3) Detailed consideration of theory in contemporary archaeology: models of scientific explanation, research design, archaeological formation processes, and methods of analysis and interpretation.

561 Archaeological Resource Management (3) Federal legislation and regulations affecting identification, protection, and management of archaeological resources. Professional ethics and responsibilities and relationship of federal and state agencies, public interest groups, and professional archaeologists in conduct of federally sponsored archaeology. May be repeated. Maximum 6 hours.

562 Special Topics in Mediterranean Archaeology (3) (See Classics 562.)

563 Lithic Artifact Analysis (3) Methods for analyzing prehistoric stone tools in practical laboratory/lecture format. Stone tool production, use, stylistic variability, and discard processes.

564 Archaeology of Southeastern United States (3) Archaeological research on prehistoric American Indian cultures in Southeastern United States; Tennessee prehistory.

565 Graduate Seminar in Ancient Mediterranean Civilization (3) (See Classics 565.)

580 Advanced Human Variation (3) Genetic and morphological variation among extant human groups; relationships of variation to geography, ecology and subsistence.

582 Paleoanthropology (4) Fossil record from origin of hominids to appearance of anatomically modern humans. Functional morphology and phylogenetic relationships of fossil humans. Prereq: 480.

583 Skeletal Biology (3) Practical and theoretical approaches to analysis of prehistoric human skeletal remains. Demography, vital statistics, pathology, nutrition, and measures of biological relationships as related to population as adaptive unit. Prereq: 480.

585 Laboratory Studies in Biological Anthropology (3) Topical coverage of laboratory methods in biological anthropology. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

590 Method and Theory in Biological Anthropology (3) Current methods of analysis in biological anthropology and of past and current history of theoretical perspectives. Paleoanthropology, human osteology, and human variation and population structure. Prereq: Consent of instructor.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Advanced Graduate Research (1-6) Independent investigation of special problems in anthropology by advanced graduate students. May be repeated. Maximum 12 hours. Only 3 hours may count toward 600-level requirement.

611 Advanced Seminar in Cultural Anthropology (3) Critical evaluation of current issues in theory and data interpretation. May be repeated. Maximum 6 hours.

660 Advanced Seminar in Archaeology (3) Selected topics in prehistoric and historic archaeology. May be repeated. Maximum 6 hours.

690 Selected Topics in Physical Anthropology (3) For doctoral students in biological anthropology. May be repeated. Maximum 6 hours.

691 Selected Topics in Paleoanthropology (3) May be repeated. Maximum 6 hours.

695 Gross Human Anatomy (9) Skeleton, muscles, and cardiovascular system. Dissection of cadavers. 5 hours and 5 labs. Prereq: 480 or Human Biology.

ARCHITECTURE (133)

403 Introduction to Preservation (3) History, theory, and legal aspects of architectural preservation and restoration.

404 Preservation Technology (3) Techniques of preservation: methods of analysis, history of materials and technology used in old buildings. Prereq: 403.

406 Ideas in Architecture (3) Historical and critical review of major ideas of architecture through the ages. Open to all students.

410 History and Theory of Urban Form (3) Patterns of community development. Selected historical and contemporary examples. Basic urban design issues and exemplary design approaches through lectures, readings, essays, and sketch studies. Historical change in urban form and design.

412 Non-Western and Indigenous Architecture (3) Building responsive to climate, material availability, and economic level, as designed by anonymous builders. Prehistoric times to present throughout world. Fertile Crescent; Indus Valley; Hindu, Buddhist, and Mughal architecture of India, China, and Japan.

415 Medieval Architecture (3) History of architecture from decline of Rome to beginning of Renaissance.

417 The International Style (3) Survey of architecture of early modern movement, primarily in Europe and America, 1900-1940.

420 History of American Architecture (3) Consideration of architecture and city planning in the United States from the pre-Columbian period until the mid-twentieth century.

425 Special Topics in Architecture (1-6) Faculty initiated courses. Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

432 Computer Applications in Design II (3) Advanced computer aided design using three-dimensional modeling software. Design analysis using computer animation, rendering techniques, visualization, and video. Prereq: 231 or consent of instructor.

433 Computer Applications in Design III (3) Integration of three-dimensional modeling and technical analysis using computer to augment building design. Independent studies under faculty direction. Prereq: Consent of instructor.

445 Advanced Lighting (3) In-depth analysis and innovative concepts in design of lighting. Prereq: 342.

463 Architectural Development (3) Principles and practice of architect as developer. Impact of economics, finance and urban policy on design and development of real estate. Open to all students.

473 Architectural Photography (3) Photography as design, research, and presentation medium. Application of photographic techniques, printing and processing. Color and black and white.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Modern Architecture: Histories and Theories (3) History and theory of modern architecture: late 19th and 20th centuries through broad-based examinations of question of modernity and specific case studies of buildings, projects, landscapes and theories.

504 Issues in Preservation (3) Architectural issues: preservation, restoration and conservation of historic structures. Prereq: Consent of instructor.

507 Architecture, Culture and Modernity (3) Scope of ideas generated in architecture’s recent history to reveal and explain production and reception of architecture: historical background necessary to understand those concepts. Complements history sequence but in specialized field of theory.

509 Seminar in Architectural Technology (3) Technological aspects influencing building form. Role of technical aspects of structural, environmental and building infrastructure as integrated systems supporting access use and expression of building.

514 Seminar in Ethical Imperatives (3) Social, cultural, philosophical and moral issues which impact professional responsibilities. Attitudes, values, and ideas that address formation of profession’s ethos.

515 Seminar in Issues in Urban Design (3) Investigations of urban forms, patterns, and attitudes that have shaped towns and cities. Prereq: Consent of instructor.
516 Materials and Methods of Construction (3) Properties of interior and exterior building materials and their relation to construction methods and detailing. Theory of materials selection and application and role materials and methods play in design process.

521 Principles of Architectural Form (3) Historical and contemporary architectural theory through investigation of literature and related examples. Theories of understanding and theories of application related to generation of architectural form and space in response to both cultural and environmental focus.

525 Special Topics in Architecture (1-3) Student- or instructor-initiated course. May be repeated. Maximum 9 hours. Satisfactory/No Credit or letter grade.

526 Directed Readings in Architecture (3) Readings on topics of interest: primary texts, history, theory, urban issues, technology and professional practice. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

528 Topics in Architectural History and Theory (3) Historic topics, ideas, and theories in architecture. Prereq: Consent of instructor.

532 Computer Applications for Architecture (3) Advanced use of computers in architecture. Prereq: Consent of instructor.

545 Principles of Environmental Control I (3) Introduction to heating, ventilating, air conditioning, solar energy, plumbing, and fire-protection systems. Prereq: 180 and Master of Architecture admission.

551 Research Methods (3) Quantitative and qualitative methods of research in architectural inquiry. Systematic study and application of applied and speculative investigations in field of architectural research. Review and identification of techniques and methodologies and applications for architectural research and scholarship.

553 Advanced Topics in Architectural Technology (3) In-depth investigations and analysis: architectural technology lighting, structure, enclosure, mechanical and other architectural technologies. Prereq: Consent of instructor.

562 Professional Practice (3) Management and organizational theories and practices for delivering professional design services: assessment of building industry and its influence on practice; analysis of basic management functions within professional firms; legal and ethical concerns facing practitioners today; and introduction to special obligations and privileges of design professional.


ART (140)

481 Museum Studies I: Museums, Purpose and Function (3) Development of museums of art, history, and applied science. (Same as Anthropology 481.)

482 Museum Studies II: Exhibition, Planning and Installation (3) Exhibition concept development and implementation. Exhibition design and installation techniques. Publicity, production, matting and framing, shipping and storage. Prereq: 481 or consent of instructor. (Same as Anthropology 482.)

484 Museum Studies III: Field Projects (1-12) Special field projects: restoration, preservation, registration, and other related research on or off campus. Prereq: 481 and 482, and consent of instructor. May be repeated. Maximum 12 hours. (Same as Anthropology 484.)

499 Special Topics (3) Student- or instructor-initiated course offered at convenience of department. May be repeated. Maximum 12 hours.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

507 Professional Practices: Teaching Internship (1) Individual study in development of skills and methodology in teaching studio courses. For students who are not GTAs. Prereq: Consent of instructor. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-9)

ART CERAMICS (135)


429 Ceramics: Special Topics (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

521 Graduate Ceramics I (2-5) May be repeated. Maximum 10 hours.

525 Graduate Ceramics II (2-5) May be repeated. Maximum 10 hours.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hours.
599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hours. Satisfactory/No Credit grading only.

ART DESIGN/GRAPHIC (136)

405 Computer Enhanced Graphic Design (3) Exploration of new technologies and their significance to graphic design. Prereq: 351, 356 with a grade of C or better and consent of instructor. May be repeated. Maximum 12 hours.

451 Advanced Graphic Design (3) Theory and techniques of visual problem-solving as applied to advanced applications of graphic design. Prereq: 352 with a grade of C or better.

452 Graphic Design Seminar (3) Discussion of design and professional issues: politics, economics, and ethics for graphic designer. Culminates in student-initiated project. Prereq: 451 with a grade of C or better.

453 Advertising Illustration (3) Media and techniques as applied to advertising illustration. Prereq: 254 and successful completion of any portfolio review.

454 Editorial Illustration (3) Media and techniques as applied to editorial illustration for books, magazines, and newspapers. Prereq: 254 and successful completion of any portfolio review.

456 Graphic Design Practicum (1-12) Practical work experience in graphic design field. Only by prearrangement with department. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

459 Special Topics in Graphic Design (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

550 Studies in Graphic Design/Illustration History (3) Design and illustration ca. 1850 to present. Prereq: MFA candidate or consent of department. May be repeated. Maximum 6 hours.

551 Graphic Design I (2-6) May be repeated. Maximum 10 hours.

552 Graphic Design II (2-6) May be repeated. Maximum 10 hours.

553 Computer Enhanced Design (2-6) Prereq: Consent of instructor. May be repeated. Maximum 10 hours.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hours.

ART DRAWING (137)

419 Special Topics in Drawing and Painting (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

511 Graduate Drawing I (2-6) May be repeated. Maximum 10 hours.

512 Graduate Drawing II (2-6) May be repeated. Maximum 10 hours.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hours.
454 Renaissance and Baroque Theory (3) Theory of Western art in early modern period: development and evolution in European art during Renaissance and Baroque periods. Prereq: 172, 173, or consent of instructor.

461 Art of Southern and Eastern Africa (3) Art traditions of eastern and southern regions of Africa. Sculpture, painting, pottery, textiles, architecture and human adornment. Some ancient Stone and Iron Age traditions. Diverse ethnic and regional art traditions practiced in the area from 19th century to present. (Same as African and African-American Studies 461.)

462 Art and Archeology of Ancient Africa (3) Historical art traditions of sub-Sahara Africa. Prehistoric rock paintings; art from archaeological sites and ancient kingdoms. First and second millennia B.C. for early terracotta sculpture and rock paintings, 11th through 19th centuries A.D. for later ancient kingdoms. (Same as African and African-American Studies 462.)

463 Arts of the African Diaspora (3) Aesthetic, philosophical and religious patterns of African descendants. Brazil, Surinam, Caribbean and United States. Full range of art forms: sculptural and performance traditions, architecture, textile, basketry and pottery art forms. (Same as African and African-American Studies 463.)

464 Oceanic Art (3) Concentrated study of selected sculpture, textiles, architecture and other traditional art forms of Polynesia, Micronesia, and Melanesia. Objects are discussed on the basis of style, style relationship, iconography and the uses to which they were put in their traditional religious, political and social contexts. Writing-emphasis course.

471 History of North American Art (3) Landmarks in painting, architecture, sculpture, and design from prehistory to 1900.

472 History of 20th-Century American Art (3) Developments in architecture, painting, and design from 1900.

473 19th-Century American Painting (3) From West and Copley to emergence of “The Eight.”

474 Theory of 20th-Century Art in Europe and America (3) Theoretical basis for modern movement. Analysis and discussion of individual works of art in light of contemporary writings by artists and theorists. Prereq: 172, 173, or consent of instructor.


476 History of 20th-Century Painting and Sculpture in Europe (3) Development of Modern and Post-Modern movements in Europe. Investigation of progression of abstraction through more recent conceptual trends. Analysis of work of individual artists such as Picasso, Matisse, and others.

479 Special Topics in Art History (3) Student- or instructor-initiated course offered at convenience of department. May be repeated. Maximum 12 hours.

483 History of American Sculpture (3) American sculpture from prehistory to 1960s.


489 Studies in Art History (3) Concentration in individually selected area. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

571 Studies in Medieval Art (3) Art and architecture of Middle Ages: major monuments from Byzantium or western Europe. Prereq: MFA candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

572 Studies in Italian Renaissance Art (3) Art and architecture of 14th, 15th, and/or 16th centuries in Italy. Early or High Renaissance or Mannerist periods. Prereq: MFA candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

573 Studies in Baroque Art (3) 17th-century art and architecture: major artists and works from southern or northern Europe. Prereq: MFA candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

574 Studies in Modern Western Art (3) Selected topics in 19th- and 20th-century western art. Prereq: MFA candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

575 Studies in Modern American Art (3) Selected topics in 19th- and 20th-century American art. Prereq: MFA candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

576 Studies in Asian Art (3) Selected topics in Japanese or Chinese Art. Prereq: MFA candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

577 Studies in Media as Art (3) Selected topics in theory and history of media as art form. May be repeated. Maximum 9 hours.

ART MEDIA ARTS (134)


433 History of Film and Modern Art (3) Study of development and interaction between cinematic arts and visual arts within context of modern art history. Available for Art History credit. (Same as Cinema Studies 433.)

435 Cinematography as Art (3) Continued development of concepts and techniques for creation of film as art form: individual projects. Prereq: 235, 330, or consent of instructor. May be repeated. Maximum 9 hours.

436 Video Art (3) Continued development of concepts and techniques for creation of video works as art form: individual projects. Prereq: 236, 330, or consent of instructor. May be repeated. Maximum 9 hours.

439 Special Topics in Media Arts (3) Student- or instructor-initiated course offered at convenience of department. May be repeated. Maximum 12 hours.


442 Large Format Photography II (4) Studio course that continues exploration of use of large format camera in photography. Prereq: 330, 342, and consent of instructor.

531 Photography I (2-6) May be repeated. Maximum 10 hours.

532 Photography II (2-6) May be repeated. Maximum 10 hours.

535 Media Arts I (2-6) May be repeated. Maximum 10 hours.

536 Media Arts II (2-6) May be repeated. Maximum 10 hours.

577 Studies in Media as Art (3) Selected topics in theory and history of media as art form. May be repeated. Maximum 9 hours.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.
595 Visiting Artist Seminar (3) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 12 hours.

599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hours. Satisfactory/No Credit grading only.

ART PAINTING (138)

413 Painting IV (6) Advanced painting, individual concepts and personal expression with varied media. Prereq: 313. May be repeated. Maximum 12 hours.


419 Special Topics in Drawing and Painting (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

513 Graduate Painting I (2-6) May be repeated. Maximum 10 hours.

514 Graduate Painting II (2-6) May be repeated. Maximum 10 hours.

515 Graduate Watercolor I (2-6) May be repeated. Maximum 10 hours.

516 Graduate Watercolor II (2-6) May be repeated. Maximum 10 hours.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor. Maximum 15 hours.

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hours.

599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hours. Satisfactory/No Credit grading only.

ART PRINTMAKING (132)

461 Advanced Print Workshop (1-6) Individual and collaborative studio work encompassing theory and practice in intaglio, lithography, relief printing, screenprinting, monoprint, papermaking, book arts, and/or photo-print processes. Prereq: 361 or consent of instructor. May be repeated. Maximum 12 hours.

469 Special Topics in Printmaking (3-6) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hours.

561 Printmaking I (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods, and monoprint. May be repeated. Maximum 10 hours.

562 Printmaking II (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods, and monoprint. Prereq: 561.

563 Printmaking III (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods, and monoprint. Prereq: 561, 562.

564 Printmaking IV (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods, and monoprint. Prereq: 561, 562, 563.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.

ASIAN LANGUAGES (144)

431 Readings in Chinese Literature (3) Prereq: Mastery of intermediate-level Chinese or consent of instructor. May be repeated. Maximum 9 hours. (Same as Chinese 431.)

451 Readings in Pre-Modern Japanese Literature (3) Prereq: Mastery of intermediate-level Japanese or consent of instructor. (Same as Japanese 451.)

452 Readings in Modern Japanese Literature (3) Prereq: Mastery of intermediate-level Japanese or consent of instructor. (Same as Japanese 452.)

ASIAN STUDIES (145)

471 Selected Topics in Asian Studies (3) Content varies. May be repeated. Maximum 9 hours.

510 Special Topics (3) May be repeated. Maximum 6 hours.

ASTRONOMY (150)

411 Astrophysics (3) Development of analytical physical models of galactic structure of universe, stellar and interstellar matter, and planetary systems. Topical and interdisciplinary, consideration of quasars, pulsars, black holes and current developments in field. Acceptable for major credit in physics. Prereq: Physics 136 or 138 or 222 or 232, and consent of instructor.

490 Special Topics in Astronomy (1-3) Topics of current interest in astronomy and astrophysics. Acceptable for graduate credit in physics with consent of department. May be repeated with consent of department. Maximum 9 hours.
Audiology and Speech Pathology (160)

431 Stuttering (3) Nature, appraisal and treatment. Prereq: 300 or consent of instructor.

433 Observation of Clinical Practice (1) Prereq: 320 or consent of instructor.

434 Clinical Practice in Speech-Language Pathology II (1-4) Prereq: 433 and consent of instructor. Enrollment for fewer than 2 hours must have prior departmental approval.

435 Introduction to Speech Sound Disorders (3) Etiology, diagnosis, and treatment of articular and phonological disorders. Prereq: 300, 305, or consent of instructor.


455 Problems in Speech Pathology (1-3) Prereq: Consent of instructor.

461 Introduction to Language Pathology in Children (3) Etiology, diagnosis, and treatment of language impairments in children. Prereq: 320 or consent of instructor.

473 Introduction to Audiologic Assessment (3) Basic principles of clinical audiometry; pure tone, speech, masking and overview of special auditory tests. Prereq: 300 and consent of instructor.

475 Appraisal of Speech and Language Disorders (3) Diagnostic procedures for children and adults with speech and language problems including observation and practice with diagnostic tests. Prereq: 300 and consent of instructor.

494 Introduction to Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification components/characteristics, assistive devices, speech acoustics, speech perception, speech reading, parent-infant, preschool school years of children, communication impairments/handicaps/remediation of adults, effects of aging/remediation on the elderly, and case studies. Prereq: 305, 473, or equivalents or consent of instructor.

497 Seminar on Stuttering (3) Current significant research in stuttering. Prereq: 431 or consent of instructor.

498 Seminar on Voice Disorders (3) Multicultural, gender, and age-related issues. Prereq: 440 or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role in speech and language. Prereq: 306.

507 Anatomy and Physiology of Hearing (3) Structure and function of the peripheral and central auditory systems, and their roles in mediating auditory processes. Prereq: 473 or equivalent or consent of instructor.

511 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, fundamentals of statistics, application of statistics, and completion of a proposal and hypothetical pilot research project.

512 Clinical Practice in Audiology (1-4) Coreq: 546. May be repeated. Maximum 24 hours.

515 Practicum in Aural Rehabilitation (1-4) Prereq: 473 and 494 or equivalent. May be repeated. Maximum 9 hours.

516 Language Sample Analysis (3) Methods of characterizing and describing language behaviors. Prereq: 320 or equivalent.

518 Adult Neurogenic Communication Disorders I (3) This course will assist students in developing basic biological, social, clinical, and theoretical understandings of commonly observed neurological impairments. Prereq: 506 or equivalent or consent of instructor.

519 Adult Neurogenic Communication Disorders II (3) This course will assist students in developing an advanced understanding of the neural, behavioral, social, clinical, and theoretical understandings of acquired neurological cognitive-linguistic impairments. Prereq: 506 and 518 or consent of instructor.

522 Seminar in Speech Sound Disorders (3) Current research in diagnosis and management of speech sound disorders. Prereq: 435 or equivalent or consent of instructor.

523 Seminar in Voice Disorders (3) Current research in diagnosis and management of voice disorders. Multicultural, gender, and age-related issues. Prereq: 440 or consent of instructor.

526 Dysphagia (3) Clinical diagnosis, evaluation, and treatment of adult swallowing disorders and critical interpretation of research literature on dysphagia. Prereq: 506 or consent of instructor.

527 Language, Culture, and Communication Disorders (3) Multicultural issues across the lifespan; theoretical rationales for speech and language development and use; assessment and treatment practices. Prereq: Graduate standing.

531 Seminar on Stuttering (3) Current significant research in stuttering. Prereq: 431 or consent of instructor.

533-534 Advanced Clinical Practice in Speech-Language Pathology (1-4, 1-4) Prereq: 434 or equivalent and consent of instructor. 534 may be repeated. Maximum 6 hours. Enrollment for less than 2 hours must have prior departmental approval.

535 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-4) Prereq: 100 hours clinical experience, consent of instructor. May be repeated. Maximum 6 hours. Enrollment for less than 2 semester hours must have prior departmental approval.

538 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4) May be repeated. Maximum 6 hours. Enrollment for less than 2 hours must have prior departmental approval.

539 Motor Speech Disorders (3) Neuromotor organization for speech production; types of motor speech disorders and associated neuromuscular symptomatology; diagnosis and management of motor speech disorders. Prereq: 506.


541 Pediatric OroMotor Disorders (3) Evaluation, diagnosis, and treatment of pediatric oromotor disabilities that affect normal acquisition of feeding and prespeech skills. Prereq: 506 or consent of instructor.

542 Hearing Disorders (3) Effects of heredity, development/aging, diseases, and physical agents on hearing. Prereq: 473 or equivalent or consent of instructor.

543 Amplification Technology (3) Description of hearing aid circuits, components and performance characteristics. Electroacoustical and real-ear analysis of hearing aids. Coupler material and geometry effects. Practical experience in troubleshooting, repair, and construction of hearing aids. Prereq: 473, 507 or equivalents or consent of instructor.
544 Amplification for Adults with Hearing Impairment (3)

545 Sound Measurement Techniques and Hearing Conservation (3)
Techniques of measurement and analysis of sound: hearing conservation in schools and industry. Prereq: Consent of instructor.

546 Audiologic Assessment (3)
Theoretical bases for behavioral audiometry and acoustic immittance measurement.

547 Special Problems in Audiology (1-3)
Prereq: 473 or equivalent and consent of instructor. May be repeated. Maximum 9 hours.

552 Seminar in Speech Pathology (2-3)
Current significant research in speech pathology. Topics vary. Prereq: 9 hours in speech pathology. May be repeated with consent of department. Maximum 9 hours.

555 Special Problems in Speech-Language Pathology (1-3)
Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

556 Independent Study in Speech-Language Pathology (1-3)
Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

558 Phonological Disorders (3)
Current theories and approaches to assessment and intervention for individuals with difficulty acquiring or using speech sound system of English. Prereq: 435 or equivalent or consent of instructor.

561 Child Language Disorders (3)
Current literature on assessment and intervention techniques for young language learners. Prereq: 461 or equivalent or consent of instructor.

563 Language Disorders: Birth to Three (3)
Overview of family-focused, interdisciplinary intervention process. Assessment/treatment of infants, toddlers, and preschoolers. Description of disabilities and resulting communication disorder. Prereq: 461 or equivalent or consent of instructor.

574 Pediatric Audiology (3)

576 Physiologic Assessment of the Auditory System I (3)
Otoreception, cochlear anatomy, and auditory brainstem responses. Anatomical origins, principles, and applications. Use of these responses in evaluation of auditory function and determination of site-of-lesion. Prereq: 507, 546 or equivalents, or consent of instructor.

577 Vestibular Disorders (3)
Anatomy, physiology, and pathophysiology of vestibular system and other systems that contribute to balance. Practicum in electronystagmography. Prereq: 507, 542, 546, 576 or equivalents or consent of instructor.

581 Assessment of Central Auditory Processing (3)
Overview of current central auditory processing disorder (CAPD) literature and assessment procedures, with emphasis on a holistic view by combining perceptual, electrophysiological, linguistic, and cognitive measurements. Prereq: 546, 574, 594 or equivalents or consent of instructor.

582 Speech and Language Services in School (3)
Organization and implementation of speech and language programs in schools.

583 Physiologic Assessment of the Auditory System II (3)
Middle-latency, long-latency, and event-related potentials. Neurophysiological mechanisms, principles, and applications. Use of these potentials in evaluation of neurological and cognitive function. Prereq: 576 or equivalent or consent of instructor.

584 Amplification for Children with Hearing-Impairment (3)
Study of strategies for selecting and fitting amplification systems for children; outcome measures and service coordination. Prereq: 543, 544, 574 or equivalents or consent of instructor.

585 Cochlear Implants (3)
Overview of cochlear implants, focusing on theory of auditory stimulation and cochlear implant systems; candidacy, surgical preparation, and follow-up outcomes; the rehabilitation process; and cochlear implant case presentations. Prereq: 507, 576, 583 or equivalents or consent of instructor.

586 Standards and Practice Issues in Audiology (3)
Overview of professional practice standards, ethics, medical/legal issues, business practices, and reimbursement procedures in audiology. Prereq: 512 or equivalent or consent of instructor.

591 Foreign Study (1-15)
See College of Arts and Sciences.

592 Off-Campus Study (1-15)
See College of Arts and Sciences.

593 Independent Study (1-15)
See College of Arts and Sciences.

594 Aural Habilitation/Rehabilitation of the Hearing-Impaired (3)
Study of grieving process, counseling group and individual amplification systems, classroom/speech acoustics, central auditory problems, therapy methods for habilitation and rehabilitation, speech reading, school-based programs, programs for adults and the elderly; student research reports/case studies. Prereq: 473, 494 or equivalents or consent of instructor.

595 The Verbotonal System: Auditory/Speech Perception (3)
Innovative theory, therapy procedures, and SUVAG amplification/filtering for diagnosis/evaluation/remediation of spoken language/listening skills of hearing-impaired children/adults: use of rhythms, movements, and suprasegmentals; special audiometric tests, acoustic filters, correcting misarticulations through optimal listening; central auditory treatment; second (foreign) language through listening/spoken language; relationship of concepts to conventional concepts/practice; student research reports. Prereq: 305, 473, 494 or equivalents or consent of instructor.

600 Doctoral Research and Dissertation (3-15)
P/NP only.

601 Experimental Phonetics (3)
Acoustical and perceptual analyses of speech production and overall oral communication. Prereq: 517 or consent of instructor.

602 Psychoacoustics (3)
Auditory perception and reception of acoustic stimuli. Prereq: 507 or equivalent or consent of instructor.

604 Molecular Genetics and Pharmacology of Hearing (3)
Study of genetics, pharmacology, and general cellular processes as they relate to hearing. Prereq: 507 or equivalent or consent of instructor.

605 Speech Perception and Hearing Impairment (3)
Study of perception of speech stimuli, with particular emphasis on the effects of hearing impairment on perception.

607 Advanced Anatomy and Physiology of the Ear (3)

611 Experimental Design in Speech and Hearing (3)
Analysis of experimental design in theses and related journals. Generation of experimental designs. Prereq: Consent of instructor.

613 Externship in Audiology (1-9)
Off-campus clinical training experience. Prereq: Consent of academic advisor. May be repeated. Maximum 36 hours.

626 Advanced Seminar in Neurologically-based Communication Disorders (3)
Topics vary. Prereq: 520, 539, 524 or consent of instructor. May be repeated. Maximum 6 hours.

650 Advanced Seminar in Audiology (3-6)
Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.
652 Advanced Seminar in Speech and Language (2) Topics vary: aberrations of voice, articulation, speaking time and rhythm, language development or use, and language symbolization. Prereq: Consent of instructor. May be repeated. Maximum 8 hours.

655 Practicum in College Teaching (1-3) Supervised experience in college teaching. Prereq: Consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

656 Directed Research (1-4) Participation in ongoing or non-dissertational research. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

657 Directed Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

658 Directed Study in Audiology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

659 Directed Study in Speech Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

660 Directed Study in Hearing Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

661 Advanced Seminar: Language Disorders in Children (3) Topics vary. Prereq: 561 or consent of instructor. May be repeated. Maximum 6 hours.

662 Advanced Seminar in Audiologic Assessment (3) Synthesis of information on audiologic and vestibular assessment and application of clinical cases. Prereq: 542, 546, 574, 576, and 577, or equivalents or consent of instructor.

663 Advanced Seminar in Aural Habilitation/Rehabilitation (3) Synthesis of information on audiologic habilitation and rehabilitation cases. Prereq: 543, 544, 584, 594, or equivalents or consent of instructor.

664 Advanced Seminar in Amplification (3) Synthesis of information on amplification technology, amplification for adults with hearing impairment, and case studies. Prereq: 543, 544, 584, 594, or equivalents or consent of instructor.

AVIATION SYSTEMS (169)

500 Thesis (1-15) P/NP only.

501 Aviation Systems: An Overview (3) Aviation systems, present and future. Socioeconomic base, aerospace and propulsion technology, meteorology, air traffic control, airport community interface, and technological trends and developments pertinent to present status, and future development of air transportation.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Air Vehicles (3) Current capabilities and future requirements for civilian and military air vehicles. Parameters significant for air vehicle type selection. Integration of air vehicle into aviation systems. Prereq: 501.


505 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure, administrative and enforcement procedures. Prereq: 501.

506 Aircraft Design (3) Design process, compromise of conflicting requirements, economical, industrial, and legal aspects. Definition of mission requirements, synthesis and optimization techniques, safety and reliability, systems integration, standards and regulations, teamwork, and decision-making process.

507 Introduction to Airborne Radar (3) Theory and application of airborne radar. Radar detection and measurement techniques through aviation systems applications. Ground effects on radar signals of multipath and clutter. Pulsed operation, coding, filters, processing techniques, Doppler effects. Problems of range and range rate and tracking. Methods and techniques for reducing radar cross section.

508 Flight Test Instrumentation (3) Principles of measurement, measuring devices with views toward both ground and flight aerospace testing: measurement fundamentals, sensors for specific parameters (e.g. temperature, heat flux, flow rate, pressure, acceleration, vibration, strain, and humidity), data bus integration, signal condition, telemetry, and fabrication.

509 Introduction to Aircraft Structures (3) Design and analysis of structures: light-weight and modern materials used for aircraft structures. Topics: load determination and aviation regulations, airworthiness, ultimate loads, limit loads, load factors; simplifying assumptions to safe side; basics of stress and strain, elasticity, shear, bending, torsion; statically indeterminate systems, frames; structural instabilities, buckling of columns, thin plates; tension field beams; principles of stressed skin construction; open, closed, thin-walled beams; tapered beams, fuselages and frames, wings and ribs; laminated composite structures; elementary aeroelasticity.

510 Special Topics in Aviation Systems (3) Current problems. Prereq: Consent of instructor. May be repeated with consent.

511 Theory and Aviation Applications of GPS (3) Global Positioning System (GPS) for improved navigation and situational awareness for civil and military applications. GPS theory: geometric dilution of precision, satellite positioning, ionospheric delay, differential GPS, and GPS errors. Applications for navigation and aircraft flight-testing. Integration of GPS for aviation infrastructure and for air vehicle navigation, concepts of WAAS and LAAS.

512 Helicopter Performance Flight Test Techniques (3) Experimental test techniques for helicopter performance flight testing. Theoretical derivation of flight test techniques. Participation in series of flight test experiments demonstrating acquisition of flight test data. Instrumentation and data reduction techniques.

513 Helicopter Stability and Control Flight Test Techniques (3) Experimental test techniques for helicopter stability and control flight testing. Theoretical derivation of flight test techniques. Participation in series of flight test experiments demonstrating acquisition of flight test data. Instrumentation and data reduction techniques.

514 Systems Flight Testing (3) Experimental test techniques for helicopter and airplane flight systems. Approach and design for testing airborne systems. Theory and operation of typical flight systems: aircraft systems, navigation systems, communications systems, and specific mission systems.

515 Aviation Human Factors (3) Human factors pertinent to aviation: concept of human factors, human error, fatigue, body rhythms, performances, motivation, vision and visual illusions, communication, attitudes, training and devices, displays and controls, space and layout, anthropometry, flight deck design and evaluation, aircraft cabin design and evaluation, flying qualities evaluation, and performance measurement techniques. Applied aviation systems.

516 Aircraft Flight Controls (3) Feedback control concepts, root locus techniques, bode analysis, PID control design, and controller and observer design concepts applied to aircraft. Complex analysis and matrix algebra.


550 Project in Aviation Systems (3) Enrollment limited to aviation system students in non-thesis program. May be repeated. Maximum 3 hours allowed toward degree.

BIOCHEMISTRY AND CELLULAR AND MOLECULAR BIOLOGY (188)

401-402 Biochemistry-Molecular Biology I, II (4,4) 401—Amino acid structure and chemistry, protein structure and chemistry, protein folding, enzyme behavior and function, reaction mechanisms, catabolism and energy transfer, synthetic metabolism including photosynthesis, and protein transport. 402—Structure of DNA and RNA, experimental methods of analyzing nucleic acids, mechanisms of RNA and protein synthesis, mechanisms of DNA replication, repair and recombination, chromosome structure and function, regulation of gene expression, genome structure and genomics, and mechanisms of biological regulation. Prereq: Biology 240, Chemistry 350, 360, 369.


404 Plant Molecular Biology (4) Introduction to current research and methodologies in plant development biology and molecular genetics. Laboratory and lecture. Prereq: Biology 140 and 240 or equivalent.


421 Cell and Tissue Structure and Function (4) Study of animal cells and tissues at light and electron microscope levels. 2 hours and 2 labs. Prereq: Biology 140.

429 Cell Biology Laboratory (3) Series of open-ended, discovery-based exercises developed to design and test new drugs using modern cell biology and computer technologies. Experimental modules: techniques used in cell isolation, purification, culturing, fluorescent microscopy, receptor binding and signal transduction, apoptosis, cell cycle analysis, protein and steroid secretion, computer modeling, and state-of-the-art electron microscopy. Experiment design, execution, data analysis, and peer evaluation. Prereq/Coreq: 401 or 410.


465 Human Genetics (3) Genetic and molecular principles and problems of human inheritance. Prereq: Biology 240.

471-481 Biophysical Chemistry (3,3) Physicochemical principles with applications to biological systems. 471—Thermodynamics; chemical equilibrium; solution chemistry; transport; electrochemistry; kinetics; enzyme catalyzed reactions. 481—Elementary quantum chemistry; interactions of light with biological molecules; optical and magnetic spectroscopy; light scattering; case studies of selected macromolecules. Prereq: Chemistry 350, 360; Mathematics 125; General Biology or consent of instructor. (Same as Chemistry 471-481.)

480 Physiology of Exercise (3) (See Exercise Science 480.)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

511 Advanced Protein Chemistry and Cellular Biology (3) Cellular structure and function at molecular and supramolecular level in progression: protein structure and function; membrane structure and function; bioenergetics and membrane proteins. Prereq: Prior knowledge of cell biology and biochemistry and/or consent of instructor.

512 Advanced Molecular Biology (3) Regulation of nucleic acid expression and protein activity. Nucleic acid structure and function; replication and repair of nucleic acids; gene expression; protein synthesis; post-translational protein modification; mitosis and meiosis; cell cycle and cell growth. Prereq: 511 or consent of instructor.

513 Advanced Protein Biochemistry and Cell Biology II (3) Advanced topics of cellular function and regulation of cell division and growth, and structure and function of supramolecular structures: cytoskeleton and cell junctions and adhesions. Prereq: 511.

515 Experimental Techniques I (2-4) Introduction to modern experimental methodology and instrumentation in biochemistry, molecular biology and cell biology, including cell culture; spectrophotometry; microscopy; nucleic acid purification and analysis; protein assays; enzyme purification; electrophysiology; computer analysis of nucleic acid and protein sequences. Team-taught lecture/demonstration format. Primarily for departmental graduate students. May be repeated. Maximum 6 hours.

516 Experimental Techniques II (2-4) Laboratory rotations. Students work in laboratory of faculty member on clearly defined project. Written proposal and oral report. Primarily for departmental graduate students. Prereq: 515. May be repeated. Maximum 8 hours.

517 Physical Biochemistry (3) Physics and chemistry of biological systems and molecules. Thermodynamics; diffusion and transport; physical chemistry of macromolecules; enzyme kinetics; binding reactions; spectroscopy; electrophysiology. Prereq: 511 or consent of instructor.

520 Special Topics (1-3) Selected directed readings or special course in topics of current interest. Consult departmental listing for offerings. May be repeated with consent of instructor. Maximum 6 hours. Satisfactory/No Credit grading only.


525 Graduate Research Participation (3-12) Tutorial laboratory experience. May be repeated. Maximum 12 hours.
530 Experimental Design and Analysis (2) Development of skills in strategies of experimental design and interpretation of experimental results. Critical discussion of research articles illustrating issues in experimental design. Preparation of grant proposal in standard format to be read and discussed by class and by panel of faculty expert in area of proposal. Prereq: Consent of instructors.

550 Advanced Concepts in Neurobiology/Physiology (3) Concepts related to neurobiology/physiology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

552 Physiology of Hormones (3) Cellular and organisinal action of hormones in invertebrate and vertebrate animals. 2 hours and 1 lab. Prereq: Consent of instructor. Recommended prereq: 410.

560 Advanced Concepts in Structural Biology/Biochemistry (3) Concepts related to structural biology/biochemistry with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

561 Environmental Toxicology (3) (See Ecology and Evolutionary Biology 561.)

562 Introduction to Electron Microscopy - Transmission Electron Microscope (4) Practical application to techniques for preparation of biological samples for viewing in transmission electron microscopy. Use of microscope and ancillary equipment, darkroom techniques, preparation of materials for publication and special project. Two 3 hour labs. Admission limited only to departmentally approved graduate students.

564 Introduction to Electron Microscopy-Scanning Electron Microscope (3) Practical introduction to techniques of electron microscopy and to scanning electron microscope. Use of microscope, introduction to darkroom techniques and digital image processing, preparation of samples for observation, and special project. 2 hours and 1 lab. Prereq: Consent of instructor.

570 Advanced Concepts in Cellular/Molecular Biology (3) Concepts related to cellular/molecular biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

580 Advanced Concepts in Genetics/Developmental Biology (3) Concepts related to genetics/developmental biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

591 Foreign Study (1-15) See College of Arts and Sciences

592 Off-Campus Study (1-15) See College of Arts and Sciences

593 Independent Study (1-15) See College of Arts and Sciences

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Departmental Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. Satisfactory/No Credit grading only.

603 Graduate Research Colloquium (1) Seminars and lectures dealing with current advances in fields of biochemical and biophysical methods. mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell biology, neurobiology, and related topics. Required every semester in residence. Satisfactory/No Credit grading only.

605 Journal Club in Neurophysiology/Physiology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

606 Journal Club in Structural Biology/Biochemistry (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

607 Journal Club in Cellular/Molecular Biology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

608 Journal Club in Genetics/Developmental Biology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

610 Current Topics in Biochemistry, Cellular, and Molecular Biology (1-3) Critical reviews of research problems and methods in biochemistry, cell biology, and molecular biology. Oral presentations, written reports, computer simulations by faculty and students. Prereq: Consent of instructor. May be repeated. Maximum 4 hours.

612 Advanced Topics in Environmental Toxicology (1-3) (See Ecology and Evolutionary Biology 612.)

615 Special Topics in Biochemistry, Cellular, and Molecular Biology (3) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell ultrastructure and physiology, neurobiology, and related topics. Prereq: 511, 512 or consent of instructor. May be repeated. Maximum 9 hours.

BIOMEDICAL ENGINEERING (192)


430 Biomedical Engineering Laboratory (4) Experience with unique problems associated with making measurements and interpreting data in living systems; experiments: mechanical testing of biological materials, imaging and physiological measurements. Prereq: 310, 346 or consent of instructor.


494-495 Special Project in Biomedical Engineering (1-3,1-3) Problems related to recent developments and practice. May be repeated. Maximum 6 hours. Prereq: Junior or senior standing, consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

507 Application of Linear Algebra in Engineering Systems (3) (See Chemical Engineering 507.)

509 Multidisciplinary Project (1) (See Industrial Engineering 509.)
511 Biotransport Processes (3) Cellular transport and electrical properties from a combined biological, physical, and engineering point of view. Matter transport across cellular membranes involving diffusion, osmosis, coupled solute and solvent transport, carrier-mediated transport, and ion transport. Homeostatic mechanisms involved in maintaining cellular solute concentrations, volume, and potential. Electrically excitable and excitable cells, lumped parameter and distributed-parameter cell models, linear electric properties of cells, and voltage gated ion channels. Prereq: Electrical and Computer Engineering 301 or consent of instructor.

531 Advanced Biomechanics I (3) Derivation of mathematical models of the human body using Kane’s Method of Dynamics to create system equations of motions. Mathematical models will pertain to human non-implanted and implanted joints. Models will be created by hand and using the symbolic manipulation algorithm Autoolve. Prereq: Mechanical Engineering 231. (Same as Mechanical Engineering 531.)

541 Fluid Mechanics I (3) (See Mechanical Engineering 541.)

555 Human Vibrations Analysis and Protection (3) Concepts of whole body vibrations, background information on the development of ANSI and ISO Standards for the protections of workers from whole body vibrations; how to apply the standards to meet the EU requirements; measurement methods and signal processing requirements for whole body vibration; background information on the development of ANSI and ISO Standards for the protections of workers for vibration white finger syndrome; development criteria for current ANSI, ISO, and EU standards; measurements methods and requirements, effectiveness of anti-vibration gloves. Prereq: Mechanical Engineering 231, Mechanical Engineering 321, or equivalent.

611 Advanced Topics in BME (3) Current research topics of interest in biomedical engineering. Consent of instructor.

611 Fields, Forces and Flows in Cells and Tissues (3) Applications of equilibrium and non-equilibrium thermodynamics to rate processes and forces in cells and tissues. Fields in heterogeneous media, electrical double layers, and electromechanical forces in physiological systems. Fluid and solid continuum mechanics of porous hydrated biological tissues. Electrophoretic, electroosmotic flows, and diffusion-reaction. Electromechanical and physicochemical interactions in biomaterials and cells. Case studies in membrane transport, electrode interfaces, electrical, mechanical, and chemical transduction in tissues. Cardiovascular, orthopedic and other clinical examples. Prereq: 511 or consent of instructor.

631 Advanced Biomechanics II (3) Using the symbolic manipulation algorithm, difficult systems pertaining to the human body will be modeled. A more in depth analysis of Kane’s method of multi-body dynamics will also be implemented in these models. Each student will focus on one complex model that pertains to an orthopedic complication that the orthopedic industry needs solved. Prereq: 531. (Same as Mechanical Engineering 631.)

659 Advanced Mechanics of Materials II (3) (See Mechanical Engineering 659.)

BIOSYSTEMS ENGINEERING (196)

411 Mechanical Systems Engineering (3) Fundamentals of power delivery systems and simple mechanisms; selection and design of mechanical, hydraulic, and tractive power transmission systems. Off-road vehicles and bioprocessing systems. 2 hours and 1 lab. Prereq: Mechanical Engineering 231, 321. Coreq: 321.

416 Hydrologic and Water Quality Engineering (3) An introduction to hydrology including: hydrologic variability, precipitation, evapotranspiration, infiltration, runoff, erosion, water quality and non-point pollution, energy dissipation, streamflow measurement, hydrographs, routing, open channel flow, and urban hydrology. Prereq: Civil Engineering 390 or Aerospace Engineering 341.

431 Bioprocess Engineering (3) Development of interdisciplinary bioprocess engineering; basics of biology in an engineering perspective; enzymatic reaction kinetics; metabolism and bioenergetics; cell growth kinetics and product formation; engineering principles applied to bioprocess engineering including mass balance, energy balance, reaction kinetics; reactor design and systems; introduction to bioseparations; practical aspects of bioprocess engineers and process development. 2 hours and 1 lab. Prereq: 321.

451 Electronic Systems (4) Basic electronics with biological applications. Analog and digital electronics; sensing and controlling physical and environmental parameters; sensor selection and interfacing; signal conditioning; process control. Laboratory experiments and design projects. 3 hours and 1 lab. Prereq: Electrical Engineering 301.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Seminar (1) (See Environmental and Soil Sciences 503.)

519 Modeling Techniques and Applications (3) Engineering approach to mathematical modeling of physical phenomena. Systems definitions and boundaries; types and formulation of models and solution techniques; verification and calibration techniques; model applications and case studies. 2 hours and 1 lab. Prereq: Graduate standing in engineering.
525 Soil Erosion and Sediment Yield (3) (See Environmental Engineering 525.)

530 Research Problems in Biosystems Engineering (1-3)
Theoretical and experimental studies relating to current problems in agricultural engineering. May be repeated. Maximum 6 hours.

532 On-Site Domestic Wastewater Treatment, Dispersal and Reuse (3)
Design and management of domestic on-site wastewater treatment and dispersal systems, use of the soil as a medium for final treatment and for wastewater dispersal, concepts of the decentralization of domestic wastewater management, and reuse of treated water for irrigation. 2 hours and 1 lab. Prereq: Civil Engineering 395 or consent of instructor. (Same as Biosystems Engineering Technology 532.)

541 Principles of Compost Engineering (3)
Comprehensive study of composting: survey of installed systems; thermodynamics of composting; biology of composting; kinetics of heat inactivation; feed conditioning; aeration; substrate characteristics; process kinetics; and odor control. Design component. Prereq: Thermodynamics, heat and mass transfer.

543 Instrumentation and Measurement (3)
Modern instrumentation techniques. Static and dynamic response of instrumentation; signal conditioning; temperature, moisture, optical radiation, displacement, strain, pressure, velocity, acceleration, and flow measurements; digital data acquisition and control. 2 hours and 1 lab. Prereq: 451 or Electronics and Computer Circuits or equivalent. (Same as Environmental Engineering 543.)

545 Monitoring Hydrologic Phenomena (3)
Application of instrumentation theory to monitoring hydrologic phenomena; strengths and weaknesses of current equipment and strategies; equipment operation and solution of environmental monitoring problems. 2 hours and 1 lab. Prereq: 416 (Same as Environmental Engineering 545.)

550 Selected Topics (1-3)
Lecture/group discussion on specialized topics. May be repeated. Maximum 6 hours.

552 Biological Treatment Theory (3) (See Environmental Engineering 552.)

555 GIS and GPS Applications to Biosystems (3)
Theory and applications of Geographical Information Systems (GIS) and Global Positioning Systems (GPS); acquiring, managing, and analyzing spatially-varying data. Site-specific agriculture, environmental site assessment, natural resource management, and hydrology. 2 hours and 1 lab. Prereq: Graduate standing in engineering, biological or physical sciences. (Same as Biosystems Engineering Technology 555.)

575 Applied Microbiology and Bioengineering (3) (See Chemical Engineering 575; Environmental Engineering 575; Microbiology 575.)

591 Environmentally-Sensitive Spray Applications (3)
Develops the concepts of spray drift causes and corrective actions to lessen the effects of pesticides in the environment. Concepts are based on factors related to dosage transfer and the competing physics of droplet delivery under a variety of atmospheric conditions. Mass balance procedures are emphasized to validate measures of spray drift. Sprayer equipment components and operation factors affecting spray drift are introduced as operator controlled measures to minimize spray drift. The role of pesticide label language is incorporated into course concepts. Best management practices are developed to ensure practical applications of course concepts are emphasized. The student will learn how to implement spray drift reduction practices as well as make objective conclusions about spray drift test data. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only

603 Seminar (1) (See Environmental and Soil Sciences 603.)

519 Mathematical Modeling for Engineers (3)
Describing physical and biological settings with mathematical expressions. Applying dimensional analysis, linear and nonlinear ordinary differential equations, partial differential equations, systems of linear equations, linearization, moving boundary problems, and series solutions to solve mathematical expressions. Prereq: 519 and a course in differential equations, or consent of instructor.

636 Geospatial Methods for Environmental Research (3)
Sampling and displaying the multidimensionality of environmental variables. Spatial and temporal sensing of the environment. Geostatistical mapping and interpretation; sampling theory; precision geomatic techniques for the environmental scientist and engineer. 2 hours and 1 lab. Prereq: 555 or equivalent.

650 Selected Topics (1-3)
Lecture, group discussion, and individual study on specialized developments. May be repeated. Maximum 6 hours.

BIOSYSTEMS ENGINEERING TECHNOLOGY (194)

422 Food and Process Engineering Technology (3)
Application of basic engineering principles to agricultural and food processes. Fluid handling, drying, evaporation, thermal processing, heating and cooling, refrigeration systems, and materials handling. 2 hours and 1 lab. Prereq: Physics 101 or 221.

432 Agricultural Machinery and Tractors (3)
Functions, selection, matching, and management of agricultural machinery systems. Tractor power ratings, engine and transmission systems, hydraulic systems, hitching, and ballasting. Field and material capacity, field efficiency, cost analysis, and machinery replacement strategies. Functional analyses of tillage operations, planters and drills, no-tillage systems, hay harvest systems, forage and small grain harvesting, and cotton harvesting. Crop drying processes, off-road machinery safety considerations, and operator ergonomics. 2 hours and 1 lab. Prereq: Mathematics 123, 125 or consent of instructor.

442 Agricultural Waste Management and Pollution Control (3)
Waste renovation fundamentals; characteristics of animal manure; techniques for collection, transporting, storing, and utilizing livestock waste. 2 hours and 1 lab. Prereq: Mathematics 123, 125 or equivalent.

452 Small Internal Combustion Engines (3)
Theory, concepts, and mechanics of small internal combustion engines; theoretical cycles; selection, operation, adjustment, troubleshooting and repair of single-cylinder engines. 2 hours and 1 lab. Prereq: Mathematics 123 or 125 or equivalent or consent of instructor.

462 Agricultural Chemical Application Technology (3)
Equipment for application of liquid, solid, and gaseous agricultural chemicals; system components; operational characteristics; calibration; selection and management; safety considerations; materials handling and disposal methods. 2 hours and 1 lab. Prereq: Mathematics 123, 125 or equivalent or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Seminar (1) (See Environmental and Soil Sciences 503.)

506 Physical Phenomena (3)
Properties of materials, fundamentals of hydraulics, principles of electricity, thermal phenomena, applications in biological systems. 2 hours and 1 lab. Prereq: Consent of instructor.

508 Special Problems in Biosystems Engineering Technology (1-3)
Individual studies of current problems. May be repeated. Maximum 6 hours.
514 CAD Applications to Biosystems Engineering Technology (3) Computer Aided Drafting (CAD) applications in agriculture and environmental science. Essentials of CAD software to create drawings of components, systems, flow charts, and process diagrams. Applications in mechanical, structural, and biosystems. 2D applications with limited exposure to 3D applications. Computer intensive course. Hands-on experience. Two 2 hour labs. Prereq: Computer proficiency and admission to graduate program. (Students cannot receive credit for both 414 CAD Applications to Biosystems Engineering and 514.)

522 Processing and Environmental Systems (3) Environmental systems in plant and animal production; application of electric power, mechanical equipment, structures, crop processing and materials handling. 2 hours and 1 lab. Prereq: 506.

532 On-Site Domestic Wastewater Treatment, Dispersal, and Reuse (3) (See Biosystems Engineering 532.)

534 Production Monitoring and Automation (3) Precision technologies for monitoring and control of agricultural systems. Applications include: yield monitoring, variable rate control and sensing systems for planters, sprayers, soil applied nutrients, water management, crop health, and pest pressure; electronic information transfer; and GPS-based vehicle guidance. 2 hours and 1 lab. Prereq: 326 or GIS experience, graduate standing, or consent of instructor. Students cannot receive credit for both 434 and 534.

542 Simulation of Agricultural Systems (3) Synthesis and analysis of agricultural systems using computer simulation, philosophy of system simulation, critical path, discrete and continuous systems. 2 hours and 1 lab. Prereq: 506 and scientific computer programming.

546 Automation Devices and Applications (3) Basic electronics as applied to simple automation systems, programmable controllers, data acquisition, digital logic and transducers. 2 hours and 1 lab. Prereq: 506 or consent of instructor.

555 GIS and GPS Applications to Biosystems (3) (See Biosystems Engineering 555.)

562 Selected Topics in Biosystems Engineering Technology (1-3) Lecture/group discussion on specialized topics. May be repeated. Maximum 6 hours.

574 Environmental Instrumentation and Monitoring (3) Equipment and techniques commonly used to measure all aspects of the hydrologic cycle: precipitation, runoff, streamflow, subsurface water movement. Sampling of all flows for contaminants. Design of monitoring systems. Analysis of data. 2 hours and 1 lab. Prereq: Environmental and Soil Sciences 324, Statistics 201, Mathematics 152 or consent of instructor. (Students cannot receive credit for both 474 and 574.)

BUSINESS ADMINISTRATION (205)

501 MBA Career Development (1) Career opportunities available in each concentration. Prereq: Admission to MBA program or consent of Assistant Dean of MBA Program. Satisfactory/No Credit grading only.


511 MBA Core I (3) Essential skills of manager: basic information technology skills, teambuilding, and written and oral communication skills. Finance and accounting fundamentals. Introduction to integrated value chain. Prereq: Admission to MBA program or consent of Assistant Dean of MBA Program. Satisfactory/No Credit grading only.

512 MBA Core II (15) Development of roles and responsibilities of business managers. Functional fundamentals: marketing, operations, human resource management. Continuous systems improvement and delivery of customer value. Role of firm in society: stakeholder value, economics, and ethical and legal environment of firm. Personal leadership skills, and assessment of students’ leadership abilities. Integration of value chain: demand management, operations management, process design management, and logistics management. Prereq: 511 or consent of Assistant Dean of MBA Program.

513 MBA Core III (9) Continuation of the functional fundamentals from 512. Integration of value chain: supply management and resource management. Capstone integrated experience using information technology. Prereq: 511, 512 or consent of Assistant Dean of MBA Program.


561 Management Project I (3) Company project. Preliminary investigation of significant strategic issue (new initiative, program or significant organizational change to enhance organizational effectiveness) in sponsoring organization. Work within firm under guidance of faculty to develop proposal which defines issue and scope of project. Proposal to be approved by company and faculty. Prereq: Admission to executive program of MBA and cooperation of sponsoring organization. Coreq: 551.


591 International Travel (1) This one-hour course provides one-hour credit/enrollment for purposes of international travel and cultural exchange programs that are sponsored by the MBA program. Prereq: Admission to MBA program or consent of Assistant Dean of the MBA Program.

593 Directed Independent Study (3) Cross-disciplinary topic of mutual interest to student and faculty. Available only by prearrangement with supervising faculty member. May require approval of Dean of the MBA Program. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

599 Executive-In-Residence (3) Interaction with corporate executives from wide spectrum of business disciplines and discussion of domestic and international strategic planning as applied in major corporations. Prereq: MBA core and consent of instructor.

611 Seminar in Theoretical Foundations (3) Theoretical foundations and frameworks common to business research. Historical and philosophical science perspectives.

612 Seminar in Research Methods (3) Research processes: philosophical foundations, problem formulation, grounded theory, qualitative methods and analysis, measurement, sources of error, experimental design and analysis, survey design and analysis.

693 Independent Study (3) Prereq: Consent of Instructor. May be repeated. Maximum 6 hours.

699 Special Topics (3) Seminars that integrate content from various business functions: international business, management information systems.

BUSINESS LAW (216)

511 Business Law and Professional Responsibility (3) Legal framework and ethical implications of business transactions. Principles and practices in law of contracts, commercial transactions, real property, trusts, estates, and professional responsibility. Prereq: 301 and admission to MAcc program or consent of instructor. Not available for students with credit for 401.

CHEMICAL ENGINEERING (226)


467 Honors: Engineering Internship in Process Control (4) Selected students work in small groups on industrial problems in process dynamics and control. Directed by faculty and engineers from host company. Prereq: 360 and consent of instructor.

477 Honors: Applied Process Automation Laboratory (3) Interfacing flexible batch continuous processes to automation systems. Top down analysis with bottom up implementation, hierarchical structures and object oriented concepts used to design automation solutions: human-machine-interfaces. Workstations with modern industrial equipment, interactive graphics, and visualization environment. Prereq: 360, consent of instructor.

483 Introduction to Reliability Engineering (3) (See Nuclear Engineering 483.)

484 Introduction to Maintainability Engineering (3) (See Nuclear Engineering 484.)

500 Thesis (1-15) P/NP only.

501 Graduate Seminar (1) Prereq: Admission to graduate program. May be repeated. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Engineering Analysis (3) Formulation and solution of problems in chemical engineering and materials areas, ordinary and partial differential equations; types of ODE, PDE and solution techniques; transform methods; conformal mapping; variational methods; introduction to numerical methods. (Same as Materials Science and Engineering 505.)

507 Application of Linear Algebra in Engineering Systems (3) Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects. Prereq: Graduate standing or consent of instructor. (Same as Biomedical Engineering 507; Electrical and Computer Engineering 507; Materials Science and Engineering 507; Mechanical Engineering 507.)

509 Multidisciplinary Project (1) (See Industrial Engineering 509.)

531 Advanced Chemical Engineering Thermodynamics (3) Phase equilibrium in ideal and non-ideal solution; composition relationship between phases, solution behavior, and application to macromolecules; introduction to microscopic approach to thermodynamics.


541 Polymer Rheology (3) (See Materials Science and Engineering 541.)

542 Diffusive and Stagewise Mass Transfer Operations (3) Analysis of mass transfer phenomena, coupled mass transfer and reaction, mass transfer operations in packed towers and agitated vessels, membrane separations. Equilibrium stage concepts applied to mass transfer operation, emphasizing nonisothermal and multi-component systems.

547 Transport Phenomena I (3) Unified treatment of momentum transport (fluid flow), energy transport (heat conduction, convection, and radiation), and mass transport (diffusion). Fundamental basis of transport phenomena and momentum transport: viscous, viscoelastic, and potential flows.

548 Transport Phenomena II (3) Unified treatment of momentum transport (fluid flow), energy transport (heat conduction, convection, and radiation), and mass transport (diffusion). Energy transport and mass transport in closed and flow systems, interrelationships between transport processes, and prediction of transport parameters.

551 Chemical Reactor Analysis (3) Rate models for heterogeneous reactions, properties of porous catalysts, catalyst deactivation, fluid-fluid and fluid-solid reactors.

575 Applied Microbiology and Bioengineering (3) Cross-disciplinary course combining basic concepts in microbiology, biochemistry, reaction kinetics, and biochemical and environmental engineering. Commercial processes, biodegradation/wastewater treatment, analysis of basic bioreactor systems, biosensors, and immobilization methods. (Same as Environmental Engineering 575; Biosystems Engineering 575; Microbiology 575.)


581 Green Engineering (3) Principles and practical aspects of the design, commercialization, and use of processes and products that are feasible and economical while minimizing the generation of pollution at the source and risk to human health and environment. Prereq: Graduate standing in engineering or consent of instructor. (Same as Environmental Engineering 581; Engineering Science 583.)

585 Process System Reliability and Safety (3) (See Nuclear Engineering 585.)

590 Special Topics in Chemical Engineering (3) May be repeated. Maximum 6 hours.

594 Culminating Integrated Project Report (3) (See Mechanical Engineering 594.)

600 Doctoral Research and Dissertation (3-15) P/NP only.

631 Advanced Topics in Statistical Thermodynamics and Molecular Dynamics (3) Statistical thermodynamics, molecular based computer simulations, Monte Carlo and molecular dynamic calculations; applications to supercritical fluids, macromolecules and biological systems. Prereq: 532.


642 Advanced Topics in Polymer Processing (3) (See Materials Science and Engineering 642.)

647 Advanced Transport Phenomena (3) Theory of mass, momentum, and energy transport in reactive and non-reactive systems. Formulation of transport models useful for application to analysis and design of separation processes, and chemical and biochemical reactors. Prereq: 505, 547.


661 Advanced Topics in Process Dynamics and Control (3) May be repeated. Maximum 6 hours.

675 Microbial Systems Analysis (3) Identification and analysis of complex microbial systems using perturbation-response methods. Structuring of important mechanistic processes, interactions, and regulation at several systems levels (reactor or macro, ecological, cellular/physiological and molecular). Experimental methods for data gathering, signal resolution and processing, mathematical signal analysis, model development (deterministic, stochastic, phenomenological), and utility and limitations of approach. Prereq: 575 or consent of instructor.

691 Advanced Topics in Chemical Engineering (3) May be repeated. Maximum 6 hours.

CHEMISTRY (235)

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 230.


471-481 Biophysical Chemistry (3, 3) (See Biochemistry and Cellular and Molecular Biology 471-481.)

473-483 Physical Chemistry (3, 3) Students may not receive credit for both 471 and 473 nor for both 481 and 483. 473 - Properties of gases; first, second and third laws of thermodynamics; chemical equilibria; simple phase equilibria; properties of solutions. 483 - Introduction to statistical thermodynamics; kinetics of chemical reactions; introduction to quantum mechanics and applications to electronic structure of atoms and molecules; molecular spectroscopy. Prereq: 130 or 138; Physics 136 or 136 or 222 or 231; and Mathematics 241, 247.

479-489 Physical Chemistry Laboratory (2, 2) Experiments on topics discussed in 471-481 or 473-483. 1 lab. Prereq/Coreq: Corresponding courses 471 or 473 for 479 and 481 or 483 for 489.

500 Thesis (1-15) P/NP only.

501 Chemistry Seminar (1) Lectures and discussion on current research. May be repeated. Continuous registration required for resident graduate students. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Special Problems (3) Specially assigned theoretical or experimental work on problems not covered in other courses. Prereq: Consent of department. May be repeated. Maximum 6 hours Satisfactory/No Credit grading only.

510 Analytical Spectrometry (3) Principles and practice of optical and mass spectrometric techniques in quantitative chemical analysis. Required background: Two semesters of physical chemistry.

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena. Required background: Two semesters of physical chemistry.

512 Electroanalytical Chemistry (3) Fundamentals of electrode processes; principles and practice of electroanalytical techniques in quantitative chemical analysis and applied to study of chemical systems. Required background: Two semesters of physical chemistry.

530 Chemical Bonding (3) Wave mechanical atom, group theory, quantum approach to molecular orbital theory, covalent, ionic, and metallic bonding, ligand field theories, solid state. Required background: One semester of inorganic chemistry.

531 Characteristics of Inorganic Compounds (3) Descriptive chemistry of elements; structure, reactions, kinetics, mechanisms, equilibria, and spectra of coordination, organometallic, bioinorganic compounds. Required background: One semester of inorganic chemistry.

532 Experimental Methods of Inorganic Chemistry (3) Electronic, infrared, Raman, microwave, NMR, ESR, nuclear quadrupole, Mossbauer, mass, and photoelectron spectroscopies for characterization of inorganic compounds. Required background: One semester of inorganic chemistry.

533 Chemistry of the Transition Metals (3) Theoretical and experimental foundations of modern coordination, organometallic, and bioinorganic chemistry of transition metals; transition metal mediated catalysis, materials chemistry, isoloval theory, kinetics and mechanism of reactions of transition metals, and applications in organic synthesis. Required background: One semester of inorganic chemistry.

550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, stereochemistry, conformational analysis, and molecular mechanics; substituent effects on acidity and reactivity; introduction to reaction mechanisms. Required background: Two semesters of organic chemistry.

552 Organic Reaction Mechanisms (3) Techniques and principles in study of organic reaction mechanisms; applications and interpretations in polar, radical, and pericyclic reactions; reactive intermediates. Prereq: 550.


554 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS and multinuclear NMR spectrometers. Development of problem-solving ability in area of spectroscopic characterization of organic molecules. Prereq: 360 or equivalent. Coreq: 553.

570 Quantum Chemistry and Spectroscopy (3) Basic principles of quantum mechanics and their applications to molecular orbital theory, molecular structure, and spectroscopy; introduction to group theory. Required background: Two semesters of physical chemistry.

571 Advanced Quantum Chemistry and Spectroscopy (3) Prereq: 570 or consent of instructor.

572 Thermodynamics and Statistical Mechanics (3) Macroscopic and microscopic description of equilibrium systems. Basic principles of thermodynamics and statistical mechanics, and application to selected chemical systems. Required background: Two semesters of physical chemistry.

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory. Required background: Two semesters of physical chemistry.

590 Polymer Chemistry (3) Fundamentals of polymer synthesis and characterization through application of organic and physical chemical principles. Required background: Two semesters each of organic and physical chemistry.


595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solution and bulk properties, rubber elasticity, kinetics of polymerization, polymer thermodynamics. Prereq: 590 or equivalent.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Chemistry Research Proposal (2) Preparation and oral defense of original written research proposal based on thorough survey of chemical literature. Prereq: Consent of department head. Satisfactory/No Credit grading only.

610 Selected Topics in Analytical Chemistry (3) Topics of current significance. Prereq: 510, 511, 512 or consent of instructor. May be repeated. Maximum 12 hours.

630 Selected Topics in Inorganic Chemistry (3) Topics of current significance. Prereq: 530, 531, 532 or consent of instructor. May be repeated. Maximum 12 hours.

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 550, 551, 552 or consent of instructor. May be repeated. Maximum 12 hours.

670 Selected Topics in Physical Chemistry (3) Topics of current significance. Prereq: 570, 572, 573 or consent of instructor. May be repeated. Maximum 12 hours.

690 Selected Topics in Polymer Chemistry (3) Topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

691 Selected Topics in Thermal Analysis of Polymeric Materials (3) Topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 9 hours. Maximum 3 hours may be applied toward degree in chemistry.

CHILD AND FAMILY STUDIES (245)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Development of Interpersonal and Supervision Skills (3) Refinement of interpersonal skills needed to work with families and other professionals. Supervisory training in others’ skill development, active listening, self-disclosure, relationship building, and negotiation. Skills adapted for use among family members.

510 Theory in Human Development (3) Theoretical models of human development: cognitive, social learning, and ecological theory; analysis, synthesis, and discussion of historical and contemporary relevance of models; application of theory to research, prevention, intervention, and education; critical reading and evaluation of theory-based research on human developmental processes.

511 Survey of Research in Child Development (3) Survey of human development research from conception through adolescence. Classic and contemporary empirical literature in domains of physical, cognitive, language, social, emotional, and moral development; biological basis of development; cross-cultural perspectives.

512 Survey of Research in Early Childhood Education (3) Current literature and issues in early childhood education. Prereq: 510 or equivalent or consent of instructor.

515 Children in Contemporary Society (3) Theory and research on environmental and developmental issues in contemporary family situations and educational environments for children from infancy through middle childhood. Implications for programs and policy.

522 Naturalistic Interventions for Parents and Teachers of Young Children (3) Common problems faced by parents and teachers; methods available to modify problem behavior.

525 Seminar on Play (3) Contrast and compare of theoretical framework and research methodologies on play. Developmental perspective on play.

530 Families of Children with Disabilities (3) Developmental nature of families’ experiences in caring for handicapped children, especially during infancy and early childhood.


550 Theory and Research in Family Studies (3) Research in various major topics in family studies and application of theoretical models to understanding research.


564 Practicum in Human Development or Family Studies I (3) School and community programs. Education for human development and family living. Prereq: Consent of instructor. Satisfactory/No Credit grading only.

565 Practicum in Human Development or Family Studies II (3) School and community programs concerned with education for human development and family living. Committee approved and supervised written project. Satisfactory/No Credit grading only.

566 Approaches to Family Intervention and Counseling (3) Various theoretical approaches for family intervention and counseling. Structural, strategic, experiential and social learning schools of practice. Effects of intervention from perspective of their impact on family functioning and communication. Prereq: 562. (Same as Counselor Education 566.)

567 Family Violence (3) Theory and research on initiation, maintenance and cessation of violent behaviors in intimate family contexts, and assessment of responses to violent family behaviors, perpetrators, victims, and family systems. Prereq: 567.


572 Professional Socialization (2) Behaviors and practices appropriate to a professional researcher and practitioner in the field of Child and Family Studies: understanding and working within the university environment, maintaining ethical standards, complying with human subject protocols, making public presentations, and networking with peers.

574 Analysis of Teaching for Professional Development (1-2) Strategies to document and analyze effectiveness of teaching and of professional development. Study and application of various approaches. Coreq: 575.

575 Professional Internship in Teaching (1-8) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to post-baccalaureate students in professional year program. Prereq: Admission to Teacher Education program. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

580 Special Topics in Human Development or Family Studies (1-3) Research, theory and current issues in child development or family studies: divorce, handicapped children, symbiotic interaction, work and family, Piaget, mainstreaming children, theory and research in human sexuality, cognition. Prereq: Six graduate hours in major or consent of instructor. May be repeated with different topics. Maximum 9 hours.

581 Directed Study in Human Development or Family Studies (1-3) Individual learning experiences in specific topics in child development and early childhood education or family studies. Prereq: 6 graduate hours or consent of instructor. May be repeated with different topics. Maximum 6 hours.

591 Clinical Studies (1-4) Group and individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.

600 Doctoral Research and Dissertation (3-15) P/NP only.

610 Advanced Special Topics in Human Development or Family Studies (1-3) Study of research and theory related to current issues. Prereq: 12 graduate hours in major or consent of instructor. May be repeated with different topics. Maximum 6 hours.

620 Advanced Directed Study in Human Development or Family Studies (1-3) Advanced, in-depth individualized learning experiences in specific topics in child development, early childhood education, or family studies. May be repeated with different topics. Maximum 6 hours.


633 Survey Design and Analysis (3) (See Sociology 633.)

634 Advanced Survey of Family Theory and Research (3) Conceptualization, analysis, and critical assessment of pertinent conceptual and empirical literatures at advanced level for variety of contemporary family issues. Prereq: 570, master's core. Required background: Six hours graduate-level statistics.

640 Advanced Theory in Human Development (3) Original conceptualizations of and current theoretical perspectives influencing field of human development and empirical evaluations of these perspectives. Prereq: 550, 510, 511 or consent of instructor.

650 Advanced Qualitative Research Methods (3) Techniques and data analysis in qualitative research in human development and family studies. Use of methods: in-depth interviewing, participant observation, and case studies. Prereq: Communication 642 or Psychology 613.


660 Experimental Design and Observation Methods (3) Experimental and quasi-experimental designs (group and time-series single-case) in natural and contrived settings as used in child and family research; observation methods used with these designs. Prereq: 570.

670 Secondary Analysis of Survey Data (3) Applied seminar in secondary analysis of survey data. Identification of data archives, accessing data, evaluation, and analysis of social science survey data. Nationally representative data sets relevant to study of families, youth, or children. SPSS analytic software. Prereq: 570 or equivalent; Statistics 532, 537 or equivalent.

680-681 Knox Area Family and Child Study (KAFCAS) Research Practica I, II (3, 3) Faculty-directed collaborative original research, including problem definition, instrumentation, data collection, data analysis, and report writing on a panel or sample of families and children in the Knox County area. Two semesters, 3 credits per semester. Prereq: 570.
691 Analytic Reasoning (3) Analysis of quantitative methods and measures used in human development and family research: validity, reliability, causality, and generalizability. Prereq: 570. Required background: Nine hours graduate coursework in child and family studies, and six hours graduate-level statistics.

CHINESE (249)

431 Readings in Chinese Literature (3) (See Asian Languages 431.)

CINEMA STUDIES (251)

400 Special Topics (3) May be repeated. Maximum 6 hours.

420 French Cinema (3) (See French 420.)

421 Topics in Italian Literature and Cinema (3) (See Italian 421.)

433 History of Film and Modern Art (3) See Art Media Arts 433.

434 Hispanic Culture Through Film (3) (See Spanish 434.)

465 Latin American Film and Culture (3) (See Spanish 465.)

469 Sexuality and Cinema (4) (See Women’s Studies 469.)

510 Special Topics in Film (3) (See English 489.)

510 Special Topics (3) May be repeated. Maximum 6 hours.

CIVIL ENGINEERING (254)

451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; application of various engineering principles and techniques to process of planning, locating and design of highway facilities; both geometric and pavement design. Prereq: 352.

452 Traffic Engineering (3) Characteristics of driver, vehicle, and roadway and their interrelationship; traffic studies; basic considerations of traffic circulation and control, lighting, capacity analysis, roadway safety analysis and design. Prereq. 352.

453 Airport/Railroad Planning and Design (3) Airport master planning and railroad engineering. Runway configuration, airfield capacity, geometries, and terminal layout and design. Railroad capacity, geometries and system layout and design. Prereq: 352.

472 Steel Design (3) Design of plate girders and composite beams; consideration of members subjected to combined stresses; design of typical framed building connections. Prereq: 471.


532 Rock Mechanics and Rock Engineering (3) Engineering properties and characterization of rock and rock masses. Discontinuity analysis, stress and strain, keyblock theory. Applications to rock slopes, underground excavations, foundations and groundwater flow. Prereq: 330 or consent of instructor.

533 Advanced Laboratory and In situ Testing of Soil (3) Instruments for measurement of electrical signals, static and dynamic transducers, data acquisition and control, insitu measurement of stress, pore pressure, deformation, load deformation behavior (seismic methods, static methods), advanced laboratory shear strength and compressibility testing. 2 hours and 1 lab. Prereq: 330.


535 Finite Element Applications in Geotechnical Engineering (3) Application of finite element method to typical problems in geotechnical engineering. Confined and unconfined flow through porous media; two-dimensional stress and strain; two-dimensional elements; representation of nonlinear soil behavior with elastic and elastic-plastic models. Prereq: Introduction to Soil Behavior and Matrix Computation or equivalent. Taught concurrently with 561. Students may not receive credit for both 534 and 561.

539 Geotechnology Seminar (1) Seminar topics in geotechnical and geological engineering. Research contributions and case histories by graduate students and engineers and scientists from surrounding community. Prereq: Graduate standing and consent of advisor. May not apply toward degree. May be repeated. Satisfactory/No Credit grading only.

540 Construction Management I (3) Management and organization of heavy and building construction projects. Prereq: 442.

541 Construction Management II (3) Management organization of heavy and building construction projects. Prereq: 442.

543 Construction Estimating (3) Project costs, estimating and takeoff techniques, market cost conditions, and feasibility of design to cost. Prereq: 442.
551 Traffic Engineering-Characteristics (3) Driver-vehicle-highway system; traffic flow modeling; elements of transportation/highway safety. Prereq: Graduate standing.

552 Traffic Engineering-Operations (3) Signs, signals and marketing; short-term operations; controllers; signal timing/phasing; one-way reversible flow; system operations; identification and correction of high-accident locations and system deficiencies. Prereq: 551 or 452.

553 Geometric Design and Layout of Roadways and Community Facilities (3) Functional and geometric design and rural and urban roads of all classes; subdivision layout; configuration of urban roads of all classes; techniques for access control; freeway interchanges and street intersections; and parking. Prereq: 451 or consent of instructor.

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control programs; roadside hardware design and crash testing. Prereq: 452 or graduate standing.

557 Transportation Planning and Operations with Micro-Computer Applications (3) Transportation system management techniques and application of micro-computers to analysis of transportation actions. Prereq: 551 and 556.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationship between various transportation modes and between transportation and other community features. Use of planning process to establish existing travel patterns, modeling of demand, proposing alternatives and evaluation. Prereq: Graduate standing. (See Political Science 555.)

561 Finite Element Applications in Structural Engineering (3) Application of finite element method to typical problems in structural engineering. Truss, beam and plate elements; two-dimensional stress and strain; two-dimensional elements; representation of nonlinear material behavior with elastic and elastic-plastic models. Prereq: Structural Analysis and Matrix Computation or equivalent. Taught concurrently with 538. Students may not receive credit for both 538 and 561.

562 Structural Systems (3) Structural system analysis and design; dead, live, wind, and earthquake loads on buildings; vertical and lateral load resisting systems; use of computers in analysis and design. Prereq: 471.

563 Statically Indeterminate Structures (3) Elastic analysis of indeterminate articular and rigid frames with non-prismatic members using energy, slope deflection, and moment distribution methods; plastic analysis of rigid frames; and stability analysis of compression members and portal frames. Prereq: 361.

565 Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elastoplastic behavior considered for structural systems; earthquake design and response of structures. Prereq: 471.

571 Behavior of Steel Structures (3) Behavior of structural steel members due to static and fatigue loading; relation between research results and current specifications for design. Prereq: 471.

572 Fracture Analysis (3) (See Geology 572.)

573 Prestressed Concrete (3) Properties of prestressing materials; methods of pretensioning and posttensioning; analysis and design of simple and continuous beams and slabs. Prereq: 471.

574 Behavior of Reinforced Concrete Members (3) Moment-curvature and load-deflection relationships for reinforced concrete beams; combined bending and axial load; shear and torsion; relation between research results and specifications for design. Prereq: 471.

576 Masonry Design (3) Clay and concrete masonry materials; unreinforced masonry design; reinforced masonry design; seismic behavior of masonry structures. Prereq: 471.

580 Risk Analysis in Civil and Environmental Engineering (3) Applications of probability theory and statistics in civil engineering disciplines: structures, geotechnology, water resources, transportation, and environmental engineering. Prereq: Calculus II or consent of instructor.

590 Special Problems in Civil Engineering (3) Enrollment limited to civil engineering students in non-thesis programs. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

595 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only.

631 Soil Dynamics (3) Introductory and advanced topics: vibrations of elementary systems, foundations subjected to repeated and impulse loading, wave propagation theory and applications, and site response to dynamic loading. Prereq: 435.

651 Analysis Techniques for Transportation Systems I (3) Analysis of trip generation, trip distribution, modal split and traffic assignment, employing mathematical, statistical, and computer science techniques. State of the art and new modeling techniques. Prereq: 554 or 558.

652 Analysis Techniques for Transportation Systems II (3) Advanced topics of application of mathematical, statistical and computer science techniques in modeling and analysis of transportation systems. Prereq: 651.

671 Behavior of Steel Bridges and Buildings (3) Behavior, analysis and design of plate girders, columns, and composite members subjected to static and dynamic loading. Prereq: 571.

674 Behavior of Reinforced Concrete Beams and Slabs (3) Strength and behavior of statically indeterminate reinforced concrete beams and frames; limit analysis; behavior, analysis, and design of reinforced concrete slabs: yield-line theory, finite element solutions, and ACI Code Method. Prereq: 574.

680 Reliability of Constructed Systems (3) Development of safety factors and probability based design codes; Monte Carlo methods; constructed system reliability; evaluation of existing infrastructures. Prereq: 580 or consent of instructor.

691 Special Topics in Civil Engineering (3) Selected advanced problems of current interest. Prereq: Consent of instructor. May be repeated.

CLASSICS (257)

401 Greek Poetry (3) Epic, lyric, drama. Authors vary. Prereq: 261. May be repeated. Maximum 9 hours.

402 Greek Prose (3) History, philosophy, and oratory. Authors vary. Prereq: 261. May be repeated. Maximum 9 hours.

405-406 Selected Readings from Greek Literature (3,3) For advanced students in Greek, plays, historical writings, poetry of ancient Greece in original Greek. Prereq: 401-402 or consent of instructor. May be repeated. Maximum 9 hours.

414 Cicero and Techniques of Latin Prose Composition (3) For advanced students in Latin, practice in prose composition, writings of Cicero the model. Prereq: 351-352 or consent of instructor.

431-432 Selected Readings from Latin Literature (3,3) For advanced students in Latin, oratory, historical writings, poetry of ancient Rome in original Latin. Prereq: 351-352 or consent of instructor. May be repeated. Maximum 9 hours.

435 Medieval Latin (3) Selected readings from Latin prose and poetry of medieval Europe. Prereq: Consent of instructor.
436 Cities and Sanctuaries of the Greek and Roman World (3) Major cities and sanctuaries in Greece, the Greek colonies, and the Roman Empire. Approach is archaeological, focusing on physical evidence—landscape, architecture and artifacts—as well as description of ancient authors. Cities include various types: planned and unplanned, seaports, caravan centers, government and commercial centers. The sanctuaries also vary in function including prophetic centers, athletic centers, theater centers, and healing centers. Writing-emphasis course. (Same as Anthropology 436.)

441 Special Topics in Classical Civilization (3) Art, literature, religion, and society of Greece and Rome. May be repeated with consent of department. Maximum 9 hours.

442 Intensive Survey of the Archaeology of the Prehistoric Aegean (3) Survey of archaeology and art of the Aegean from the earliest human to the rise of the Greek polis in the 8th century B.C. Highlights include Early Cycladic art, Minoan and Mycenaean complex societies, Thera, cultural interconnections with Egypt and the Near East, and the Trojan War. Emphasis on anthropological and modern art historical approaches. Writing-emphasis course. (Same as Anthropology 442.)

443 Intensive Survey of the Archaeology of Greece (3) Survey of the archaeology and art of Greece and the Greek-speaking areas from the Orientalizing through Hellenistic periods (c. 700–30 B.C.). Developments in architecture, sculpture, and vase painting seen in the context of changes in society. Archaeological evidence for daily life, economy, and political institutions. Writing-emphasis course. (Same as Anthropology 443.)

444 Intensive Survey of the Archaeology of Etruria and Rome (3) Survey of the archaeology of Italy and the Roman World from prehistoric times to the fall of the Roman Empire (1000 B.C.–A.D. 476). Highlights are the rise and decline of Etruscan culture, the development of Roman architecture, art, and urban planning, and architecture used for political propaganda, and Roman cosmopolitan culture during the Empire. Writing-emphasis course. (Same as Anthropology 444.)

562 Special Topics in Mediterranean Archaeology (3) Selected topics in archaeology or art of the prehistoric Aegean, historic Greece or Rome. Lectures, discussions, student presentations, and papers. May be repeated. Maximum 9 hours. (Same as Anthropology 562.)

565 Graduate Seminar in Ancient Mediterranean Civilization (3) Theoretical and practical issues in the civilizations of the prehistoric Aegean or historic Greece. Study and discussions conducted in seminar format. Emphasis on developing students’ skills in research and oral as well as written presentation. May be repeated. (Same as Anthropology 565.)

COMMUNICATION AND INFORMATION (248)

501 Orientation to Graduate Study (1) Overview of the communication and information discipline. Orientation to resources needed for successful graduate study. Prereq: Admission to program. P/NP only.

540 Communication Theory (3) Overview of theory-building process and theories in communication. Prereq: Consent of instructor or admission to the program.

600 Doctoral Research and Dissertation (3-15) P/NP only.

612 Fundamentals of Communication Research (3) Universal research process from defining ideas and problems to reporting results. Causal inference and relative strengths of various research designs. Fundamentals and specific applications of most common data-gathering and measurement techniques in communications research: experimental, survey, content analysis, historical and qualitative. Prereq: Consent of instructor or admission to program.

620 Seminar in Communication and Information Education (3) Role and scope of mass communication teaching unit, historical perspectives of curricular trends. Teaching methods and instructional objectives; classroom testing and measurement; design of professional curricula, research and extension; program evaluation; grants and contracts in research. Prereq: Consent of instructor or admission to program.


640 Communication and Information Theory I (3) Selected research hypotheses and theories in literature of mass communication theory. Prereq: Consent of instructor or admission to program.

641 Communication and Information Theory II (3) Selected topics in theory. Critical evaluation of extant theory, derivation of hypotheses, and advanced theory construction. Prereq: 640.

642 Qualitative Research (3) Theory and application of qualitative research methods to social science and communications research. Theoretical considerations underlying symbolic interactionism as translated into research strategies of participant observation, life history, interviewing, archival analysis, and case studies. Prereq: 612 or consent of instructor.

652 Mass Communication Law and Legal Research (3) Legal restrictions under which mass media operate. Finding, interpreting and analyzing sources of legal information. Prereq: 612 or consent of instructor.

COMMUNICATION STUDIES (250)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Human Communication Research Methods (3) Understanding of wide array of data collection and analysis procedures used in human communication research.

520 Survey of Interpersonal Communication (3) Identifies and addresses theory and research in human communication.

525 Survey of Interpersonal Health Communication (3) Identifies and addresses theories and research concerning how people communicate about health.

540 Survey of Organizational and Team Communication (3) Identifies and addresses theories and research in human interactions in organizations and teams.

560 Special Topics in Communication Studies (3) Contemporary Topics. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

580 Survey of Public Communication (3) Identifies and addresses theories and research in public discourse.

590 Project (3) Capstone project under guidance of faculty. Application of principles from previous coursework. Satisfactory/No Credit grading only.
591 Foreign Study (1-15) Independent study outside U.S. Prior to departure student must have plan of study approved by department head and supervising faculty member. Credit given only upon fulfilling all requirements set by department. May be repeated. Maximum 15 hours.

592 Off-Campus Study/Internship (1-6) Independent study outside traditional classroom setting: community involvement and/or work experiences. Credit given only upon fulfilling all requirements set by department. May be repeated. Maximum 6 hours.

593 Independent Study (1-6) Independent study by individual under direction of faculty member. Must obtain approval of faculty member and department prior to study.

**COMPARATIVE AND EXPERIMENTAL MEDICINE—GRADUATE SCHOOL OF MEDICINE (262)**

Participating departments include: Anesthesia, Medicine, Medical Genetics, Obstetrics and Gynecology, Pathology, Pediatrics, Radiology, and Surgery.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

508 Graduate Research Participation (3) Advanced research techniques while conducting individual biomedical research projects under supervision of faculty. Open to all graduate students. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 9 hours. Satisfactory/No Credit grading only.

541 Molecular Basis for Human Diseases (4) Disease at molecular level. Changes in molecular events in cells that lead to disease and occur as result of disease. Correlation with clinical and pathological states. Prereq: Biochemistry and Cellular and Molecular Biology 410-419 or equivalent.

545 Clinical Genetics (3) Human genetic disorders: new developments in cytogenetics, molecular genetics, clinical diagnoses and prevention. Prereq: Biology and genetics background or consent of instructor.

600 Doctoral Research and Dissertation (1-15) P/NP only.

610 Medical Biology Seminar (1) Invited speakers. Topics posted in advance. May be repeated. Satisfactory/No Credit grading only.

611 Advanced Topics in Medical Science (1-3) New developments in biological research applicable to clinical medicine. Primarily for doctoral candidates in Comparative and Experimental Medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

**COMPARATIVE AND EXPERIMENTAL MEDICINE—VETERINARY MEDICINE (261)**

Participating departments include: Animal Science, Comparative Medicine, Microbiology, Pathology, Large Animal Clinical Sciences, and Small Animal Clinical Sciences. Several faculty in the Department of Microbiology hold joint appointments in the College of Veterinary Medicine. See Microbiology for additional courses.

500 Thesis (1-15) P/NP only.

501 Special Topics in Comparative and Experimental Medicine (1-6) Specialized experience in comparative and experimental medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Predictive Toxicology (3) Principles and techniques of predictive toxicity: structure-activity relationships, expert systems, neural nets, and molecular similarity.

505 Laboratory Animal Care and Use (2) Review of basic laboratory animal care and use as prerequisite to conducting research using animal subjects. Compliance issues and techniques.

506 Experimental Animal Surgery (3) Competence in performing humane surgical modifications of experimental animals. Techniques of anesthesia. Drug administration and postoperative care. Prereq: Embryology, parasitology, physiology and/or consent of instructor. 1 hour and 2 labs.

530 Wildlife Diseases (2) (See Wildlife and Fisheries Science 530.)

561 Pharmacology (4) Principles of pharmacokinetics and pharmacodynamics properties of drugs: mode of action, pharmacologic effects, chemical and physical properties, metabolism, toxicities, important idiosyncrasies, and clinical applications. Prereq: Consent of instructor.

562 Registration for Use of Facilities (1-15) P/NP only.

602 Surgical Pathology (1-2) Examination of biopsy specimens and interpretation of observations. Preparation of specimens for sectioning. Prereq: Consent of instructor. May be repeated. Maximum 3 hours.

603 Correlative Post-Mortem Pathology (1-3) Gross and microscopic post-mortem examination of animals. Correlative interpretation of clinical diseases and lesions. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

604 Veterinary Pathology Seminar (1) Microscopic slides and transparencies of lesions from cases examined by pathologists, residents, and graduate students. Interpretation of observations. Prereq: Consent of instructor. May be repeated. Maximum 4 hours.

605 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar per term enrolled. Prereq: Consent of instructor. May be repeated. Maximum 4 hours, Class meets once monthly.

606 Clinical Epidemiology (3) Theory and principles of design implementation and analysis of clinical research. Lab: appraisal of biomedical literature and design of proposal for clinical research project. Prereq: Consent of instructor.

607 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (3) Advanced study of virus diseases important to domestic animals: virus biology, pathogenesis, pathology and diagnosis of diseases. Technical training in virus diseases diagnosis. Prereq: Consent of instructor. 2 hours and 1 lab.

608 Descriptive and Applied Epidemiology (3) Principles of epidemiology and historic and modern application to diseases of animals. Host-agent relationships, measurement of disease frequency, animal production and disease, monitoring and control, field investigations, animal health economics. Prereq: Consent of instructor.

609 Mechanisms of Disease (4) Advanced topics in pathobiology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, hemorrhage. Principal biochemical and morphologic responses of various cells, tissues, and organs to injury and other metabolic derangements. Selected contemporary topics from current literature and textbooks. Prereq: Consent of instructor.
610 Advanced Topics in Comparative and Experimental Medicine (1-3) Specialized in-depth experience in various disciplines. Current and future research methodology, recent advanced in instrumentation in analytical techniques for comparative medicine. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

651 Advanced Topics in Animal Anatomy (1-4) (See Animal Science 651.)

652 Disorders of the Endocrine System (2) (See Animal Science 652.)

COMPARATIVE LITERATURE (260)

401-402 Special Topics in Comparative Literature (3,3) Content varies. May be repeated. Maximum 9 hours.

452 Modern Drama, 1880-1945 (3) (See English 452.)

454 Twentieth-Century International Novel (3) (See English 454.)

510 Special Topics (3) May be repeated. Maximum 6 hours.

COMPUTER SCIENCE (266)

420 Advanced Topics in Machine Intelligence (3) Search, learning, expert systems, neural networks, pattern recognition, and natural language processing. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hours.

430 Advanced Topics in Hardware Systems (3) Architecture, parallel processors, microprogramming, networks, and communications. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hours.

460 Advanced Topics in Software Systems (3) Operating systems, compilers, parallel computation, software engineering, database systems, and programming languages. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hours.

470 Advanced Topics in Scientific Computation (3) Numerical methods, supercomputers and computer modeling and simulation of physical systems. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hours.

471 Numerical Analysis (3) (See Mathematics 471.)

472 Numerical Algebra (3) (See Mathematics 472.)

480 Advanced Topics in Theoretical Computer Science (3) Theory of computation, complexity theory, formal languages and graph theory and its applications. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hours.

494 Special Topics in Computer Science (1-3) May be repeated. Maximum 9 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

522 Cybernetics (3) Various functions in living systems and their actual or potential realization in computers. Prereq: Discrete Structures.

525 Software Engineering (3) Survey of key ideas in software engineering: formal methods, tools, testing, reliability, structured design and development, metrics, management, and history of the field.

530 Computer Systems Organization (3) Architectures and systems organization for serial and parallel machines. Prereq: Architecture or machine organization.

541 Database Management Systems (3) Data model theory, optimization, and normalization; intelligent database systems; comparison of implementations; analysis of distributed and networked databases. Techniques for evaluation of performance, integrity, security and reliability. Prereq: 311.

551 Pattern Analysis (3) Decision-theoretic and structural pattern analysis. Deterministic and statistical decision rules, feature extraction and representation; syntactic and semantic methods, relational models. Prereq: Discrete structures and probability or statistics.

552 Image Analysis (3) Enhancement and restoration of digital images. 2D transforms. Segmentation and description. Computational procedures for image reconstruction. Prereq: One year calculus and discrete structures.

560 Software Systems (3) Design and implementation of compilers, software systems; optimization, run-time storage administration. Software system design issues; description, structure and design of contemporary software systems. Prereq: 360.

571-572 Numerical Mathematics (3) (See Mathematics 571-572.)

574 Finite Element Methods (3) (See Mathematics 574.)

575 Matrix Theory and Techniques in Numerical Analysis (3) (See Mathematics 575.)

576 Sparse Matrix Computations (3) Solution of large sparse linear systems: graph models, reordering techniques, symbolic factorizations, data structures, numerical algorithms, complexity analyses, parallel algorithms. Prereq: Numerical linear algebra.

580 Foundations (3) Foundations of computer science, including Turing machines, computability and computational complexity. Prereq: Automata theory.

581 Algorithms (3) Analysis of algorithms and relevance of analysis to design of efficient computer algorithms. Sorting, searching, graph algorithms, pattern matching, dynamic programming, efficient approximation algorithms. Prereq: Fundamental algorithms.

592 Off-campus Study (1-6) See College of Arts and Sciences. May be repeated. Maximum 6 hours.

593 Independent Study (1-15) May be repeated.

594 Special Topics in Computer Science (1-3) May be repeated.

600 Doctoral Research and Dissertation (3-15) P/NP only.

620 Advanced Topics in Intelligent Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

650 Advanced Topics in Pattern/Image Analysis (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

660 Advanced Topics in Software Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

670 Advanced Topics in Scientific Computing (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

680 Advanced Topics in Theory and Foundations (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

690 Advanced Topics in Computer Science (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

COUNSELOR EDUCATION (255)

410 Sex Role Development: Implications for Education and Counseling (3) Theories and research: development of gender roles and their relevance to identity and behavior in socio-psychological, educational, and counseling settings. (Same as Women’s Studies 410.)
431 Personality and Mental Health (3) Various perspectives of mental health with application to education and other social institutions. (Same as Educational Psychology 431.)

480 Interviewing and Counseling Techniques (3) An introduction to basic helping skills necessary to the preparation of counselors, teachers, and others involved in human service delivery.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Maximum 15 hours. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

504 Special Topics (1-3) Instructor-initiated course offered at convenience of academic unit on topics of current interest. May be repeated. Maximum 15 hours. Satisfactory/No Credit or letter grade.

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only.

521 Mental Health Consultation (3) Intended for advanced students in the helping professions, especially Mental Health Counseling. Its main goal is to prepare students for providing mental health consultation and collaboration in the field.

525 Formal Measurement in Education and Counseling (3) Principles of test construction and item analysis. Survey of standardized tests of intelligence, achievement, aptitude, vocational interest, attitudes and personality.

535 Ethical, Legal, and Professional Issues in Counseling (3) Professional practice issues in school and community counseling and related fields: education, research, standards of practice, credentialing, and policy. Prereq: Admission to counseling program or consent of instructor.

550 Foundations in School Counseling (3) History, philosophy, professional standards, counselor role in relation to school staff and mental health professionals, and ethics of profession.

551 Theory and Practice of Counseling (3) Philosophical bases of helping relationships; development of counselor and client self awareness; counseling theory/techniques.

552 Career Development: Vocational Theory, Research and Practice (3) Relationship of vocational theory, career development research, and societal factors to life career roles.

553 Career and Educational Information Systems and Resources (3) Use of print and non-print materials: computer-based systems, for career and educational planning. Prereq: 552 or consent of instructor and Internet access account.

554 Group Dynamics and Methods (3) Theory and types of groups, descriptions of group practices, methods, dynamics, and facilitative skills, supervision of leadership skills. (Same as Psychology 567.)

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with individual clients. Prereq: Admission to program, 431, 525, 551 and consent of instructor. May be repeated. Maximum 9 hours. (Same as Psychology 569.)

556 Orientation to Mental Health Counseling (3) Mental health counseling as profession: professional organizations, work settings, code of ethics, certification requirements, and role identity.

558 Internship in School Counseling (1-6) Supervised post-practicum employment at academic unit approved site. Prereq: 550 and consent of instructor. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

559 Internship in Mental Health Counseling (1-6) Supervised postpracticum employment at academic unit approved human services agency. Prereq: Admission to mental health counseling program, 555 and consent of instructor. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

561 Development and Operation of School Counseling Programs (3) Management of comprehensive school counseling programs to include needs assessment, program goals, resource identification, evaluations, and use of computer-based program management software. Prereq: 550.

565 Facilitation of Technical Task Groups (3) Technical and social aspects of group dynamics in context of technical task groups. Application of counseling techniques to facilitation of workplace teams. Prereq: 551, 554, or consent of instructor.

566 Approaches to Family Intervention and Counseling (3) (See Child and Family Studies 566.)

570 Cross-Cultural Counseling: Theory and Research (3) Theory and research on issues and problems in counseling of clients from different cultural backgrounds in U.S. and abroad. (See Psychology 574.)

580 Case Management Process in Mental Health Counseling (3) Introduction and application of knowledge and skills of the case management process: assessment, planning, and service provision/coordination.

585 Seminar in Gerontology (1) (See Health 585.)

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Professional Seminar (1) (See Educational Psychology 601.)

602 Directed Research (1-3) Instructor- or student-initiated group investigation of empirical and theoretical problems in educational and counseling psychology. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

604 Special Topics (1-3) Instructor-initiated courses offered at convenience of academic unit on topics of interest. May be repeated. Maximum 15 hours. Satisfactory/No Credit or letter grade.

625 Advanced Study in Personality (3) (See Psychology 625.)

635 Ethical, Legal, and Professional Issues in Psychology (3) (See Psychology 635.)

650 Seminar in Counselor Education (3) Professional issues related to role and function of counselor educator. Prereq: Admission to doctoral program in counselor education.

651 Reality Therapy and Brief Counseling (3) Seminar in theory and practice of reality therapy and brief counseling for advanced graduate study. Prereq: 551 or permission of instructor.

655 Practicum in Counselor Education (3) Supervised practice and application of counseling skills with clients. Prereq: Admission to counselor education program and consent of instructor. May be repeated. Maximum 6 hours.

659 Internship in Counselor Education (1-6) Supervised experience in departmentally approved counseling, teaching, supervision, or consultation internship sites. Prereq: Admission to counselor education doctoral program and consent of the instructor. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

660 Advanced Theory and Practice of Counseling (3) An in-depth exploration of theories of human nature and the practice of counseling. Prereq: Admission to the PhD program or permission of instructor.
665 Group and Systems Theory and Interventions (3) Exploration of group and family systems theory, preparation as practitioners in facilitation of counseling and task groups, and examination of counseling and psychotherapy interventions applicable to group dynamics. Prereq: Admission to the PhD program or permission of instructor.

670 Theory and Practice of Counseling Supervision and Consultation (3) Theory of counseling supervision and consultation, supervision of entry-level counselors, and agency consultation. Prereq: Admission to the PhD program or permission of instructor.

671 Personality and Vocational Assessment (3) (See Psychology 667.)

675 Theory and Practice of University Teaching In Counselor Education (3) Emphasis on teaching and learning theories and classroom applications in the preparation of future mental health, school, and rehabilitation counselors. Prereq: Admission to the PhD program or permission of instructor.

693 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

CULTURAL STUDIES IN EDUCATION (271)


512 History of Women's Education (3) Historical study of the institutions and philosophies of education that have shaped the education of girls and women in the United States. 

526 Philosophy of Education (3) Description, interpretation, and critique of philosophical/theoretical arguments: truths, knowledge, and values in relation to education. 

539 Development of Education Thought (3) Historic and philosophic approach to lives and writing of influential educators: Plato, Quintilian, Comenius, Rosseau, Pestalozzi, Froebel, Dewey. Prereq: Graduate status and consent of instructor.

544 Survey of Contemporary Philosophies in Education (3) Current debates within various philosophical fields of study related to education.

545 Educational Sociology (3) Sociological analysis of American education system. Controversial social issues that affect education in system and potential solutions offered by various programs. Open to juniors, seniors, and graduate students.

548 Transforming Critical Thinking: Constructive Thinking and Educational Implications (3) Critique and transformation of critical thinking to more holistic, relational, and aesthetic model of multicultural and gender-sensitive constructive thinking; confronting power and addressing educational implications.

549 Topics in International Education (3) Historical, philosophical, and sociological foundations; selected nations and their cultures. May be repeated.

550 Multicultural Education (3) Introduction to history, varieties, theory and practice of multiculturalism and multicultural education. Addresses the promotion and critique of multicultural education and related concepts in theory and educational practice.

560 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research proposals. Overview of qualitative research methods: ethnography, case study, historiography, biography, oral and life history. Critical reading and evaluation of qualitative research studies.

561 Qualitative Research in Education Settings (3) Implementing and writing qualitative studies in educational settings. Qualitative data collection, analysis, and report writing. Prereq: 560 or equivalent.

590 Cultural Studies Seminar (2) Two-semester sequence (fall and spring); ongoing discussion about cultural studies: popular culture, interdisciplinary work, social justice issues. Presentations, videos, readings. May be repeated. Maximum 4 hours. Satisfactory/No Credit grading only.

591 Issues in Cultural Studies (3) Combination of theoretical readings in cultural studies and service learning for social justice project. Discussion of interdisciplinary, social justice and activism. Links between theory and practice of cultural studies.

592 Justice, Schools, and Sports (3) Social justice issues: education and sport practices. Social justice, moral commitments to others in educational and sport settings, and equal opportunity to acquire social goods and benefits. Prereq: Admission to doctoral program with concentration in cultural studies in education.

607 Advanced Seminar in the Social Foundations of Education (3) Interdisciplinary team-taught seminar. Readings selected by faculty and participants from classic studies and current periodical literature in anthropology, sociology, history, and philosophy of education. Part of general core for PhD program. Prereq: Doctoral student in Education.

608 Seminar in Philosophy of Education (3) Selected philosophical issues in education. Prereq: 2 courses in history or philosophy of education. May be repeated with consent of instructor.

609 Feminist Theories and Education (3) Theoretical research currently presented by feminist scholars questioning traditional (male) theories; application of these feminist theories to current feminist work in education.

625 Seminar in History of Education (3) Selected historical issues in education. Prereq: 2 courses in history or philosophy of education. May be repeated with consent of instructor.


CURRICULUM, EDUCATIONAL RESEARCH, AND EVALUATION (256)

520 Techniques of Research in Education (3) Study and application.

532 Instructional Research: Analysis and Application (3) Analysis of research on instruction. Translation and application of research findings into instructional performance.

534 Program Evaluation in Education (3) Issues and practices in planning and conducting program and curriculum evaluation in variety of settings. Fundamentals of design, measurement, philosophy, ethics, and underlying values; proper role and use of evaluation in educational organizations. Prereq: Consent of instructor. (Same as Educational Administration 534; Higher Education Administration 554.)

541 The High School Curriculum (3) Identification of problems associated with curriculum study, Tennessee curriculum framework, assessment of trends in programs of local, regional, and national significance.

552 School Law for Educators (3) Case and statutory material for public school educators; problems concerning law and public education.

557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Characteristics of students, curriculum designs, instructional patterns, and organization and structure of junior high and middle school.

558 Curriculum Planning and Development (3) Foundations and principles of curriculum planning and development. Historical analysis of curriculum theory, principles of planning and development, and classroom applications for improved learning.
500 Student Assessment (3) Processes for assessing student progress; interpretation and use of available assessment data. Methods of assessment other than tests and measurements: portfolios, performance tasks, exhibitions.

580 Techniques for Research in Curriculum and Instruction (3) Fundamentals of research methodology applicable to curriculum, instruction, and other areas of educational inquiry. Critical reading of research and development of skills needed for proposal development.

588 Instructional Theory and Design (3) Relationship of curriculum to instruction; examination of instructional and related learning theories; instructional models and teaching styles.

604 Seminar in Curriculum and Instruction (1) Required 2 consecutive semesters. Satisfactory/No Credit grading only.

623 Using Research for Curriculum Improvement (3) Research methodology; application to descriptive/survey curriculum materials. Critical reading of research, methodological development in descriptive and survey areas.

630 Seminar in Assessment and Evaluation (3) Trends and issues in student/client assessment, personnel evaluation, and program evaluation; and examination of current state, regional, and national assessment and evaluation projects. Prereq: Consent of instructor.

631 Application of Assessment/Evaluation (3) Systems designs, instruments, procedures, reporting formats used in personnel and program evaluation and student assessment; analysis, synthesis, and interpretation of data sets. Prereq: 630.

672 Interpretation and Application of Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction, newer methodologies and strategies. Utilization of research to improve curriculum and instruction practice, application of research principles in context of specific professional assignments. Prereq: Consent of instructor.

674 Designing and Implementing Personnel Assessments (3) Models and methods for assessing performance of educators and other professionals. Critique of systems currently in use and design of evaluation system.

675 Curriculum Evaluation: Theory and Application (3) Evaluation trends and issues. Theoretical frameworks to design evaluation studies for various educational programs.


DANCE (274)

415 Teaching Creative Dance for Children (2) Theory, methods, materials, and practical experience in presentation and integration of creative dance in grades K-6. Mini-teaching experience.

480 Dance Through the 19th Century (3) Dance of various societies and culture from pre-history through 19th century.

490 Dance in the 20th Century (3) History and philosophy of dance.

495 Dance Pedagogy (3) Principles and methods of teaching dance with practical application in mini-teaching experience. Prereq: Upper-class or graduate standing and consent of instructor. Different level of performance is expected of those registered for graduate credit.

510 Ballet: Level IV (2) Instruction and practice in advanced classical ballet techniques. Prereq: Consent of instructor. May be repeated. Maximum 8 hours.

520 Jazz: Level IV (2) Instruction and practice in advanced jazz styles and techniques. Prereq: Consent of instructor. May be repeated. Maximum 8 hours.

530 Modern: Level IV (2) Instruction and practice in advanced modern dance techniques. Prereq: Consent of instructor. May be repeated. Maximum 8 hours.

550 Dance Composition IV (3) Independent study applying choreographic and production skills, culminating in presentation of two works. Prereq: 440 Composition I and 445 Composition II or consent of instructor.

593 Independent Study (1-3) May be repeated.

ECOLOGY AND EVOLUTIONARY BIOLOGY (278)

410 Plant Evolutionary Morphology (4) Morphology, development, natural history, and evolution of fungi, cyanobacteria, non-vascular plants (algae and bryophytes), and vascular plants (ferns, fern allies, gymnosperms, and flowering plants). Prereq: Biology 102 or 110 or 130 or equivalent.

411-412 Minicourse in Ecology and Evolutionary Biology (2) Selected advanced topics in ecology, behavior, and evolutionary biology, concentrated in time and subject matter. Consult departmental listing for topics offered. Prereq: As announced. May be repeated. Maximum 4 hours. May apply toward departmental major.

414 Plant Anatomy (3) Cells, tissues and organs, their development in vegetative and reproductive structures of vascular plants—emphasis on seed plants. Prereq: Biology 111-112 or Biology 130-140 or equivalent.

419 Science as Method (3) Dynamic process of scientific discovery. Comparisons of science, non-science, pseudoscience, successful and unsuccessful science. Ethics of scientific research, philosophical aspects of scientific enterprise, and implications for teaching and writing about science. Prereq: Introductory science or philosophy course, or consent of instructor. (Same as Philosophy 419.)

421 Community Ecology (3) Interactions between individuals, species, communities, and environments—including competition, coexistence, predation, herbivory; causes and consequences of biological diversity; biological invasions; application of advanced sampling and analysis techniques; local to global environmental change. Periodic field trips or laboratories. Prereq: Biology 250 or equivalent.

433 Plant Ecology (3) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in ecosystems. Weekly field trips or laboratory periods, and at least two weekend field trips. Prereq: 330 or equivalent.

446 Introduction to Oceanography (4) Basic oceanography: physical, chemical, geological and biological processes and patterns. Oceanic subsystems: upwellings, polar oceans, hydrothermal vents, gyres, coral reefs, estuaries, and coastal regions. Field trip to coast required. Prereq: General Biology and Chemistry 120-130; Biology 250 recommended.

450 Comparative Animal Behavior (3) Principles and methods of ethology: ecological, developmental, physiological, and evolutionary aspects. (See Psychology 450.)

459 Comparative Animal Behavior Laboratory (3) Introduction to observational and experimental research in ethology. Coreq: 450. (See Psychology 459.)

460 Evolution (4) Principles, facts, and theories regarding biological evolution. Concepts, processes, and product in development of organic diversity. Historical development of ideas concerning biological evolution. 3 hours and 2 hours lab/discussion. Prereq: Biology 240 or consent of instructor.

461 Special Topics in Organismal Biology (3) Evolution, ecology, biogeography, classification, and anatomy of selected animal and plant taxa. Prereq: Biology 250 or consent of instructor. May be repeated if topic differs. Maximum 12 hours.
465 Evolutionary and Functional Vertebrate Morphology (4) A detailed study of the structure and function of the vertebrates. Analysis of evolutionary patterns of vertebrates using the comparative method and data from anatomy, developmental biology and functional morphology within a phylogenetic context. Laboratory requires intensive dissection to learn vertebrate anatomy, evolutionary trends and specializations. 2 hours and 2 labs. Prereq: Biology 250 or consent of instructor, Physics 221 recommended.

470 Aquatic Ecology (3) Introduction to the physiochemical nature of inland waters with description of biotic communities and their interrelationships. 2 hours and 1 lab. Prereq: Chemistry 120-130, Biology 250.

474 Ichthyology (4) Evolution, classification, collection and identification, distribution and biology of fishes: freshwater fauna of Eastern North America. 2 hours and 2 labs. Prereq: Biology 250 or consent of instructor.

484 Conservation Biology (3) Application of principles and techniques of ecological research to conservation of biological diversity at genetic, population, community, and ecosystem levels. Prereq: Biology 240, 250.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Ecology and Evolutionary Biology Seminar (1) Advanced topics in ecology, behavior, and evolutionary biology. Senior departmental majors encouraged. Required of all first- and second-year graduate students. May be repeated. Maximum 4 hours. Satisfactory/No Credit grading only.

504 Special Topics (1-3) Selected directed readings or special course in topics of current interest. Consult departmental listing for offerings. May be repeated with consent of instructor. Maximum 9 hours. Satisfactory/No Credit grading only.

508 Introduction to Faculty Research (1) Orientation of new graduate students to current research of departmental graduate faculty. Prereq: Admission to program in Ecology and Evolutionary Biology. Required of all first-year students. Satisfactory/No Credit grading only.

509 Foundations: Readings in Ecology (1-2) Readings and discussion of classic papers in field.

511 Foundations: Readings in Evolution (1-2) Readings and discussion of classic papers in field.

512 Foundations: Readings in Conservation Biology (2) Readings and discussion of classic papers in field.

514 Foundations: Readings in Mathematical and Computational Ecology (2) Readings and discussion of classic papers in field.

515 Foundations: Readings in Environmental Toxicology (1-2) Readings and discussion of classic papers in field.

524 Physiological Ecology of Animals (3) Adaptive physiological response of animals to natural changes in or extremes of physical and biotic environment. Terrestrial vertebrates. Prereq: Undergraduate courses in animal physiology and ecology, Biochemistry and Cellular and Molecular Biology 440 and Biology 250 or equivalent.

530 Advanced Taxonomy of Flowering Plants (3) Evolution and classification of families of angiosperms, local flora. 2 hours lecture and 1 lab. Prereq: 330 or equivalent.

535 Ecology and Development in the Amazon (3) Natural history, ecosystem diversity and function, and opportunities for sustainable economic development in the Amazon Basin. Includes field trip of 7-10 days to Manaus, Brazil.

540 Insect Taxonomy I: Major Orders (3) Survey of classification of major orders of insects, with practical experience in identification of insects at family level. 4 hours combined lecture and lab. Prereq: Consent of instructor.

541 Insect Taxonomy II: Minor Orders (3) Survey of classification of minor orders of insects, with practical experience in identification of insects at family level. 4 hours combined lecture and lab. Prereq: 540 or consent of instructor.

542 Insect Structure and Function (3) Integrated study of morphology and physiology at tissue and cellular level of insects. Prereq: Consent of instructor.

543 Aquatic Insects (3) Taxonomy and biology of aquatic insects; immature forms. 2 hours and 1 lab. Prereq: Consent of instructor.

544 Fresh Water Invertebrate Zoology (3) Ecology and taxonomy of fresh water invertebrates exclusive of insects. 3 hours lab and field study. Prereq: Comparative Invertebrate Biology or equivalent and consent of instructor.

545 Advanced Animal Behavior (3) Second-level course in ethology, stressing evolution, genetics, physiology, ecology, and human behavior. Prereq: 450 or equivalent. (Same as Psychology 545.)

546 Ethological Psychology (3) (See Psychology 546.)

547 Conceptual Foundations of Evolution and Behavior (3) (See Psychology 547.)

556 Ice-Age Environments and Global Climate Change (3) Glacial-interglacial climatic cycles and dynamic responses of landscapes within glacial, periglacial, and non-glacial environments across North America over past 2.5 million years. (Same as Geology 556.)

557 Quaternary Ecology (3) Perturbation, process, and pattern within Quaternary ecosystems; climatic change and vegetational response during last 2.5 million years. Prereq: Consent of instructor. (Same as Geology 557.)

560 Biometry (3) Statistical applications in biological research. Prereq: Statistics course or consent of instructor.

561 Environmental Toxicology (3) Basic concepts in toxicology; molecular toxicology and detoxification; reproductive toxicology; mutagenesis, teratogenesis, carcinogenesis, pathologic changes and environmental impact. Prereq: Biochemistry and Cellular and Molecular Biology 410, Organic Chemistry or consent of instructor. (Same as Biochemistry and Cellular and Molecular Biology 561.)

575 Ecological Genetics (3) Genetics of natural populations, using both single-locus and quantitative genetical approaches. Prereq: Statistics course.

577 Landscape Ecology (3) Ecological structure, function, and change through time of landscape mosaics; quantitative measures of landscape heterogeneity; responses of organisms to changes in landscape heterogeneity. Prereq: Biology 250 or equivalent or consent of instructor.

581-582 Mathematical Ecology (3,3) (See Mathematics 581-582.)

583 Zoogeography (3) Processes determining geographic distribution of animals and distribution and composition of animal communities. Prereq: Ecology course or consent of instructor.

585 Mathematical Evolutionary Theory (3) (See Mathematics 585.)

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.
595 Advanced Evolutionary Ecology (3) Advanced concepts in evolutionary and ecological genetics. Biogeography, climate, population genetics, evolution and natural selection, population growth and regulation, competition, niche, experimental ecology, predation, phylogenetics in ecology, biodiversity, and conservation. Prereq: General biology and general ecology; one or more courses on organismal biology (ecology, evolution) at the upper-undergraduate level or consent of instructor. Students cannot receive credit for both 495 and 595.

600 Doctoral Research and Dissertation (3-15) P/NP only.

602 Advanced Topics in Ecological Process and Structure (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in ecological process and structure. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

603 Advanced Topics in Evolutionary Biology (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in evolutionary biology. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

606 Advanced Topics in Conservation Biology (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in conservation biology. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

609 Advanced Topics in Comparative Animal Behavior (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in animal behavior. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

610 Advanced Topics in Mathematical, Theoretical and Computational Ecology (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in mathematical, theoretical, and computational ecology. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

611 Advanced Topics in Organismal Biology (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in organismal biology. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

612 Advanced Topics in Environmental Toxicology (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in environmental toxicology. Consult departmental listing for offerings. May be repeated with consent of department. Maximum 9 hours.

635 Environmental Assessment and Sustainable Development in Third World Countries (3) Concepts and methods of environmental impact assessment and risk assessment. Sustainable development concepts and issues in developing countries. The role of risk and impact assessment in achieving sustainable development. Prereq: Biology 250 or equivalent.

662 Seminar in the History of Botany (2) History of botanical exploration and advances from early civilization to modern periods. May be repeated. Maximum 4 hours.

681-682 Advanced Mathematical Ecology (3,3) (See Mathematics 681-682.)

ECONOMICS (283)

400 Special Topics (3) Topics vary. Prerequisites determined by department each time course is offered. Numerical grade is given to law students. Prereq: 201. May be repeated when topic varies. Maximum 9 hours.

413 Macroeconomic Fluctuations (3) Analysis of historical data, methods of analyzing macroeconomic fluctuations, theoretical explanations of cycles, and the role of monetary and fiscal policies in the aggregate economy. Prereq: 313 or consent of instructor. Writing-emphasis course.


462 Economics of Resources and Environmental Policy (3) Economic analysis of environmental policy and allocation of resources. Benefits and costs of development of natural resources and impacts of growth on environment. Major writing requirement. Prereq: 201.

471 Public Finance: Optimal Government Functions and Expenditure Analysis (3) Problems of collective consumption, external effects, public investment, social decision making. Major writing requirement. Prereq: 201.

472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual taxes and of tax systems, non-tax sources of revenue, fiscal federalism. Major writing requirement. Prereq: 201.

482 Introduction to Mathematical Economics (3) Application of basic mathematical tools: calculus, matrix algebra, etc. to major topics of economic theory. Prereq: Intermediate Microeconomics with B or better and Calculus.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

511-512 Macroeconomic Theory (3,3) Theory of consumer choice and demand, theory of revealed preference, attributes of goods and implicit prices, market demand, labor supply, individual behavior under uncertainty, theory of firm, theory of production and cost, market structures, derived demand and factor pricing, introduction to welfare economics, market failure and theory of second best, pure exchange.

513-514 Macroeconomic Theory (3,3) Dynamic general equilibrium models, endogenous growth theory, credibility of monetary policy, budget deficits and fiscal policy, consumption, investment, asset pricing, overlapping generations models, real business cycle, search theory, and open-economy macro models.


577 Environmental Economics and Policy Management (3) Interdisciplinary perspective on goals of sustainable economic development and environmental quality. Development of decision-making tools and conflict resolution.


600 Doctoral Research and Dissertation (3-15) P/NP only.

621 International Economics (3) Comparative advantage, trade migration, commodity composition of trade, protectionist devices, protectionist arguments, trade liberalization, U.S. trade policy, exchange rate determination, balance of payments adjustment, multinational corporations, and international capital flows. Prereq: 512 and 514.

622 International Finance (3) Analysis of macroeconomic adjustment in open economies, with attention to foreign exchange markets, balance of payments, international policy coordination, integration of world capital markets, liberalization of non-market economies and the international monetary system. Prereq: 512 and 514.

623 Economic Development: Theories and Policies (3) Principal theories explaining economic behavior in developing countries and policies and strategies used to promote development. Prereq: Undergraduate degree in economics or consent of instructor.

631 Industrial Organization I (3) Standard models of imperfect competition, oligopoly, and asymmetric information. Topics include pricing with market power and strategic decision making. Prereq: Consent of instructor.

632 Industrial Organization II (3) Economics of regulation and antitrust. Topics include public utility regulation, consumer product regulation, occupational safety regulation, environmental regulation and antitrust legislation. Prereq: Consent of instructor.

633 Monetary Theory (3) Study of money, credit, and liquidity as related to real output determination, interest rates, employment, and prices. Prereq: 513.

635 Topics in Monetary Theory (3) Advanced monetary models, issues in monetary policy, open economy monetary theory and policy. Student participation. Prereq: 651.

651 Regional and Urban Location and Development Theory (3) Theory of industrial and agricultural location and human migration. Economic basis for land-use patterns, central places, and urban form. Spatial inequalities and urban problems. National policies for regional and urban assistance.

662 Methods of Regional and Urban Analysis (3) Theory of regional/urban economic structure and growth. Regional income and product accounts, shift and share analysis, economic base studies, and regional/urban input-output models. Theory and problem solution.


672 Public Finance: Taxation and Intergovernmental Relations (3) Theory of taxation; tax incidence and tax efficiency; policy analysis of U.S. tax structure at federal, state, and local levels. Theory of fiscal federalism and intergovernmental relations.

677 Environmental and Natural Resource Economics (3) Alternative paradigms for allocating and valuing environmental resources. Exploration of issues related to market failure and differences between renewable and nonrenewable resources.

678 Economics of Environmental Policy (3) Topics in environmental policy analysis. Consideration of alternative policy instruments, defining policy objectives and role of risk in decision-making process.

682 Advanced Topics in Cross-Section Econometrics (3) Models with limited dependent variables, panel data analysis, nonparametric estimation, selection models and duration models. Prereq: 582-583 or equivalent.

683 Time Series Econometrics (3) Univariate and multivariate time series modeling of economic data-AR, MA, ARMA, VAR; models of non-stationary time series-unit roots, cointegration and error correction models; time series models of heteroskedasticity-ARCH, ARCH-M, GARCH; exogeneity and causality. Prereq: 582-583 or equivalent.

690 Workshop (3) Advanced topics in economics. Student participation. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

693 Independent Study (1-3) Directed research on topic of mutual interest to faculty and student. Variable title for transcript purposes. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

EDUCATION (289)

540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and in-service programs. May be repeated. Maximum of 6 hours. Satisfactory/No Credit or letter grade.

574 Analysis of Teaching for Professional Development (2) Strategies to document and analyze effectiveness of teaching and of professional development. Study and application of various approaches. Coreq: 575.

575 Professional Internship in Teaching (1-8) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to postbaccalaureate students in professional year program. Prereq: Admission to Teacher Education program. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

576 Practicum in Classroom Teaching (1-8) Teaching and teaching-related experiences in elementary and secondary school settings. Specific hours and school level assignment determined by licensure or certification requirements. May not be used for probationary licensure year. May not be used toward degree requirements. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

589 Field Experience (1-3) Application of curricular and instructional principles, methods, and materials in schools. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

591 Clinical Studies (4) Group and individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.

EDUCATION OF THE DEAF AND HARD OF HEARING (285)

415 Language Development of Deaf/Hard of Hearing I (3) Language problems of hearing impaired contrasted with scope and sequence of normal language development. Formal linguistic systems used to describe language development problems.

416 Language Development of Deaf/Hard of Hearing II (3) Developmental and remedial systems of teaching language to hearing impaired children. Comprehension and production differences, idiomatic and figurative structures. Prereq: 415 or consent of instructor.
419 Speech Development of Deaf/Hard of Hearing (4) Theories of speech development, approaches in training perception and production of speech, and aural habilitation. Practicum experiences.

424 Nature of Hearing Impairments (3) Basic principles of audiology: anatomy and physiology of hearing; nature and causes of hearing loss; methods and instrumentation for assessment of hearing level; interpretation of audiological services to medical and other rehabilitative disciplines.

425 Introduction to the Psychology and Education of the Deaf/Hard of Hearing (3) Primarily for those planning to teach hearing impaired. Overview of research related to psychology, social adjustment, communication methodology, language development and education of hearing impaired. Survey of literature. Visits to programs.

504 Clinical Experience in Teaching and Supervision of Exceptional Children (3-9) Placement in educational settings. May be repeated. Maximum 9 hours. Satisfactory/No Credit or letter grade. (Same as Special Education 504.)

509 Vocational Guidance and Career Planning With Hearing Impaired (3) Utilization of psychological, educational, social and vocational, diagnostic materials and resources appropriate for hearing impaired persons to provide guidance in career decisions and individualized rehabilitation plan.

523 Practicum with Deaf/Hard of Hearing (3) Receptive and expressive language capabilities of hearing impaired student. Designing, teaching, and post-testing unit of instruction for remediation of specific language errors.


529 Teaching Reading to Deaf/Hard of Hearing (3) Specific methods necessary to teach the prelingually hearing impaired student. Practice in preparation of developmentally appropriate reading materials. Methods which assist in integrating hearing impaired students in regular reading curricula and materials.

579 Special Topics (1-3) Prereq: Admission to graduate program. May be repeated. Maximum 9 hours. Satisfactory/No Credit or letter grade.

EDUCATIONAL ADMINISTRATION (293)

513 Administrative and Organizational Theory (3) Introduction to theoretical administrative and organizational foundations of management and leadership of educational programs and institutions. (Same as Higher Education Administration.)

515 Human Relations and Communication in Administration (3) Development and use of effective interpersonal communication skills and channels, inter-group relations, supportive work climates, personnel motivation, conflict management skills, and role of values, attitudes, and expectations in administration.

516 Research Methods (3) Descriptive, experimental, and quasi-experimental designs to help students without quantitative background to read and understand technical professional literature. Introduction to inferential statistics, needs assessments, and evaluation procedures. (Same as Higher Education Administration.)

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only.

523 Administration of Special Services (3) Legal, programmatic, and ethical responsibilities of educational administrators in design and implementation of special service programs within school settings. Special learner characteristics, program categories, service delivery models, and legal/ethical frameworks. Inclusion and full service delivery.

529 Politics and Public Relations in Education (3) School/community relations in political context of modern, complex society. Administrator and supervisory competencies: political, social, ethnic, cultural, and racial environments in which schools operate.

534 Program Evaluation in Education (3) (See Curriculum, Educational Research, and Evaluation 534.)

535 Administrative Applications of Micro Computers (3) DOS, word processing, data based management, spread sheets, and computer communications. Review and development of specific administrative applications: scheduling, attendance, student record systems, and accounting.

544 School Finance and Business Management (3) For prospective building level administrators. Financial and logical management tasks and procedures in individual school setting.

548 Supervision and Personnel Administration (3) Basic supervisory and personnel concepts and related competencies at the micro-organizational level: interviewing, personnel planning, collecting and maintaining employee information, supervision of personnel, performance appraisal and staff development.

553 Strategic Planning (3) Processes for improving decision-making function through use of both quantitative and qualitative planning techniques.

554 Policy Issues in Educational Law, K-12 (3) Logical arrangement of case and statutory materials for public school administrators and teachers; problems concerning law and public education.

560 Grant Writing and Project Management (3) Processes of finding funding for research efforts, writing grant proposals, negotiating with funding sources, implementing and maintaining funded programs, and closing out projects at end of funding support.

577 Educational Statistics (3) (See Educational Psychology 577.)

580 Internship in Educational Administration (3) Field experience in appropriate educational setting working directly with administrator. At end of planned program of study. Placement by department assignment. May be repeated. Maximum 6 hours.

583 Educational Leadership-Principalship (3) Knowledge, skills and relationships for principals to be effective educational leaders.

592 Field Problems in Educational Administration and Supervision (3) May be repeated. Maximum 6 hours.

596 Seminar in School Leadership, K-12 (3) On-site study of quality school processes throughout region. May be repeated. Maximum 6 hours.

605 Advanced Seminar in Administrative Theory (3) (See Higher Education Administration 605.)

606 Leadership Forum (1-3) Development of research, evaluation, policy analysis skills and critical analysis and evaluation of philosophical principles undergirding American education. Continuous enrollment for 2 years, on-campus. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only. (Same as Higher Education Administration.)

610 Internship in Educational Administration (3) Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical tasks of educational administration under supervision of practitioner and University representative. May be repeated at discretion of student's committee. Maximum 12 hours. Satisfactory/No Credit grading only.

614 Statistics for Educational Administrators (3) An introductory statistics course that focuses on the application of statistical procedures to problems in educational administration. Included are: scales of measurement, hypothesis testing, and descriptive and inferential statistical techniques. Computer applications are explored. (Same as Higher Education Administration 614.)
615 Research Design (3) The foundations of designing, conducting, and evaluating quantitative, qualitative, and mixed-methods research and the philosophical assumptions underlying these approaches. Topics covered include: identifying a research problem, reviewing the literature, specifying a purpose, writing research questions and hypotheses, and collecting and analyzing data. (Same as Higher Education Administration 615.)

616 Research Methods (3) The techniques of multiple regression, analysis of covariance, and multivariate analysis as applied to problems in educational administration. Computer applications are explored. Prereq: 614 (Same as Higher Education Administration 616.)

617 Case Study Methods in Educational Research (3) Methods, techniques and strategies consistent with case study approaches to inquiry in educational and related settings. Prereq: 615 (Same as Higher Education Administration 617.)

629 Seminar in Policy Issues in Education (3) Local, state, and federal education policy: theory analysis, development and implementation. Why education policy is changing rapidly, ways to follow and influence education policy, and conceptual frameworks to use for future understanding. (Same as Higher Education Administration 629.)

646 Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation.

656 Legal Issues in Education (3) School law; constitutional foundations as they relate to public education at state and local levels.

658 Conflict Management (3) (See Higher Education Administration 658.)

670 Values and Ethics in Educational Leadership (3) (See Higher Education Administration 670.)

680 Administration of Complex Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational programs and organizations. (Same as Higher Education Administration 680.)

EDUCATIONAL INTERPRETING (287)

431-432 American Sign Language III, IV (3,3) Fluency of expressive and reception sign communication skills. Use of language in context. Grammatical structures of ASL and cultural implications of deaf community. Must be taken in sequence. Prereq for 431: 226 or consent of instructor. Prereq for 432: 431 or consent of instructor.

435 Linguistics of American Sign Language (3) Introduction to grammatical and linguistic structures of ASL. Language variations, discourse, bilingualism and language contact also covered in this course. Course conducted in ASL. Prereq: 431 or consent of instructor. Satisfactory/No Credit or letter grade.

EDUCATIONAL PSYCHOLOGY (310)

431 Personality and Mental Health (3) (See Counselor Education 431.)

460 Self-Management in the Helping Professions (3) Applications of self-management strategies to career, social, emotional, and health domains for both helping professionals and their clientele. Prereq: Introductory course in psychology or consent of instructor. Satisfactory/No Credit or letter grade.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

504 Special Topics (1-3) Instructor-initiated course offered at convenience of unit on topics of current interest. May be repeated. Maximum 15 hours. Satisfactory/No Credit or letter grade.

505 Quasi-Experimental and Single-Subject Design Research (3) History, theory and research design techniques used to examine cause and effect relationships during applied psychoeducational research. Focus on controlling threats to internal validity through research design.

507 Survey of Educational Psychology (3) Historical developments and current issues; analysis of concepts, principles, techniques and models as they are used to facilitate teaching and learning and the creation of effective educational environments.

509 Internship in Adult Education (3) Practical field experiences in selected settings under supervision of practitioner and departmental representative. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

510 Psychological Theories of Human Development Applied to Education (3) Theory and research on emotional, social, and intellectual development over life span with applications to educational and therapeutic settings.

513 Reflective Practice in Education and Psychology (3) Concepts, theories and processes of reflective practice applied to educational settings.

514 Individual Study in Adult Education (3) Prereq: Consent of supervising instructor. Approval form must be completed in office of unit head. May be repeated. Maximum 6 hours.

515 Educational Applications of Behavioral Theories of Learning (3) Behavioral theories and research, conditioning, observational learning, and ethological learning as systems apply to student motivation, discipline and learning.

516 Educational Applications of Cognitive Learning Theories (3) Cognitive theory and research, social learning, attribution and information processing as applied to education.

517 Direct Assessment and Interventions for Academic Skills Deficits (3) Theory, techniques and procedures shown to prevent and remedy academic skills deficits; curriculum-based assessment and direct intervention procedures.

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only.

520 Survey of Adult Education (3) Historical development, philosophies of adult education agencies, associations, programs, issues, and literature illustrating process of adult education and diversity of continuing education. Prereq: Consent of instructor.

521 Program Development and Operation in Adult Education (3) Theories and methods from research to practice in planning and operating adult education programs. Prereq: Consent of instructor.

522 Adult Development (3) Theory and research in adult development and change over lifespan and its implications for adult learning in formal and informal contexts.

523 Post-Secondary Education for Adults (3) History, evolution, philosophy, structure and functions of post-secondary, sub-university institutions, their programs and clientele. Prereq: Consent of instructor.

524 Continuing Professional Education (3) Theories and concepts supporting design and management of educational programs for adults in professions. Prereq: 520 or equivalent.

525 Characteristics of Adult Learners (3) Key characteristics of adult learners, current theory and research on adult learning, and implications for teaching and learning concepts.

527 Controversies in Adult Education (3) Controversies confronting the field of adult education; development of critical analysis skills by looking at controversies from different perspectives.

528 Psychology of Aging (3) Theory and research of aging and gerontology related issues: psychological and related physiological changes that occur in later life stages of human development. Implications for treatment programs and policy.

529 Facilitating Adult Learning (3) Theory, research, and practice related to working with adults in teaching-learning situations.

530 Methods of Collaborative Inquiry (3) Philosophical and theoretical frameworks for designing and conducting collaborative inquiry projects. Practice in conducting research.

540 Seminar in School Psychology (3) Essentials of theory and practice of school psychology as professional specialty. Consideration of history and current issues in school psychology.

541 Psychoeducational Assessment (3) Direct, psychometric and naturalistic assessment methods in learning environments. Prereq: Admission to school psychology program or consent of instructor, and Counselor Education 525 or equivalent. May be repeated. Maximum 6 hours.

542 Practicum in Psychoeducational Assessment (3) Application of assessment skills to clients in learning environments. Coreq: 541 or consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

545 Psychoeducational Consultation (3) Use of two and three-person models of consultation in educational and therapeutic settings based on behavioral, ecological, social learning and cognitive-behavioral theories.

546 Practicum in Consultation (3) Application of consulting skills to educational settings. Prereq: 545.

549 Internship in School Psychology (1-6) Supervised employment in unit approved school psychology internship sites. Prereq: Enrollment in school psychology program and consent of instructor. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

550 Statistics and Research Design: Conceptual (3) Content-oriented, conceptual treatment of statistics, research design, and quantitative basis of testing

560 Discipline and Conflict Resolution (3) Applications of major models of discipline and conflict resolution strategies in development of constructive atmosphere for classroom learning.

569 Internship in Educational Psychology (3) Supervised employment in unit approved educational psychology internship sites. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

572 Cognitive Education: Models and Approaches (3) Models and approaches in field of cognitive education: research and theoretical support for various program components, critical variables of organizational learning that affect success of implementation.

573 Meeting Needs of Nontraditional and Underachieving Learners (3) Exploration of students’ needs at any age and level of functioning who are not progressing up to their fullest potential. Causes of academic and motivational problems, and approaches to overcome them. Learning to learn, cultural alienation, and personal world view and interaction with effective teaching and learning.

574 Facilitating Group Change (3) Practical issues of group change. Analyses of group and individual experiences in all types of educational settings in relation to systems theory and collaborative learning theory. Needs of individuals and groups involved in change and roles of inside and outside change agents.

577 Educational Statistics (3) Applications of descriptive and inferential statistics to educational and instructional problems. Use of Internet sites and computer programs to analyze data. Prereq: One year of college mathematics, an elementary course in statistics, or consent of instructor. (Same as Educational Administration 577.)

585 Seminar in Gerontology (1) (See Health 585.)

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Professional Seminar (1) An introduction to doctoral study in Educational Psychology and Counseling that explores research requirements, the meaning of scholarship in academe, resources, survival strategies for students, and related topics. Prereq: Admission to a doctoral program in the Educational Psychology and Counseling Department. May not be used to meet the Educational Psychology 600 or Counselor Education 600 requirement. Satisfactory/No Credit grading only. (Same as Counselor Education 601.)

602 Directed Research (1-3) Instructor- or student-initiated group investigation of empirical and theoretical problems in educational and counseling psychology. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

604 Special Topics (1-3) Instructor-initiated courses offered at convenience of unit on topics of interest. May be repeated. Maximum 15 hours. Satisfactory/No Credit or letter grade.

609 Advanced Seminar in Curriculum and Learning (3) Team-taught interdisciplinary seminar: trends, themes, and issues in curriculum and learning. Reading and discussions based on significant research and scholarly publications.

620 Seminar in Adult Education (3) Issues in adult education, theories and concepts, philosophical positions, research trends and methodologies. Prereq: 520 or equivalent.

621 Advanced Seminar in Program Planning (3) Concepts, principles, and theories related to program planning in adult education. Prereq: 521 or equivalent.

622 Advanced Seminar in Adult Development and Learning (3) Adult development and adult learning theory and research. Prereq: 522, 525, or equivalent.

630 Doctoral Seminar in Collaborative Learning (3) Issues, theories, concepts and research in collaborative learning. Prereq: Admission to EdD in Educational Psychology and Counseling: collaborative learning concentration. May be repeated. Maximum 12 hours. Satisfactory/No Credit or letter grade.

635 Ethical, Legal, and Professional Issues in Psychology (3) (See Psychology 635 and Counselor Education 635.)

640 Seminar in Applied Educational Psychology (2) Issues, theories, concepts and research in applied educational psychology. Prereq: Admission to PhD in Education. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

649 Advanced Internship in School Psychology (1-9) Supervised experience as school psychologist in unit-approved internship site for doctoral level students. Prereq: Enrollment in doctoral level school psychology program and consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.
650 Professional Practice in School Psychology (1) Field setting to facilitate academic, social and interpersonal development of children and adults. School and mental health settings for intervention, consultation, prevention, and assessment services. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

655 Research in Psychoeducational Studies (1) Data analyses, collection, and interpretation. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.


663 Scale Construction (3) Development, pilot testing, and revision of attitude inventories, rating scales, and other paper-and-pencil techniques for assessing beliefs, personality characteristics, and opinion. Prereq: Counselor Education 525, and two-course sequence in statistical analysis.

665 Analysis of Research in Instructional Technology (3) Research on human learning, design of learning environments. Analysis of teacher behavior, text development, computer software design and video presentations.

668 Practicum in Instructional Planning (3) Development and management of course or program of instruction in educational psychology. Prereq: 665, or consent of instructor.

669 Internship in Educational Psychology (1-6) Supervised employment in unit approved educational psychology internship sites. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

671 Mediated Learning Theory (3) Feuerstein’s theory of mediated learning experience and its connections to work of Piaget, Vygotsky and others. Implications for transformational learning and building of learning communities for learners of all ages. Prereq: Admission to doctoral program or consent of instructor.

673 Collaborative Learning (3) Theories of collaborative learning and research related to facilitating collaborative learning in professional practice settings. Prereq: 513 and 671 or consent of instructor.

677 Advanced Educational Statistics (3) Applications of parametric and nonparametric statistical inference to educational and instructional problems. Use of computer programs and internet sites in analyzing data. Prereq: 577.

690 Psychopathology of Childhood (3) Descriptive and critical study of psychopathology of childhood and of systems of nomenclature applied to individuals with mental disorders: nomenclature provided in State Department of Education’s Student Evaluation Manual and Diagnostic and Statistical Manual of Mental Disorders of American Psychiatric Association.

693 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

**ELECTRICAL AND COMPUTER ENGINEERING (319)**

Note: Courses cannot be used in the electrical engineering undergraduate curriculum unless required for either the MS or PhD programs. No 400-level course may be used toward a graduate degree in electrical engineering except when required by the program.

400 Senior Design (5) A major design project that focuses the student’s attention on professional practice, accumulated background of curricular components, and recent developments in the field. This major design emphasis is directed to topics within the field of electrical engineering. Includes Level 3 design projects which require laboratory work. Prereq: 316, 335, 342, 355.


421 Electric Energy Systems (3) Structure and operation of electrical energy grid; load flow; economic loading; planning; control; reliability. Balanced and unbalanced faults; system protection; system stability. Level 1 design projects. Prereq: 316, 325.


432 Electronic Amplifiers (3) Feedback amplifier principles; wideband linear amplifier design; low-noise preamplifier design; audio power amplifier design. Introduction to radio-frequency amplifier design; oscillator principles. Includes laboratory experiments and design projects. Includes Level 2 design projects which require laboratory work. Prereq: 431.

441 Digital Communication (3) Quantization and pulse code modulation. Binary and Mary signaling, spectra of line codes, link budget analysis, binary communication in presence of noise, matched filtering and equalization, bandpass digital transmission, introduction to multiple access techniques. Level 1 design projects. Prereq: 342.

442 Communication System Design (3) Application of communication theory to system design. Hardware and software design and simulation. Modern communication topics. Includes Level 1 design projects. Prereq: 441.

443 Antennas and Propagation (3) Introduction to antenna theory: fundamental antenna concepts and parameters (directivity, gain, pattern, etc.) and signal propagation. Theory and design of linear and loop antennas, arrays, and other simple antennas. Level 1 design projects. Prereq: 316, 341, 342.

446 Electromagnetic Compatibility (3) Principles and practices to avoid interference among and within electrical devices. Parameters and coupling for dipole, biconical, and log-periodic antennas. High frequency effects in circuit elements. Radiated and conducted emissions and susceptibility. Crosstalk, shielding, electrostatic discharge, and EMC regulations. Level 1 design projects that require laboratory work. Prereq: 316, 341, 342.

451 Computer Systems Architecture (3) Architecture and design of microcomputer systems with microprocessors or microcontrollers. Instruction set architectures, software interfaces, processor structures, memory hierarchy, interfacing. Level 1 design projects that require laboratory work. Prereq: 355.
453 Introduction to Computer Networks (3) Principles of computer networking and software design of network protocol with an emphasis on the internet and TCP/IP protocol suite. Includes Level 1 design projects. Prereq: 206.

471 Introduction to Pattern Recognition (3) Statistical decision theory, adaptive classifiers, and supervised and unsupervised learning. Application of techniques in areas of current interest: face recognition, speech processing, remote sensing, data mining and bioinformatics. Level 1 design projects. Prereq: 316. Non-majors require consent of instructor.


481 Power Electronics (3) Principles and characteristics of power semiconductor devices, single-phase and polyphase phase controlled converters, converter control, ac voltage controller. Level 1 design projects and laboratory work. Prereq: 316, 325, 336.

482 Power Electronic Circuits (3) Voltage-fed inverters, PWM principles, control of inverters, dc-dc converters, de machine drives, resonance converters, step motor drives, brushless de machine principles. Includes Level 1 design projects. Prereq: 481.

491 Special Topics (3) Basic design and current practice. May not be repeated to satisfy senior requirements for graduation. Prereq: Completion of all junior Electrical and Computer Engineering courses or consent of instructor. Level 1 or 2 design projects that may require laboratory work.

495 Senior Seminar (1) Current topics. Prereq: Completion of all junior Electrical and Computer Engineering courses or consent of instructor. Satisfactory/No Credit or letter grade.

500 Thesis (1-15) P/NP only.

501 Project in Lieu of Thesis (3) Capstone course taken under supervision of student’s major professor and master’s committee. Individual project involving literature survey, development of some software or hardware, testing, writing a white paper or journal paper, or other suitable project. Prereq: Consent of graduate committee. May be repeated. Maximum 15 hours.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.


504 Random Process Theory for Engineers (3) Probability and random variables as approached by set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis as applied to response of systems to random signals.

505 Digital Signal Processing I (3) Discrete-time signals and systems, sampling, fast Fourier transform (FFT) and fast convolution, design of FIR filters and IIR filters.

506 Digital Signal Processing II (3) Filter properties in the Z and Fourier transform domains, structures for digital filters, sampling and reconstruction, hardware implementation of digital filters.

507 Application of Linear Algebra in Engineering Systems (3) (See Chemical Engineering 507.)

509 Multidisciplinary Project (1) (See Industrial Engineering 509.)

511 Linear Systems Theory (3) State space models of linear dynamical systems, linear algebra, state transition map, matrix exponential, controllability, observability, realization theory, and stability theory. Coreq: 507.

512 Multivariable Linear Control System Design (3) Design of controllers, for multivariable systems, which satisfy constraints on robustness to plant uncertainties, disturbance rejection, command following. Prereq: 511.

521 Power Systems Analysis I (3) Matrix-vector representations of power networks, sequence modelling of power system components, unbalanced shunt and series faults. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 421 or equivalent.

522 Power Systems Analysis II (3) Operation and control of interconnected power systems, transient and dynamic stability. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 521.

523 Power Electronics and Drives (3) Forced commutated inverters, advanced PWM techniques, current-fed inverters, drive system modeling, vector and scalar control of induction machines, parameter variations, control principles of synchronous machine.

525 Alternative Energy Sources (3) Energy outlook, interconnection issues of distributed energy resources, efficiency of power production, electric energy conversion and storage. Photovoltaics, fuel cells, wind turbines, microturbines.

531 Advanced Analog Electronics I (3) Physical operation of modern electronic devices; semiconductor devices: diodes, bipolar transistors, J-FETs, and MOS-FETs. Small-signal equivalent circuits and noise models of active devices. Project laboratory. Prereq: 431, 432, or consent of instructor.


541 Electromagnetic Fields (3) Maxwell’s equations, special relativity, wave reflection and transmission, generalized media, guided waves, radiation from current elements. Prereq: Mathematics 404.

542 Communication Systems Simulation (3) Simulation is used as a design and performance evaluation tool for communication systems. Simulation models for stochastic signals and system components including decoders, modulators, non-linear power amplifiers, bit and carrier synchronizers, equalizers and receivers are discussed along with the error effects resulting from the use of these models. Techniques for modeling time-varying and nonlinear systems are included. Monte Carlo techniques, semi-analytic techniques and variance reduction methods are covered.


545 Introductory Microwave Networks and Components (3) Scattering and transfer representation for multiports; unilateral and bilateral microwave and millimeter wave devices. Component and system parameter measurement by modern network analyzers. Electronic oscillators and amplifiers, frequency sweep oscillators, transit time devices, parametric devices, mixers, switches.


552 Digital System Design II (3) State identification and structure realizations of sequential machines. Digital system architecture design: microprogramming and interrupt control. Prereq: 551.

553 Computer Networks (3) Principles of computer networks with a focus on the Internet and TCP/IP protocol suite. In-depth study of several core issues and design options involved. Employs a top-down approach in the discussion from the application layer down to the physical layer. An emphasis is given on protocol design and performance analysis. Other topics include ad-hoc networking, network security and network simulation. Assignments that require hands-on networking and programming skills will be issued in order to solve concrete problems.

554 Computer Architecture and Design (3) An exploration of the central issues in computer architecture: instruction set design, addressing and register set design, control unit design, microprogramming, memory hierarchies (cache and main memories, mass storage, virtual memory), pipelining, bus organization, RISC (Reduced Instruction Set Computers), and CISC (Complex Instruction Set Computers), implementation issues, technology trends, architecture modeling and simulation. Prerequisites: none.

561 Plasma Diagnostics I (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor-based data handling and analysis, and reduction of time series data. Prereq: 461, 463, or consent of instructor.

562 Plasma Diagnostics II (3) Laboratory instruction in operation of plasma diagnostic instruments in plasma science laboratory, experience with high voltage, vacuum, RF, and digital data handling techniques. Prereq: 561.

565 Industrial Plasma Engineering I (3) Low temperature plasma physics relevant to industrial applications: kinetic theory, particle dynamics in electric and magnetic fields, gaseous discharges, and electron, ion, and plasma sources. Prereq: Graduate standing or consent of instructor.

566 Industrial Plasma Engineering II (3) Continuation of 565 to industrial applications: ion implantation in solids, plasma deposition and etching, space propulsion systems, plasma chemistry, plasma lighting devices, insulating dielectrics and breakdown, materials processing with plasma arcs, and related topics. Prereq: 565 or consent of instructor.

571 Pattern Recognition (3) Decision-theoretic and structural approaches to pattern recognition. Deterministic and statistical decision rules, feature extraction and representation, syntactic and semantic methods. Prereq: 471 or consent of instructor.


573 3D Methods in Robot Sensing, Vision and Visualization (3) Tools used in image synthesis and analysis, 3D recovery by nonlinear estimation. Projective geometry, analytic photogrammetry, range sensing, lighting models, differential geometry, and 3D rendering.

574 Advanced Computer Vision (3) Principles and methods for analysis of time and/or space varying imagery. Imaging physics and color theory, shape-form-X, feature correspondence and tracking, stereo vision, structure from motion, optical flow, motion-based segmentation, and selected topics form current literature. Prereq: 573 or consent of instructor.

575 Computer Networks (3) Principles of computer networks with a focus on the Internet and TCP/IP protocol suite. In-depth study of several core issues and design options involved. Employs a top-down approach in the discussion from the application layer down to the physical layer. An emphasis is given on protocol design and performance analysis. Other topics include ad-hoc networking, network security and network simulation. Assignments that require hands-on networking and programming skills will be issued in order to solve concrete problems.

577 Decision Theory and Machine Learning (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor-based data handling and analysis, and reduction of time series data. Prereq: 461, 463, or consent of instructor.

578 Artificial Intelligence (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor-based data handling and analysis, and reduction of time series data. Prereq: 461, 463, or consent of instructor.

579 Computer Networks (3) Principles of computer networks with a focus on the Internet and TCP/IP protocol suite. In-depth study of several core issues and design options involved. Employs a top-down approach in the discussion from the application layer down to the physical layer. An emphasis is given on protocol design and performance analysis. Other topics include ad-hoc networking, network security and network simulation. Assignments that require hands-on networking and programming skills will be issued in order to solve concrete problems.

580 Advanced Plasma Diagnostics (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor-based data handling and analysis, and reduction of time series data. Prereq: 461, 463, or consent of instructor.

581 Plasma Diagnostics I (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor-based data handling and analysis, and reduction of time series data. Prereq: 461, 463, or consent of instructor.
631 Advanced Topics in Electronic Instrumentation I (3) Based on particular interests of students. Fundamental physical processes in instrumentation transducers: thermoelectric, magnetoelectric, electromechanical and quantum-mechanical devices. Prereq: 531-32 and consent of instructor.


642 Wireless Communications (3) Fundamental theory and design of wireless communications systems; mobile radio propagation; modulation techniques; coding, diversity and equalization. Wireless systems and standards. Prereq: Satisfactory completion of 441 and 504.

643 Detection and Estimation Theory (3) Detection theory; coding theory; system identification. Signals with unknown parameters; optimal filter synthesis; adaptive systems; sequential detection; suboptimal detection. Prereq: 504 or consent of instructor.

644 Coding and Information Theory (3) Structure of algebraic and probabilistic codes; linear codes, convolutional codes, error-correcting codes, decoding methods. Identification schemes: deterministic, stochastic, and hierarchical methods. Prereq: 643.

651 Computer-Aided Design of VLSI Systems I (3) Fabrication of microelectronic devices; computer architecture design; algorithmic state machines; partitioning; structured design methodology. Prereq: 551-552 or consent of instructor.

652 Computer-Aided Design of VLSI Systems II (3) Computer-aided design tools; design and implementation of fully custom very large scale integrated (VLSI) circuits; design for testability; testing of fabricated chips. Prereq: 651.

653 Advanced Computer Networks (3) Topics of current interest to students and faculty: high-speed Internet switch/router architectures, routing algorithms and protocols, network performance analysis and packet scheduling algorithms. Coursework will include theoretical as well as practical (simulation-based) assignments. Prereq: 553 and consent of instructor.

657 Advanced Computer Architecture and Design (3) Advanced computer architecture issues including topics such as superscalar architectures, parallel algorithms, principles of parallelism detection and vectorizing compilers, interconnection networks, SIMD/MIMD machines, processor synchronization, shared and distributed memory, data coherence, multiprocessors, multicomputers, dataflow machines, special purpose processors. Prereq: 557.

658 Computer and Telecommunications Systems Performance Evaluation (3) Introduction to the basic tools of computer and communications systems analysis and evaluation. Deterministic and stochastic modeling concepts are presented. Queuing theory and discrete event (DES) simulation methods are studied with application to a variety of examples drawn from the computer and communications performance evaluation literature. A standard DES language is used in modeling and simulation studies. Topics of current interest such as computer input/output models, mass memory, bus models, and communications network models are discussed. A modeling project is typically required. Prereq: 504.

659 Digital Systems Verification (3) Three critical issues for robust digital systems are design errors, manufacturing faults, and failures during operation. This course covers digital system verification, testing, and reliability for both timing and logic, in order to prepare students to deal with these in real designs. Verification will cover formal verification for logic and timing, and contrast with simulation. Methods for generating test vectors, scan testing, and built-in self test will be covered. MTBF will be calculated for several small systems with emphasis on models and their limitations. Prereq: 551, 557.

663 Advanced Plasma Physics I (3) Basic concepts of high temperature plasma physics. Magnetohydrodynamics and kinetic descriptions of plasma, plasma transport, plasma waves, equilibrium, and stability. Prereq: Physics 541-542, 461-462 or 563-564, or consent of instructor.

664 Advanced Plasma Physics II (3) Plasma heating and radiation phenomena. Advanced topics of current interest. Must be taken in sequence. Prereq: 663.

671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, multi-sensor systems. Prereq: 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereovision, shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning and navigation. Prereq: 672.

691 Advanced Graduate Seminar (1) Research in department. May be repeated. Satisfactory/No Credit or letter grade.

692 Special Topics (1-3) Advanced topics of current interest to PhD students in Electrical Engineering. May be repeated. Maximum 9 hours.

ELEMENTARY EDUCATION (322)

421 Elementary and Middle School Science and Social Studies Instruction (3) Methods and materials for teaching science and social studies. Development of functional relationships and entities of two fields. Not open to students with recent course or background in teaching science and/or social studies. Prereq: Admission to teacher education.

429 Language Arts/Reading Instruction in Elementary and Middle Schools (3) Language and language development as applied to teaching of oracy (listening-speaking) and aspects of literacy (reading process/readiness and writing). Not open to students with recent course in language arts methods. Prereq: Admission to teacher education.


504 Studies and Theory in Language Development (3) Studies and theory of language development in children. Prereq: 1 elementary school language arts course or consent of instructor.

505 Elementary and Middle School Teaching Methods II (6) Applied methods of teaching reading, language arts, science, social studies and mathematics: accommodation strategies for students with diverse needs. Prereq: Elementary and Middle School Teaching Methods I. Coreq: 575.

515 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students’ programs. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.


527 Elementary School Curriculum (3) Examination, evaluation and application of curriculum designs in elementary school. Trends and issues which affect elementary education. Prereq: Consent of instructor.

528 Teaching Language Arts Elementary and Middle School (3) Recent trends and current materials and methods in teaching elementary language arts (except reading). Prereq: Course in language arts or consent of instructor.
529 Practicum in Diagnosis and Remediation of Difficulties in Learning Mathematics (3) Assessment and practicum experience with children having difficulties in learning elementary school mathematics. Prereq: 523 or consent of instructor.

550 Assessment and Correction of Language Arts Difficulties (3) Procedures and materials for diagnosing and correcting language arts difficulties; analysis of children’s work. Prereq: At least one language arts course or consent of instructor.

566 Curriculum for Early Childhood Education (K-3) (3) Theoretical foundations and current research in content and skill areas of curriculum for kindergarten-grade 3; application to local school setting. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

567 Application of Theory in Early Childhood Education (K-3) Principles and practices from selected theoretical orientations. Prereq: Course in early childhood education or consent of instructor. May be repeated. Maximum 6 hours.

584 Seminar in Early Childhood Education (3) Analysis of research and theory in early childhood education; educative process of young children. Prereq: Course in early childhood education. May be repeated. Maximum 6 hours.

606 Research in Elementary Education (3) Analysis of research in elementary education with application to classroom teaching. Prereq: Research course.

650 Advanced Studies in Early Childhood Education (3) Prereq: 2 graduate courses in early childhood education and consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

651 Advanced Studies in Elementary School Language Arts (3) Selected issues in elementary school language arts. Prereq: Graduate course in elementary school language arts or consent of instructor.

ENGINEERING MANAGEMENT (328)

501 Capstone Project (3-6) Application-oriented project to show competence in major academic area. Prereq: Enrollment in engineering management. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

532 Productivity and Quality Engineering (3) Productivity and quality measures defined and used to analyze current competitive position of important sectors of American industry with respect to national and international competition. Study of management theorists and systems which promote or inhibit productivity or quality improvements.

533 Theory and Practice of Engineering Management (3) Principles of engineering management, including: business and organization design, culture, leadership, marketing and competition in global economy, motivation and performance management, empowerment, organizational behavior, and diversity. Systems thinking, learning organizations, and systems dynamics modeling. Principle application to work settings and case studies.


535 Management of Technology (3) Creativity and innovation; incorporation of advanced technology equipment; application of systems thinking; new methods in business and manufacturing organizations; justifying technology; assimilating and managing change; changing management roles; and impacts of new technologies. Prereq: 539 and Industrial Engineering 518.

536 Project Management (3) Development and management of engineering and technology projects. Project proposal preparation; resource and cost estimating; and project planning, organizing, and controlling: network diagrams and other techniques. Role of project manager: team building, conflict resolution, and contract negotiations. Discussion of typical problems and alternative solutions. Case studies and student projects. Prereq: 537 or consent of instructor.

537 Analytical Methods for Engineering Managers (3) Survey of management analysis and control systems through IE techniques. Qualitative and quantitative systems: methods analysis, work measurement, incentive systems, wage and salary development, production and inventory control, facility layout, linear programming, and applied operations research techniques. Not for credit for students with undergraduate degrees in industrial engineering.

538 New Venture Formation (3) Factors other than mechanical or chemical which enter into successful establishment of manufacturing or service enterprise. Organizational and financial planning and evaluation. Cost and location studies and market analysis to determine commercial feasibility of new ventures. Prereq: 539.

539 Strategic Management in Technical Organizations (3) Strategic planning process and strategic management in practice; corporate vision and mission; product, market, organizational, and financial strategies; external factors; commercialization of new technologies; and competition and beyond. Prereq: 533 and Industrial Engineering 518 or consent of instructor.


543 Legal and Ethical Aspects of Engineering Management (3) Legal aspects imposed by government and ethical considerations in engineering practice. Selected readings, lecture, discussion, and student presentations. Current topics from government and industry.

ENGINEERING SCIENCE (335)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.


528 Ceramic Matrix Composites: Material and Mechanics (3) Micromechanics and microstructural design; fabrication of ceramic matrix composites; interface characterization and mechanics; electron microscopy examination; nondestructive evaluation; fracture; fatigue; applications. Prereq: Consent of instructor. (Same as Materials Science and Engineering 528.)

529 Fatigue of Engineering Materials (3) Fatigue life prediction, crack initiation, crack propagation. Variable amplitude loading, multi-axial loading, environmental fatigue, creep fatigue, metallurgical and microstructural variables, fractography, non-metals. Prereq: Consent of instructor. (Same as Mechanical Engineering 534.)

530 Continuum Mechanics (3) Cartesian tensors, transformation laws, basic continuum mechanics concepts; stress, strain, deformation, constitutive equations. Conservation laws for mass, momentum, energy. Applications in solid and fluid mechanics. (Same as Aerospace Engineering 539; Biomedical Engineering 539; Mechanical Engineering 539.)

531 Fluid Mechanics I (3) (See Mechanical Engineering 541.)

532 Fluid Mechanics II (3) (See Mechanical Engineering 542.)

533 Dynamics (3) (See Mechanical Engineering 533.)

534 Mechanical Vibrations (3) (See Mechanical Engineering 534.)

552 Computational Fluid Dynamics (3) Modern discrete approximation procedure for incompressible-thermal flows: Navier-Stokes equations, turbulence, heat transfer, Boussinesq form. Fundamentals of weak form methods, error extremization/estimation, finite element implementations; comparison to legacy finite difference methods. Applications in 1, 2, and 3 dimensions, non-linearity, unsteady problems, coupled equation systems. Examples from diverse technical fields; fluid mechanics, heat/mass transfer, elasticity, electromagnetics, reacting systems. Computer projects. Prereq: Bachelor’s degree in engineering or natural science. (Same as Aerospace Engineering 571; Biomedical Engineering 561; Mechanical Engineering 561.)

553 Computational Solid Mechanics (3) Finite element techniques in structural mechanics and linear elasticity. Two and three-dimensional formulations; isoparametric elements, numerical quadrature. Equation solving, matrix iteration techniques. Applications in beams, plates and shells; use of representative computer programs in PC and networked Unix-CAD-solids modeler. Prereq: 321 Mechanics of Materials I or equivalent. (Same as Aerospace Engineering 563; Mechanical Engineering 573.)

559 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 559.)


566 Optical Engineering I (4) Wave optics; scalar diffraction theory; introduction to Fourier optics; ray or geometric optics; lens, mirror, gratings; paraxial design methods; introduction to aberrations.

568 Optical Engineering II (4) Statistical optics; spontaneous and induced emission: black and gray body radiation; incoherent, partial and totally coherent radiation; mutual coherence function; detectors; radiometry. Prereq: 566.

571 Biomechanics of Hard and Soft Tissue (3) Introduction to terminology, physiology, and analytical methods for mechanics of living tissue. Continuum mechanics analysis of hard and soft issue, biological fluid flows. Flow properties of blood, rheology of blood in micro vessels; bioviscoelasticity of fluids and solids, mechanical properties of blood vessels; skeletal, heart and smooth muscle; bone and cartilage. Research paper. (Same as Biomedical Engineering 571.)

572 Biomedical Fluid Mechanics (3) Application of fluid mechanics theory to fluid flows in living systems. Solutions to differential equations of motion for blood flow in arteries, veins and the microcirculation. Measurement of flow properties of blood and other biological fluids. Analysis of pathological flows, blood flow through arterial stenoses. Study of flow through artificial heart valves and in extracorporeal devices. Prereq: 541. (Same as Biomedical Engineering 572.)

574 Green Engineering (3) (See Chemical Engineering 581.)

575 Selected Engineering Problems (2-6) Enrolment limited to students in problems program. Prereq: Consent of advisor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

577 Neural Networks in Engineering (3) (See Nuclear Engineering 577.)

578 Fuzzy Systems in Engineering (3) (See Nuclear Engineering 578.)

581 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Prereq: Consent of instructor. May be repeated with consent of department.

585 Green Engineering (3) (See Chemical Engineering 581.)

600 Doctoral Research and Dissertation (3-15) P/NP only.


645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic turbulence, energy spectra, Kolmogorov’s hypothesis, large and small eddy structure for turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq: 542. (Same as Aerospace Engineering 645.)
651-652 Advanced Topics in Computational Fluid Dynamics (3,3) Modern approximation theory for non-linear Navier-Stokes systems. Algorithm constructions; finite element, finite volume; accuracy, convergence, stability; smooth and non-smooth solutions; shocks, artificial dissipation mechanisms. Two- and three-dimensional, compressible viscous and inviscid flows; potential, Euler and complete Navier-Stokes descriptions: turbulence closure models, reacting flows; mixed subsonic-supersonic. Computer projects, production software. Prereq: 551, 552. (Same as Aerospace Engineering 651-652; Mechanical Engineering 661-662.)

653-654 Advanced Topics in Computational Solid Mechanics (3,3) Fracture mechanics; singularity solutions; non-linear constitutive problems, variable stiffness, initial strain-stress methods, plasticity, creep; geometrically non-linear problems, large deflection, stability, shell structures, solids; accuracy, convergence, adaptive grids; systems of nonlinear equations, solvers. Use of production-level finite element software, Computer projects. Prereq: 553. (Same as Aerospace Engineering 663-664; Mechanical Engineering 653-654.)

657 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/structural mechanics. For departmental thesis students only. May be repeated.

659 Advanced Mechanics of Materials II (3) (See Mechanical Engineering 659.)

671 Advanced Topics in Applied Artificial Intelligence (3) (See Nuclear Engineering 671.)

681 Advanced Topics in Engineering Mechanics (3) Advanced problems in mechanics, group or individually. Prereq: Consent of instructor. May be repeated with consent of department. 500 Thesis (1-15) P/NP only.

ENGLISH (339)

Students enrolling in English graduate courses must first register in the office of the Director of Graduate Studies in 306 McClung Tower.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.

402 Chaucer (3) Reading and analysis of Canterbury Tales and Troilus and Criseyde in Middle English.

404 Shakespeare I: Early Plays (3) Shakespeare’s dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night; English histories, including Henry IV; and early tragedy, including Hamlet.

405 Shakespeare II: Later Plays (3) Shakespeare’s dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from great tragedies, including Othello; problem plays, including Measure for Measure; and dramatic romances, including The Tempest.

406 Renaissance Drama (3) English theatre between 1590 and 1640 through reading of representative plays by Shakespeare’s contemporaries: Marlowe, Webster, Jonson.

409 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of 16th-century authors; Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.

410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of 17th century: poetry of Milton, Donne, Marvell; and prose of Browne, Bacon, Walton.

411 Literature of Restoration and Early 18th Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1745.

412 Literature of Later 18th Century: Johnson to Burns (3) Survey of English literature and culture from 1745 to 1800.

413 Restoration and 18th-Century Genres and Modes (3) A major genre or literary mode: drama, novel, poetry, non-fiction prose, satire, romance, or epic, written between 1660 and 1800. May be repeated.

414 Romantic Poetry and Prose I (3) Wordsworth, Coleridge, and Blake; readings from Lamb, De Quincey, and other prose writers.

415 Romantic Poetry and Prose II (3) Keats, Shelley and Byron; readings from Hazlitt, Peacock, and other prose writers.

416 Early Victorian Literature (3) May include poetry by Tennyson and the Brownings; prose by Carlyle, Newman, and Mill.

419 Later Victorian Literature (3) May include poetry by the Pre-Raphaelites, Arnold, Hopkins, and Hardy; prose by Arnold, Ruskin, and Carroll; plays by Gilbert and Wilde.

420 The Nineteenth-Century British Novel (3) Scott to Hardy.

421 Modern British Novel (3) Works from authors such as Joyce and Woolf through contemporary British fiction writers.

422 Women Writers in Britain (3) Literary consciousness and works of women writers in Britain. Content will vary: Marie de France, Margery Kempe, Aemilia Lanyer, Elizabeth Cary, Aphra Behn, Frances Burney, Mary Wollstonecraft, Mary Shelley, George Eliot, Virginia Woolf, and Doris Lessing. Writing-emphasis course. May be repeated. Maximum 6 hours. (Same as Women’s Studies 422.)

423 Colonial and Postcolonial Literature (3) Emphasis on historical and theoretical methodologies for reading colonial and post-colonial literature. May be repeated once with instructor’s consent.

431 Early American Literature (3) From earliest texts to 1830: exploration and discovery, Native American, colonial, revolutionary, and early national works.

432 American Romanticism and Transcendentalism (3) Prose and poetry of American Renaissance, from c. 1830 to end of the Civil War: Cooper, Poe, Hawthorne, Melville, Emerson, Thoreau, Stowe, Douglass, Whitman, and Dickinson.

433 American Realism and Naturalism (3) Literature from time of the Civil War to World War I: Twain, Howells, James, Jewett, Freeman, Crane, and Norris.

434 Modern American Literature (3) World War I to present.

435 American Novel before 1900 (3) From earliest sentimental novels through Brown and Cooper, and major figures to 1900: Hawthorne, Melville, Stowe, Clemens, and James.


441 Southern Literature (3) Southern writing from colonial period into 20th century: frontier humorists, local color writers, and Southern literary renaissance.

442 American Humor (3) Early 19th century into 20th century: Mark Twain.

443 Topics in Black Literature (3) Contents vary: particular genres, authors, or theories from 1845 to present: Langston Hughes and Harlem Renaissance, Richard Wright and Gwendolyn Brooks, writing by Black women, international Black literature in English, and Black American autobiography. (Same as African-American Studies 443.)

451 Modern British and American Poetry (3) From Yeats and Frost to Auden, Stevens, and more recent poets.

452 Modern Drama, 1880-1945 (3) Survey of British, American, and international drama from the advent of modern drama to the end of World War II. (Same as Comparative Literature 452.)

453 Contemporary Drama (3) Survey of British, American, and international drama since World War II.
250 COURSES OF INSTRUCTION

454 Twentieth-Century International Novel (3) Fiction in English translation from such writers as Kafka and Camus through contemporary authors. (Same as Comparative Literature 454.)

455 Persuasive Writing (3) Writing and analyzing persuasive texts in public, private, and academic contexts. Prereq: 355 or consent of instructor.

456 Contemporary/Postmodern Literature (3) Studies in literature written after World War II. Content will vary. May be repeated with consent of instructor. Maximum 6 hours.

460 Technical Editing (3) Editing technical material for publication. Principles of style, format, graphics, layout, and production management. Prereq: 360 or consent of instructor.

462 Writing for Publication (3) Principles and practices of writing for publication. Dissertation, theses, articles, and reports in science and technology. Prereq: 360 or consent of instructor.

463 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 363 or consent of instructor.

464 Advanced Fiction Writing (3) Further development of skills acquired in basic writing fiction course. Prereq: 365 or consent of instructor.

466 Writing, Layout, and Production of Technical Documents (3) Principles of design for desktop publishing. Production of various documents to be incorporated into professional portfolio. Prereq: 360 or consent of instructor.

470 Special Topics in Rhetoric (3) Topics vary. Prereq: 355 or consent of instructor. May be repeated with consent of department. Maximum 6 hours.

471 Sociolinguistics (3) Study of language in relation to society. Empirical and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 471.)

472 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 472.)

474 Teaching English as a Second or Foreign Language I (3) Major issues surrounding teaching ESL/EFL: political implications of teaching ESL/EFL; introduction to second language acquisition; learner variables in language learning; traditional and innovative approaches to ESL/EFL; basic features of American English grammar necessary for teaching ESL. Prereq: Second year of foreign language or consent of instructor. (Same as Linguistics 474.)

476 Second Language Acquisition (3) How humans learn second languages. Theoretical models and research: differences between first and second language acquisition; learner variables; socio-cultural factors; and implications for second foreign language instruction. (Same as Linguistics 476.)

477 Pedagogical Grammar for ESL Teachers (3) Aspects of English syntax and morphology presenting difficulties for non-native learners of English. Basic and complex sentence structures; noun and article system; and verb tense, aspect, modality, and complementation. (Same as Linguistics 477.)

479 Literary Criticism (3) Historical survey of major works of literary criticism.


481 Studies in Folklore (3) Topics vary. May be repeated with different topic. Maximum 6 hours.

482 Major Authors (3) Content varies. Concentrated study of at least one of the most influential writers in British or American literary history: e.g., Donne, Pope, Austen, Tennyson, Whitman, Faulkner, Lawrence, Baldwin, or Morrison.

483 Special Topics in Literature (3) Topics vary. May be repeated. Maximum 6 hours.

484 Special Topics in Writing (3) Original writing integrated with reading, usually taught by professional author. Topics vary. May be repeated. Maximum 6 hours.

485 Special Topics in Language (3) May be repeated. Maximum 6 hours with consent of department. (Same as Linguistics 485.)

486 Special Topics in Criticism (3) Content varies. Theoretical and practical approaches to British and American literature. May be repeated with consent of department. Maximum 6 hours.

489 Special Topics in Film (3) Content varies. Particular directors, film genres, national cinema movements, or other topics. May be repeated with consent of department. Maximum 6 hours. (Same as Cinema Studies 489.)

490 Language and Law (3) Language in Anglo-American legal process: focus on differences between spoken and written language; lexical and syntactic ambiguity; pragmatics; speech act analysis; and language rights of linguistic minorities. Prereq: 371 or 372 or consent of instructor. (Same as Legal Studies 490; Linguistics 490.)

495 Introduction to Rhetoric and Composition (3) Historical, theoretical, and empirical modes of inquiry in rhetoric and composition and implications for teaching of composition. Prereq: 355 or consent of instructor.

496 Rhetoric of Legal Discourse (3) Application of basic principles of persuasive writing to legal materials. Issue identification and argument through written position papers, briefs, and memoranda. Critical reading and discussion. Introductory research techniques. No prior legal knowledge necessary. Prereq: 355 or consent of instructor. (Same as Legal Studies 496.)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Teaching Freshman Composition (3) Introduction to teaching Freshman English through study of various techniques and philosophies of composition. Required of all first-year teaching associates.

506 Introduction to Literary Research (3) Critical examination of aims of English studies, profession of English teacher, theory of literature, and methods of research: collecting of information, evaluation of material, and transmitting of results of scholarship.

507 Applied Criticism: The Rhetoric of Literary Forms (3) Study and application of ways in which major critics have analyzed form in poetry and prose fiction. May be repeated. Maximum 6 hours.

508 History of the English Language I (3) Phonological, morphological, and syntactic development of English language: Old and Middle English.

509 History of the English Language II (3) Phonological, morphological, and syntactic development of the English language with concentration on developments after 1500, especially in American English.

513-514 Readings in Medieval Literature (3,3) Reading and analysis of selected masterpieces of Old and Middle English literature and their continental sources in modern English. May be repeated. Maximum 9 hours each.
520-521 Readings and Analysis in Selected Areas of 16th- and 17th-Century Prose, Poetry, and Drama (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hours each.

530-531 Readings in English Literature of the Restoration and 18th Century (3,3) Topics vary. Genre: poetry, prose, fiction, drama; or period: Restoration, earlier eighteenth century, later eighteenth century. May be repeated. Maximum 9 hours each.

540-541 Readings in English Literature of the 19th Century I and II (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hours each.

550-551 Readings in American Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hours each.

552 Readings in Black American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hours.

560-561 Readings in 20th-Century Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hours each.

575 Issues in Second/Foreign Language Rhetoric and Composition (3) Examination of cross-linguistic and cross-cultural issues in the development of academic writing proficiency in a second/foreign language. (Same as Linguistics 575.)

576 Introduction to Contemporary Criticism (3) Introductory survey of twentieth-century literary criticism from New Criticism to present.

580 Fiction Writing (3) Advanced fiction projects under supervision of instructor and for independent study. Prereq: Extensive background in reading and writing fiction. May be repeated. Maximum 6 hours.

581 Colloquium in Poetry Writing (3) Major poetic project or continuation of project begun in 463. Individual consultation with instructor supplements class analysis; readings in contemporary poetry and theory. Prereq: 463 or consent of instructor. May be repeated. Maximum 6 hours.

582 Special Topics in Writing (1-3) Topics vary. May be repeated. Maximum 6 hours. Enrollment by consent of director of graduate studies only.

583 Special Topics in Literature (3) Topics vary: genres, modes, and other literary subjects not in standard period divisions. May be repeated. Maximum 6 hours.

584 Topics in Feminist Studies (3) Topics vary. May be repeated. Maximum 9 hours.

585 Issues in Invention, Style, and Audience (3) Theoretical perspectives on contemporary research in rhetoric and composition.

586 History of Rhetoric I (3) Survey of rhetoric from Sophists to Ramus.

587 History of Rhetoric II (3) Survey of rhetoric from Bacon to present.

588 Readings in Applied Rhetoric (3) Content varies: Writing across curriculum, writing centers, technical communication, text linguistics. May be repeated. Maximum 6 hours.

589 Special Topics in Language (3) Topics vary. May be repeated. Maximum 6 hours.

590 Topics in Critical Theory (3) Topics vary. May be repeated. Maximum 9 hours.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

594 Film History, Form, and Analysis (3) Issues in film studies: history of narrative film; concept of film form; critical approaches to film study (genre, auteur, formalist, and others); and critical analysis of individual films.

600 Doctoral Research and Dissertation (3-15) P/NP only.

610 Studies in Old English Language and Literature (3) Old English grammar with readings in prose and poetry.

611 Studies in Beowulf (3) Translation and critical study of Beowulf. Prereq: English 610 or consent of instructor.

620 Studies in Medieval English Literature (3) Seminar in literary and genre studies of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year. May be repeated. Maximum 9 hours.

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer’s writings. Prereq: Previous course in Chaucer. May be repeated. Maximum 6 hours.

630-631 Studies in Renaissance Literature (3,3) Seminars: Spenser, Milton, 17th-century prose and poetry, Shakespeare, 16th-century prose and poetry, non-Shakespearean drama. May be repeated. Maximum 9 hours each.

640-641 Studies in Restoration and Eighteenth-Century Literature (3,3) Topics vary: Swift, satire, restoration literature, Johnson and Boswell, Addison and Steele, restoration drama, Dryden. May be repeated. Maximum 9 hours each.

650 Studies in English Romanticism (3) Seminar content varies: particular literary figure or figures, genre, theme, or other coherent focus. May be repeated. Maximum 9 hours.

651-652 Studies in Victorian Literature (3,3) Seminar content varies: particular literary figure or figures, genre, theme, or other coherent focus. May be repeated. Maximum 9 hours each.

660-661-662 Studies in American Literature (3,3,3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain. May be repeated. Maximum 9 hours each.

670-671-672 Studies in 20th-Century Literature (3,3,3) Seminar content varies: particular literary figure or figures, genre, theme, or other coherent focus. May be repeated. Maximum 9 hours each.

680 Topics in English Language (3) May be repeated with consent of director of graduate studies. Maximum 9 hours.

682 Studies in Rhetoric and Composition (3) Content varies. Advanced work in theory and/or history of rhetoric and composition. Issues in invention, textuality, literacy, historiography, style and ethics. May be repeated. Maximum 9 hours.

688 Studies in Creative Writing (3) Content varies. Connection between theory and practice in writing. May be repeated. Maximum 9 hours.

689 Special Topics (3) Content varies. History of ideas, humor, biography, autobiography, extra-literary disciplines. May be repeated. Maximum 9 hours.

694 Studies in Film (3) Content varies. Advanced work in film history and analyses. May be repeated. Maximum 6 hours.

ENGLISH EDUCATION (340)

460 Teaching Reading and Literature in the Secondary School (3) Approaches for teaching basic reading skills and ways of teaching literature.

507 Teaching Poetry Grades 7-12 (3) Research and theory in application to teaching of poetry. Design of strategies and materials for teaching and writing and reading of poetry. Review of texts and materials.

508 Teaching Composition in the Secondary School (3) Teaching narration, description, exposition, and argumentation; writing process and marking of student papers.

509 Teaching Fiction in the Secondary School (3) Teaching of novels and short stories.

521 Interdisciplinary Aesthetics (3) Discussions, visual and audio presentations concerned with aesthetic considerations of areas of study: geography, history, physics, literature, languages, music, visual arts and drama.

590 Seminar in Teaching English in Secondary Schools (3) Content varies. Theoretical and practical approaches to teaching English in secondary school. May be repeated.

592 Linguistics and the Teaching of English (3) Grammar, usage, semantics, dialectology, history of language, and lexicography.

597 Teaching Drama Grades 7-13 (3) Strategies and materials for teaching creative dramas, enacting and writing of plays, reading of scripts.

598 Developing Speaking and Listening Skills, Grades 7-12 (3) Teaching approaches to nonverbal communication, interpersonal and group communication, public address and listening. Review of tests and materials.

601 Studies in English Education (3) Issues and research in teaching of English.

ENTOMOLOGY AND PLANT PATHOLOGY (341)

410 Diseases and Insects of Ornamental Plants (3) Symptoms, identification and management of diseases and insect pests that affect plants in greenhouse, nursery, and landscape environments. Prereq: 313 or 321 or consent of instructor.

451 Plant Tissue Culture (3) Methods for the culture of cells, tissues, and organs including media preparation and maintenance of cultures. Lecture and lab. Prereq: 110-120 or Biology 130-140 or equivalent and Chemistry 120-130 or equivalent. Recommended: 310, 321, 412; Microbiology 310 or 319; Plant Sciences 330. (Same as Plant Sciences 451.)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Mycology (3) Survey of the fungal kingdom and traditional allies in the context of phyla and classes. Systematics, biology, reproduction, structure-function, physiology, and ecology illustrated with fresh and preserved material and cultural techniques in laboratories. 2 hours and 1 lab. Prereq: Biology 111-112 or Biology 130-140. Students cannot receive credit for both 405 and 505.

507 Professional Development Seminar (1) (See Agriculture and Natural Resources 507.)

512 Soilborne Plant Pathogens (3) Causal agents; host-parasite-soil environment interactions; epidemiology; detection and identification of soilborne plant pathogens; biological, cultural, and chemical control. MS students only. Students who receive credit for 612, may not enroll in 512. Prereq: 313 or consent of instructor.

513 Plant Pathogenic Fungi (2) Morphology, taxonomy, and biology of fungal plant pathogens. 2 hours and 2 labs weekly for 7 weeks. Prereq: 313 or consent of instructor. (Same as Plant Sciences 513.)

514 Bacterial Plant Diseases (2) Morphology, taxonomy, ecology, physiology, and genetics of bacterial plant pathogens; infection and disease development, pathogenesis and resistance; diagnosis, detection, effect of environment, and management of bacterial plant diseases; beneficial plant-bacterial interactions. 3 hours and 1 lab for 7 weeks. Prereq: 313 or consent of instructor.

515 Physiology of Plant Disease (3) Biochemical and physiological events involved in host-pathogen interactions. Mechanisms of disease resistance. Master’s students only. Prereq: Introductory plant physiology and pathology or consent of instructor. Students taking 515 cannot receive credit for 615.

520 Plant Parasitic Nematodes (2) Morphology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships. 2 hours and 2 labs weekly for 7 weeks. Prereq: 6 hours biological science or consent of instructor.

521 Plant Virology (3) Symptomatology, epidemiology, and management of virus infection; structure, morphology, replication, transmission, purification, characterization, and classification of plant viruses; serology; plant pathogenic viroids, mycoplasmas and virophages. 2 hours and 1 lab. Prereq: 313 or consent of instructor.

523 Field Crop and Vegetable Insects (2) Identification, biology and management of insects affecting commercial vegetable and home garden crops. 1 hour and 1 lab. Prereq: 321 or basic entomology course.

525 Medical and Veterinary Entomology (3) Morphology, taxonomy, biology and control of arthropod parasites and vectors of pathogens of humans and animals. Ecology and behavior of vectors in relation to pathogen transmission and control. 2 hours and 1 lab. Prereq: 321 or 325, or consent of instructor.

530 Integrated Pest Management (3) Principles and application of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic threshold levels. Prereq: 321, or consent of instructor. (Same as Plant Sciences 530.)

531 Special Problems in Entomology (1-3) Comprehensive individual study of current problems. May be repeated. Maximum 6 hours.

532 Special Problems in Plant Pathology (1-4) Comprehensive individual study of current problems. May be repeated. Maximum 6 hours.

533 Concentrated Study in Entomology (1-3) Selected subjects in entomology for advanced students, concentrated in time and subject matter. Prereq: 321 or basic entomology course. May be repeated. Maximum 6 hours.

541 Seminar (1-2) Review in oral or poster form of literature and current research in entomology or plant pathology, or report on student’s thesis research; critique and analysis of presentation effectiveness. Presentations on current topics by outside speakers. Master’s students only. May be repeated. Maximum 6 hours.

544 Protein Gel Electrophoresis (1) Practical experience with isolating native and denatured proteins from plants and fungi, determining protein concentrations, PAGE of proteins including total proteins and assays for specific enzymes (isozyme) analyses. 1 hour and 4 labs weekly for 5 weeks. Prereq: 8 hours biological/botanical sciences, 8 hours chemistry, consent of instructor. (Same as Plant Sciences 544.)

545 Plant Microtechnique (1) Practical light and scanning electron microscopy methods for investigating aspects of plant development, histochemistry and pathological structures in ornamental forest and crop species. 1 hour and 4 labs weekly for 5 weeks. Prereq: 8 hours biological/botanical sciences and consent of instructor. (Same as Plant Sciences 545.)
548 Taxonomy of Adult Insects (3) Classification, phylogeny, and distribution of insects and related arthropods. Lectures on theory and practice of insect systematics and major features of insect evolution. Laboratory practice on methods of collection, preservation, and study of insects, with emphasis on order and family identification of adults. Substantial insect collection (above requirements for 448), one or more field trips, and a taxonomically oriented project required. Prereq: Consent of instructor. Students cannot receive credit for both 448 and 548.

550 Molecular Epidemiology and Mycology (3) An overview of molecular tools for exploring population biology as well as gene function with an emphasis on tools for emerging and traditional model organisms that have whole genome sequences available. The course will include lectures, assigned reading and discussion, and laboratory demonstrations. The course is open to upper-level undergraduate (junior or senior), master’s, and PhD students. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) Doctoral Research and Dissertation. P/NP only.

602 Advanced Topics in Entomology (1-3) Morphology, systematics, physiology, ecology and genetics of arthropods, apiculture, medical and veterinary entomology, insect biodiversity, and insect pathology. May be repeated. Maximum 12 hours.

604 Advanced Topics in Plant Pathology (1-3) Biological control, disease diagnosis and management, epidemiology, fungal plant pathogens, integrated pest management, molecular plant-microbe interactions, nematology, plant pathogenesis, plant pathogenic bacteria, soil- and seed-borne pathogens, and virology. May be repeated. Maximum 12 hours.

606 Advanced Topics in Bioactive Natural Products (1-3) Bioactive pesticides, ethnobotany and paleoethnobotany, ethnopharmacology, biocontrol of plant pathogens, bioprospecting, natural product diversity, alternative bioactive crops, organic agriculture, allelopathy in agriculture, regulatory issues in natural product development, and bioactivity-guided isolation. May be repeated. Maximum 12 hours.

608 Advanced Topics in Integrated Pest Management (1-3) Selected issues and topics of current significance to integrated pest management: transgenics in agriculture, issues in biological control, pesticide resistance management, ethics in pest management, environmental manipulations, epidemiology of plant diseases, biological control of plant pests, induced plant resistance, plant-microbe interactions, and new pesticide chemistries. Prerequisite: 530 or consent of instructor. May be repeated. Maximum 12 hours.

612 Soilborne Plant Pathogens (3) Causal agents; host-parasite-soil environment interactions; epidemiology; detection and identification of soilborne plant pathogens; biological, cultural, and chemical control. PhD students only. Students who have received credit for 512, may not enroll in 612. Prereq: 313 or consent of instructor.

615 Physiology of Plant Disease (3) Biochemical and physiological events involved in host-pathogen interactions. Mechanisms of disease resistance. PhD students only. Prereq: Introductory plant physiology and plant pathology or consent of instructor. Students who have taken 515 cannot receive credit for 615.

640 Seminar (1) Review of literature and current research in entomology and plant pathology. May be repeated. Maximum 2 hours. PhD students only.

643 DNA Analysis (2) Practical experience in isolating genomic DNA from prokaryotic and eukaryotic organisms, amplification of DNA using arbitrary nucleotide primers. DNA profiling techniques (DAF, ASAP, ITS ribosomal DNA and 16S bacterial gene) isolation and purification of amplified products. Data collection and analysis of relationships between organisms. 1 hours and 4 labs weekly for 7 weeks. Prereq: 12 hours biological sciences, 8 hours chemistry, written consent of instructor. (Same as Plant Sciences 643.)

ENVIRONMENTAL AND SOIL SCIENCES (345)

434 Environmental Soil Chemistry (3) Composition and chemical properties of soils and processes that govern fate and behavior of chemicals in soil environment: clay mineralogy; soil organic matter; mineral weathering and stability; aqueous speciation; surface chemistry; ion exchange, adsorption and molecular retention; oxidation-reduction; and soil acidity, alkalinity, and salinity. Prereq: 210; Chemistry 110 or 350.

442 Soil Genesis and Classification (3) Soil genesis and formation; observing and describing morphology of agricultural and forest soils; chemical and physical properties, classification. 3 weekend field trips. 2 hours and 1 lab. Prereq: 210.

444 Transport Processes in Soil (3) Basic understanding of soil physical properties and processes; influence of soil physical properties on water and chemical movement in soil; practical experience in the measurement and analysis of soil physical properties, water flow, and chemical movement in soil. Prereq: 210 and Physics 221 or equivalent.

462 Environmental Climatology (3) Study of atmosphere as environment. Physical, chemical and biological factors affecting climates of various earth environments; meteorological process affecting biosystems. Climatic change and the human impact on the atmosphere, consequences of climatic change and mitigation policies, microclimates and urban climates, atmospheric pollution, extreme events and ozone depletion. Design and operation of weather information systems; automated weather stations. Prereq: Agriculture and Natural Resources 290 or equivalent.

481 Capstone in Environmental and Soil Sciences (3) Integrative course in which students work individually and collaboratively to develop solutions for soil and water related environmental problems. Writing and oral communication emphasis course. Prereq: 434 and senior standing.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Seminar (1) Presentations and discussions of current scientific material. May be repeated. Maximum 3 hours. (Same as Biosystems Engineering 503; Biosystems Engineering Technology 503.)

511 Soil-Plant Relationships (3) Principles of mineral nutrition of higher plants: plant physiological characteristics that influence uptake of water and nutrients; functions of nutrient elements in plants; soil factors influencing nutrient availability to plants; important relationships at soil-root interface; and responses to adverse soil environmental conditions. 3 hours and 1 rec. Prereq: 434 or Integrated Plant Systems 431 or Plant Sciences 431 or General Plant Physiology.

512 Pedology (3) Physical and chemical weathering processes, factors of soil formation, soil forming processes. 2 hours and 1 lab. Prereq: 442 or consent of instructor.

513 Advanced Soil Chemistry (3) Chemical properties and processes that operate in soil environment: thermodynamics of soil solutions and surface chemistry of soils, soluble complex formation, mineral solubility, electrochemical equilibria, geochemical modeling, ion exchange equilibria, surface functionality and reactivity, adsorption phenomena, and surface complexation modeling. Prereq: 434 or consent of instructor.
514 Environmental Soil Physics (3) Principles of water, gas, heat, and solute movement in soil/water systems; application of appropriate models for the description of these processes; methods for characterizing hydraulic and chemical transport properties of soil; applications of the science of soil physics to solution of contemporary problems in water conservation, prevention of surface/ground water contamination, and management of plant water status. Prereq: 444 or equivalent.

516 Soil Biology and Biochemistry (3) Soil organisms and their activities in soils: soil ecology, biogeochemical cycling of important elements, organic matter dynamics, and applications of agricultural and environmental biology and biochemistry. 2 hours and one 3 hour lab. Prereq: 210 or consent of instructor.

593 Special Problems in Plant and Soil Science (1-3) May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15)

601 Special Topics in Soil Science (1-3) Thermodynamics of soil solutions, clay structure and surface chemistry, soil mineralogy, plant mineral nutrition, soil microbiology, water movement and use by plants, soil structure, soil thermal properties, interaction in the soil-plant environment. May be repeated. Maximum 6 hours.

603 Seminar (1) Presentations and discussion of current scientific material. May be repeated. Maximum 3 hours. (Same as Biosystems Engineering 603.)

613 Advanced Topics in Soil Chemistry and Fertility (2) Topics of current significance; scientific literature. Prereq: 513 or equivalent.

614 Advanced Topics in Soil Biology and Biochemistry (2) Topics of current significance; scientific literature. Prereq: 516 or equivalent.

615 Advanced Topics in Soil Physics, Genesis, and Morphology (2) Topics of current significance; scientific literature.

ENVIRONMENTAL ENGINEERING (344)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

508 Seminar (1) Reports on current research in environmental engineering at the University of Tennessee, Knoxville. Prereq: Graduate standing. Satisfactory/No Credit grading only.

520 River Mechanics (3) An integrated study of river mechanics including the principles of open channel flow, and the fluvial processes associated with a mobile bed. Theory and analysis of open channel hydraulics include uniform, gradually-varied, rapidly-varied, spatially-varied, and unsteady flow conditions. Fluvial processes consist of sediment properties, dynamics of suspended and bedload sediment transport, adjustments in channel morphology and channel stability, channel regime theory and erodible channel design, and modeling applications. Prereq: Civil Engineering 390 or consent of instructor.

522 Floodplain and Urban Flood Management (3) Review of national, regional, and local flood problems; state of the art flood damage reduction alternatives: structural and non-structural; institutional responses: policies, programs, organizations, regulations, and legal aspects; floodplain hydrology and hydraulics, HEC-1, HEC-2: floodway encroachment, flood hazard zone and damage potential determinations; cast studies. Prereq: Civil Engineering 390 or consent of instructor for non-majors.

525 Soil Erosion and Sediment Yield (3) Theory of soil erosion and sediment yield processes from disturbed land; methods and computer models for estimating sediment yield. Erosion and sediment control theory and management practices. Local and state regulations. Prereq: Civil Engineering 395 or 416. (Same as Biosystems Engineering 525.)

530 Urban Hydrology and Stormwater Engineering (3) Planning, design, modeling, management, and maintenance of urban stormwater systems. Theory and application of hydraulic and hydrologic principles to design of stormwater management systems; design of inlet structures, conveyance systems, detention/retention basins and appurtenances, and selected best management practices (BMP’s); evaluation of land-use changes of runoff quantity and quality; review, selection and application of contemporary computer models. Prereq: Civil Engineering 395 or 416.

535 Applied Ground Water Hydrology (3) Applied hydrology of multi-layered aquifer systems. Modeling of complex ground water systems that will include: the development and implementation of conceptual, analytical and numerical models. Numerical approaches to the solution of PDEs that describe flow through porous media: boundary conditions, stability, existence and uniqueness. Prerequisite: 485 or Geology 485 or consent of instructor. (Same as Geology 535.)

543 Instrumentation and Measurement (3) (See Biosystems Engineering 543.)

545 Monitoring Hydrologic Phenomena (3) (See Biosystems Engineering 545.)

551 Physicochemical Unit Processes (3) Theory and design application in water and wastewater treatment. Prereq: Civil Engineering 380 and 390.

552 Biological Treatment Theory (3) Theory and design applications of biological processes to treatment of wastewater and solid wastes. 2 hours and 1 lab. Prereq: Civil Engineering 380. (Same as Biosystems Engineering 552.)

553 Aquatic Chemistry (3) Theoretical, applied and analytical chemistry related to generation, measurement and treatment of environmental contaminants. 2 hours and 1 lab. Prereq: General Chemistry.

554 Environmental Engineering Chemistry (3) Application of chemical principles in analyzing physical, chemical, or biological interactions of chemical contaminants in various environmental compartments: atmosphere, hydrosphere, and lithosphere. Prereq: One year chemistry and consent of instructor.

555 Solid Waste Management (3) Magnitude and characteristics of solid waste problems; collection systems; design of disposal systems: landfill, incineration, and composting, design of resource recovery systems; current and future regulations. Prereq: Senior standing.

556 Hazardous Waste Management (3) Analysis and design of operations and processes for hazardous waste disposal and processing: regulations analysis; industrial applications. Prereq: Graduate standing or consent of instructor.

570 Air Quality Management/Pollution Control (3) Introductory course on concepts of air pollution, analysis of relationships among sources, meteorology, effects; stack sampling; emission control systems. Prereq: Consent of instructor.

571 Design of Air Pollution Control Systems (3) Design and evaluation of systems used to control emission of gaseous and particle air pollutants. Comprehensive design of specific devices and systems. Prereq: 570.

572 Air Quality Dispersion Modeling (3) Diffusion in atmosphere; application of atmospheric dispersion models and evaluation of meteorological and air quality data. Prereq: 570.

573 Sampling of Air Pollutants (3) Standard sampling methods for particulate and gaseous air pollutant emissions from industrial processes; ambient air monitoring instrumentation/techniques. Prereq: 570.

575 Applied Microbiology and Bioengineering (3) (See Chemical Engineering 575.)

581 Green Engineering (3) (See Chemical Engineering 581.)
590 Special Problems in Environmental Engineering (3) Enrollment limited to environmental engineering students in non-thesis program. Prereq: Graduate standing. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

595 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated.

620 Advanced Surface Water Hydraulics (3) Advanced topics in surface water hydraulics; solutions in St. Venant equations of unsteady flow for complex channel situations; dam breach modeling. Prereq: 520.

651 Industrial Waste Unit Operations and Processes (3) Theoretical design and laboratory modeling of industrial waste treatment processes and operations. 2 hours and 1 lab. Prereq: 551, 553. Prereq or coreq: 552.

653 Pollutant Fate Modeling and Risk Assessment (3) Application of scientific principles concerning movement and fate of chemicals at interfaces of air, water, and earthen solids in environment. Methods of assessing risk posed by presence of those chemicals. Prereq: 551.

691 Special Topics in Environmental Engineering (3) Selected advanced problems of current interest. Prereq: Consent of instructor. May be repeated.

EXERCISE SCIENCE (347)

480 Physiology of Exercise (3) Functions of body in muscular work: physiological aspects of fatigue, training and adaptation to environment. Prereq: Biochemistry and Cellular and Molecular Biology 230 or 440. (Same as Biochemistry and Cellular and Molecular Biology 480.)

500 Thesis (1-15) P/NP only.

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

508 Research in Exercise Science (3) Research for writing of thesis and institutional review board proposals; presentation of research through free communications and poster presentations; calculation and interpretation of statistics related to common research designs used in research; and use of computer software.

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

513 Biomechanics of Orthopedic Rehabilitation (3) Effect of physical activity on musculoskeletal tissue: flexibility development and measurement, surgical implications, and rehabilitation related research.

516 Therapeutic Exercise (3) Current research in therapeutic exercise: role of nervous system, soft tissue healing, proprioception, muscle activation patterns, and strength.

521 Physical Activity Epidemiology Methods (3) Epidemiological foundation for research in physical activity related to individual and population-based health. Emphasis on analytic methods, surveys, and research designs. Focus on issues within special populations (e.g., elderly, children). Prereq: Course in statistics or consent of instructor.

525 Epidemiology of Injury and Violence (3) Epidemiologic methods to describe magnitude and examine etiology of unintentional and intentional injury. Alternative approaches for preventing or controlling occurrence of injury and violence in both general population and high risk sub-populations.


533 Exercise Physiology (3) Physiology of human performance: acute and chronic effects of exercise on metabolic, cardiac, pulmonary, and skeletal systems. Prereq: Human physiology or general physiology, general chemistry. 2 hours and 1 lab.

541 Special Topics (1-3) Advanced study in selected areas of exercise science. May be repeated.

565 Advanced Physiology of Exercise (3) Systematic study of skeletal muscle and metabolism related to acute exercise and physical training: lectures, discussions of major scientific reviews, and appropriate laboratory experiments. Prereq: 480 or 533.


569 Clinical Exercise Physiology (3) Cardiac structure and function, interpretation of 12-lead electrocardiograms, exercise considerations for cardiac and pulmonary patient. Prereq: 480 or 533, and 567.

570 Cardiac Rehabilitation Practicum (1-3) Supervised experience in hospital-based exercise programs for participants with cardiac and/or pulmonary disorders. Use of telemetry monitoring, leading safe exercise regimens counseling participants on safe exercise guidelines. Presenting educational class on topic applicable to participants. Prereq: 533 and 567, or consent of instructor. Coreq: 569. May be repeated. Maximum 6 hours.

581 Biomechanics Instrumentation (1) Kinematic, kinetic and muscle activity measurement of human movements using computerized videography, force platform, electromyography and other relevant instruments. May be repeated. Maximum 3 hours. Satisfactory/No Credit grading only.

585 Seminar in Gerontology (1) (See Health 585.)

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Research Seminar (1) Research topics in different aspects of exercise science, sport psychology, and sport sociology. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only. (Same as Sport Studies 601.)

622 Directed Independent Research (3-6) Prereq: Doctoral student or consent of instructor. May be repeated. Satisfactory/No Credit or letter grade.

625 Mortality and Survival (3) Life table and other population-based approaches to studying international and sociodemographic patterns and differentials in mortality, morbidity, and disability. Prereq: 2 graduate statistics courses or consent of instructor.

635 Physical Activity and Positive Health (3) Review of clinical, epidemiological, and experimental evidence concerning relationship and effects of exercise on health-related components of fitness. Prereq: Elementary statistics, 480 or 533 and 567 or consent of instructor. (Same as Public Health 635.)

661 Seminar in Exercise and Applied Physiology (1-3) Selected topics in exercise and environmental physiology. Prereq: 480 or 533. May be repeated with consent of instructor.

664 Research Participation in Exercise Science (1-6) Participation in research with faculty member whose interests coincide with those of student. Satisfactory/No Credit grading only.

681 Practicum (1-3) Intern experience in areas of major interest. May be repeated.
693 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

FINANCE (349)

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

511 Strategic Management for Creation of Financial Value (3) Strategic issues in corporate finance, investments, and capital markets: how firms can employ financial strategies to create value. Use of derivatives, risk management, real options, fixed income securities, venture capital, initial public offerings and financial restructuring. Prerequisites: Business Administration 511, 512, and 513, or consent of instructor.

512 Problems in Financial Management (3) Readings and cases that apply finance theory to real-world investment, financing, and asset management problems. Prerequisites: Business Administration 511, 512, 513, and 514, or consent of instructor.

525 Investment Analysis and Portfolio Management (3) Investment process, portfolio applications. Asset allocation decision in global setting; organization and functioning of financial markets; equity and bond valuation; asset valuation models; equity and bond portfolio management; options, forwards and futures contracts; evaluation of portfolio performance; and review of alternative economies and emerging markets. Prerequisites: Business Administration 511, 512, 513, and 514, or consent of instructor.

532 Commercial and Investment Banking (3) Analysis of management policies of financial institutions and investment banking firms. Legal, economic and regulatory environment and implications for management. Financial institution structure and competition and changing trends in U.S. financial system. Analysis of raising new funds through underwriting new issues of corporate stocks, bonds and other instruments. Analysis of securities brokerage, market-making, merchant, banking, and mergers and acquisitions. Prerequisite: Business Administration 511, 512, 513, and 514, or consent of instructor.

551 Financial Management of a New Enterprise (3) Financial issues associated with formation, control, and long-term planning of new enterprise. Acquisition of venture capital. Prerequisite: Business Administration 511, 512, 513, and 514, or consent of instructor.

581 Real Estate Investment and Finance (3) Financial and market analysis used to make real estate investment decisions. Effects of variety of financing options on rate of return on income-producing properties. Effect of various financing options on consumer’s decisions to purchase. Relationship between primary and secondary mortgage markets and impact of those markets on cost and availability of funds for real estate lending. Effects of government intervention (taxation, subsidization, and regulation) in both real estate and mortgage markets. Prerequisites: Business Administration 511, 512, 513, and 514, or consent of instructor.

599 Special Topics in Finance (1-3) Topics vary. Prerequisite: Consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

641 Seminar in Finance (1-3) Capital markets, utility theory, asset pricing, theory of the firm, capital structure, dividend policy. Prerequisites: Consent of instructor. Satisfactory/No Credit or letter grade.

651 Seminar in Corporate Finance (1-3) Recent theoretical and empirical developments in micro-finance literature. Topics vary. Prerequisite: 641 and consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

652 Seminar in Asset Pricing and Markets (1-3) Recent theoretical and empirical developments in finance. Topics vary. Prerequisite: 641 and consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

653 Seminar in Financial Institutions (1-3) Theoretical and empirical studies of financial institutions. Topics: modeling banking firm, efficiencies in banking, bank lending arrangements and asymmetric information, international competitiveness, and deposit insurance. Prerequisite: 641 and consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

654 Special Topics (1-3) Recent developments in finance. Topics vary. Prerequisite: 641 and consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

FOOD SCIENCE AND TECHNOLOGY (390)

410 Food Chemistry (4) Reactions of water, proteins, lipids, carbohydrates, minerals, enzymes, vitamins, and additives in foods. 3 hours and 1 lab. Prerequisites: Chemistry 110, Biochemistry and Cellular and Molecular Biology 310.

420 Food Microbiology (2) Physical, chemical and environmental factors moderating growth and survival of foodborne microorganisms; pathogenic and spoilage microorganisms affecting quality of foods and their control. Prerequisite: Microbiology 210. Corequisite: 429.


430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods. 2 hours and 1 lab. Prerequisite: Basic statistics.

445 Application of Food Chemistry and Processing Principles (4) Interactions and functions of dairy, egg, cereal and other plant-based ingredients during the production and storage of processed food products. 3 hours lecture and 1 lab. Prerequisite: 340 and 410 or consent of instructor.

460 Meat Science (3) Carcass characteristics of meat animals, muscle structure and composition, cut identification, curing, freezing and cookery. Prerequisite: 140 or consent of instructor.

469 Meat Science Lab (1) Slaughter and processing methods for beef, pork, lamb and poultry. Corequisite: 460.

490 Food Laws and Regulations (3) Laws and regulations designed to preserve safety, wholesomeness, and nutritional quality of United States food supply; precedent case studies and their impacts on laws and regulations. Prerequisite: 140; consent of instructor for non-majors.

495 Quality Assurance and Sanitation Practices (3) Design and evaluation of food processing operation to produce safe and acceptable quality food product. Prerequisite: 320 and 340 or consent of instructor.

500 Thesis (1-15) P/NP only.

501 Seminar (1) Individual reports and discussion on topics from current literature. May be repeated. Maximum 3 hours. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Satisfactory/No Credit grading only.

507 Professional Development Seminar (1) (See Agriculture and Natural Resources 507.)
510 Instrumental Analysis of Food (3) Modern instrumental methods for control of food manufacturing processes. Prereq: 410, 2 hours and 1 lab.

512 Flavor of Foods (2) Chemical basis, measurements, and reactions involved in flavor changes in foods. Manufacture and application of flavorings in foods. 1 hour and 1 lab. Prereq: 410 or equivalent.

515 Food Carbohydrates, Proteins and Lipids (4) Advanced study of chemical and physical properties of carbohydrate, protein, and lipid components of foods; effects of components on production of safe and consistent quality food products; and changes during processing and/or distribution of food products. 3 hours and 1 lab. Prereq: 410 or equivalent.

521 Advanced Food Microbiology (3) Extrinsic and intrinsic factors associated with foods and food processing that relate to growth, survival, inhibition, detection, and recovery of foodborne pathogens and spoilage organisms; traditional and current approaches to microbiological food safety and quality. Prereq: 420, 429 or equivalent.

540 Food Product Development (3) Art, science and technology of developing and marketing new food products. 2 hours and 1 lab. Prereq: 340.

560 Advanced Meat Science (3) Physical and chemical changes that occur in conversion of muscle to meat; effect of postmortem treatments on meat quality, composition and palatability; packaging, preservation and quality control. 2 hours and 1 lab. Prereq: 460.

590 Special Topics in Food Technology and Science (1-3) Critical reviews of current research and production concerns of food industry. May be repeated. Maximum 9 hours.

593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Seminar (1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hours. Satisfactory/No Credit grading only.

620 Food Toxicology (3) Basic and applied concepts in food toxicology; toxicological aspects of processed foods. Mode of action, prevention and control of food toxicants in food supply. Prereq: 410, 521, or consent of instructor.

640 Advanced Food Processing (3) Role of processing treatments in modification of food properties; texture, flavor and color characteristics. Prereq: Food Preservation, 510, 511, 512 or consent of instructor.

FOREIGN LANGUAGE/ESL EDUCATION (394)

455 Teaching of Foreign Languages, Grades 7-12 (3) Instructional methods, lesson planning, peer-teaching; materials for teaching foreign language and culture; evaluation techniques. Required for certification in modern foreign languages and Latin. Prereq: Completion or near completion of foreign language hours for certification and admission to teacher education.

555 Foreign Language in the Elementary Schools Practicum (3) Experiences designing, implementing and assessing second language instruction in elementary school setting. Prereq: 587 or consent of instructor.

556 English as a Second Language Practicum (3) Experiences designing, implementing and assessing English instruction to non-native English speakers. Required course for ESL certification. Prereq: 578 or consent of instructor.

578 Teaching English as a Second Language (3) Instructional methods; utilization of assessment procedures to diagnose English linguistic proficiency; materials for non-native speaker in K-12 classroom. Required for Tennessee ESL (K-12) licensure. Prereq: 587 or consent of instructor.


678 Advanced Studies in English as a Second Language (3) Research, curricula, assessment, trends and issues in English as a second language. Prereq: 578 or consent of instructor.

687 Advanced Studies in Foreign Language Education (3) Research, curricula, assessment, trends and issues in foreign language education. Prereq: 587 or consent of instructor.

FORESTRY (396)

421 Forest and Wildland Resource Economics (3) Production functions, supply-demand and market analysis; non-market programs and projects; economic analysis and decision models; investment and financial analysis; managerial economics; taxes; forest products marketing. Prereq: 324 or consent of instructor.

422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; forest and wildland law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing or consent of instructor.

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, site design projects; management strategies, methods of visitor and recreation site management; case studies. Weekend field trips. 2 hours and 1 lab. Prereq: 321 or consent of instructor.

433 Wood Adhesives and Glued Wood Products (2) Theory and practice of adhesive bonding of wood; wood substrate-adhesive interface for bonding; principles of adhesion; wood adhesives; gluing of solid wood and composite wood manufacturing practices; laboratory manufacture and/or testing of adhesives, adhesive bond strength and glued-wood product performance; day field trips. 1 hour and 2 labs. Prereq: 331 and 332, or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identify, analyze and prepare written report. Topic and report must have approval of graduate committee. Available only to students in non-thesis option for MS in Forestry.

512 Seminar (1) Current developments in forestry. Required of all graduate students in residence in fall. May be repeated. Maximum 2 hours. Satisfactory/No Credit grading only.

514 Tree Physiology (3) Tree structure, growth and development, and function, and how these are related to the environment and to cultural practices. Influence of environmental variables on plant growth and distribution; effects of forest management practices on growth and function. Prereq: Botany 110-120, or Biology 101/102. Students cannot receive credit for both 414 and 514.

515 Forest Conservation Workshop (1-3) Relation of forest biology, ecology and management to conservation issues; integration of current conservation issues into classroom work and student projects; environmental education strategies. Not available to students in forestry or wildlife and fisheries science. May be repeated. Maximum 3 hours.
520 Advanced Forest Ecology (3) Physiological ecology and adaptations of trees; relationships between overstory structure, microclimate, and understory response; regeneration ecology; competition and effects of natural and human disturbance regimes at multiple scales; forest succession and stand dynamics. Prereq: Graduate standing in forestry or biological science, or consent of instructor.

521 Composite Materials from Renewable Resources (3) Manufacturing processes, science and engineering of composite materials derived from renewable resources. Overview of renewable resources and utilization; structure and properties of natural fibers, thermosets, thermoplastics, and bioplastics; fundamentals of adhesion; engineered wood composites; natural fiber reinforced composites; and mechanical property and durability testing. Prereq: Basic understanding of polymer chemistry, engineering and physics, or consent of instructor. Prereq: Silvicultural methods and Biology 220 or consent of instructor.

525 Woodlot Management (3) Current technologies and management strategies concerning wise use of forest resources for private, non-industrial forest landowners necessary for decision-making and implementation. 6.5 hours and 1 lab weekly for 6 weeks. Prereq: Graduate standing in forestry or biology or consent of instructor. Not available to students in forestry or wildlife and fisheries science.

530 Advanced Forest Resource Management (3) Analysis of forest management problems in public and private organizations. Classical forest regulation; linear and goal programming, as applied to resource management problems; advanced forest investment analysis; decision making methods for primary forest management activities; and methodologies for incorporating non-timber values in forest management operations. Prereq: Senior-level forest management or consent of instructor.

540 Genetics in Forestry (3) Genetic improvement of forest trees, selection of superior phenotypes; field testing for genetic variability; tree breeding: development of seed orchards; hybridization; tree cytology and tissue culture; use of biochemical variation; planning and conducting forest genetics research.

550 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development on forests and associated lands; analysis and critique of specific contemporary alternatives. Overnight field trips. Prereq: Senior level in forest recreation or consent of instructor.

580 Advanced Silviculture (3) Silvical characteristics, silvicultural practices and systems applied to commercially important hardwood and softwoods. In-depth analyses of silvicultural principles involved and tools used, prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, structure, growth/yield. 2 hours and 1 lab. Prereq: Undergraduate silviculture course or consent of instructor.

585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory; fixed and variable plot sampling; list sampling; Poisson sampling; regression estimators; multistage and multiphase sampling. Growth and yield predictors for even-aged and uneven-aged forests. Prereq: 326 and 329 or consent of instructor.

590 Advanced Topics in Forestry (1-3) Recent advances and concepts; research techniques and analysis of current problems. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

593 Independent Study in Forestry (1-4) May be repeated. Maximum 6 hours.

630 Forest Growth and Development (3) Forest stand dynamics, analysis of changes in species composition and forest stand structure (physical and temporal) during forest succession, response of stands to disturbances (anthropogenic and natural), modeling techniques to make predictions of future stand development. 2 hours and 1 lab. Prereq: Undergraduate silviculture course or consent of instructor.

540 Seminar on Integrated Resources Management in Biosphere Reserves (2) MAB program, UNESCO-sanctioned global conservation initiative. Analysis of integrated resources management practices that demonstrate concept of sustainable development. Environmental policy and application of science to management practice. Applicable to majors in Forestry and in Wildlife and Fisheries Science.

570 Natural Resource Sustainability: Social, Political and Institutional Dimensions (3) Use and management of natural resources in a world of constant change, interdependent systems (environmental, social, economic and political), and inevitable conflicts, utilizing technical as well as social/political advances. Historical and current approaches to natural resource governance, associated and inherent conflicts, changes in institutions and new paradigms of collaboration, adaptive management, social learning and social capacity building. Prereq: Graduate standing. Students who received credit for Forestry 570 may not receive credit for Forestry, Wildlife and Fisheries 570.

590 Advanced Topics in Forestry, Wildlife and Fisheries (1-3) Recent advances and concepts, research techniques, and analysis of current problems. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.


610 Seminar in Natural Resources (2) Selected issues in natural resources and natural resource management at regional, national, or international level. Development of interdisciplinary approach to addressing problems; evaluating current state of knowledge, developing alternative actions to address problems, and identifying criteria for evaluation of alternatives.
612 Seminar in Forestry, Wildlife and Fisheries (1) Current issues and developments in forestry, wildlife and fisheries. Required of all doctoral students in residence during fall. May be repeated. Maximum 3 hours.

**FRENCH (405)**


411 French Literature of the 16th Century (3) Highlights of 16th-century French literature. Excerpts from Rabelais and Montaigne; readings of poems from writers from Lyon and members of Pléiade. Prereq: 300-level literature course.


413 French Literature of the 18th Century (3) Major works of Enlightenment. Prereq: 300-level literature course.


420 French Cinema (3) French cinema from earliest days through New Wave directors. Prereq: 300-level literature course. May apply toward major. *(Same as Cinema Studies 420.)*

421 Phonetics (3) Foundation in science of phonetics. Practical exercises and individual performance. Graduate credit not offered to students majoring in Romance language. Prereq: 333 or 334 or 345 or permission of department.

422 Advanced Grammar (3) Improving one’s written French by studying basic and more refined structures of French language. Writing creative free-style compositions. Prereq: 333 or 334 or 345.

423-424 Advanced Conversation (1,1) Informal conversation with native speaker on contemporary topics. Stresses in-class contact rather than outside preparation. Prereq: 333 or 334 or 345. Meets 2 hours a week.

425 Introduction to Descriptive Linguistics (3) Theory and practice of techniques of linguistic analysis in sub fields of phonetics, phonology, morphology, syntax, semantics, pragmatics and historical linguistics; discussion of relevance to learning and teaching of foreign languages and to study of literary texts. Recommended prereq: Language, Linguistics and Society. *(Same as German 425; Linguistics 425; Russian 424; Spanish 425.)*

426 Methods of Historical Linguistics (3) *(See German 426.)*

429 Romance Linguistics (3) Development of Classical Latin through Vulgar Latin into major Romance languages. *(Same as Linguistics 429; Spanish 429.)*

430 Theatrical French (4) Comprehensive introduction to dramatic texts, performance, and theatrical production in French. Students collaborate in the creative staging of a French play and they actively participate in its public performance. Writing-emphasis course. Prereq: French 351 or 352. May apply toward major as a literature course.

431 Highlights of French Civilization (3) Survey of French civilization from the Gauls to World War II. Historical events, daily life, all forms of arts. Prereq: 300-level literature course.

432 Contemporary French Culture (3) Current French cultural issues placed in historical perspective with comparative emphasis. Taught in English; readings in French for majors.

434 Literature of Quebec (3) Survey of literature of Quebec as well as French literature connected with North America. Readings include explorer and missionary works, such as Voyages of Champlain and Journals of Jesuits, and literature of contemporary Quebec. Prereq: 300-level literature course.

445 Advanced French for Business (3) Advanced contemporary French language and culture as relates to business transactions. Comparative approach to explore differences and similarities between francophone business culture(s) and those of North America and Japan. Building knowledge of business terminology while being sensitized to cultural differences and dangers of simplistic stereotyping. Prereq: 345 or consent of instructor.

500 Thesis (1-15) P/NP only.

501 Techniques in Literary Analysis (3) Required for MA program. Close stylistic analysis of texts representative of different eras and of different genres. Development and improvement of student’s written French.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 The French Language (3) French as spoken and written from Medieval period to present.

512 Teaching a Foreign Language (3) Practical application of methods for teaching and evaluating basic language skills and foreign language skills, and cultural aspects through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all MA and PhD students holding Graduate Teaching Assistantships, except those whose previous training or experience warrants their being excused by department.

515 Technology Enhanced Language Learning (3) Introduction to TELL. Overview of existing software, programs, and professional literature on topic. Hands-on development of instructional Web site for teaching language, culture, or literature.

519 Bibliography and Methods of Research (3) Critical research tools and scholarly contributions in French literature and language. Practical exercises on compiling of scholarly data using computer-based and non-computer sources.

520 French and Francophone Film (3) French and Francophone culture through film.

530 French and Francophone Theater (3) Changing approaches to French and Francophone Theater.

540 French Literature and Culture I (3) Literary and cultural heritage of 16th- and 17th-century France.

550 French Literature and Culture II (3) Literary and cultural heritage of 18th- and 19th-century France.

560 French Literature and Culture III (3) Literary and cultural heritage of 18th- and 19th-century France.

570 French and Francophone Literature and Culture I (3) Literary and cultural heritage of France and other Francophone countries in first part of 20th century.

573 French and Francophone Literature and Culture II (3) Literary and cultural heritage of France and other Francophone countries from late 20th century to present.

580 Critical Moments in French and Francophone Studies, or Linguistics (3) Contribution of France and Francophone world to evolution of literature, society, and ideas. May be repeated. Maximum 6 hours with consent of department.

584 Modern Theory and Criticism (3) Survey of 20th century critical theory, including psychoanalysis, Marxism, structuralism, and more.
591 Foreign Study (1-15) See College of Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
593 Independent Study (1-15) See College of Arts and Sciences. Satisfactory/No Credit or letter grade.
594-595 French Directed Readings (3,3) P/NP only.
600 Doctoral Research and Dissertation (3-15) P/NP only.
610 Doctoral Seminar in French and Francophone Studies, or Linguistics (3) Content varies. May be repeated. Maximum 12 hours with consent of department.

GEOGRAPHY (415)
410 Global Positioning Systems and Geographic Data (3) Theory, field, and laboratory use of Global Positioning Systems for capturing digital geographic data; management of geographic data: coordinate systems, datum issues, scanning and digitizing, map standards, and uncertainty in Geographic Information Systems. 2 hours and one 2 hour lab.
411 Introduction to Geographic Information Science (3) Concepts and methods of spatial analysis and their application using geographic information systems software and techniques. Emphasizes both theoretical and applied aspects of GIS. 2 hours lecture and 2 hours lab. Prereq: 310 or consent of instructor.
412 Advanced Cartography Techniques (3) Cartographic design and data display techniques for reference and thematic maps. Basic principles and methods of map reproduction. 2 hours and 2 labs. Prereq: 310 or consent of instructor.
413 Remote Sensing: Types and Applications (4) Principles and uses of remote sensing imagery, digital data, and spectral data: geographic interpretation and mapping techniques. 3 hours lecture, 2 hours lab. Prereq: 310 or consent of instructor.
414 Spatial Databases and Data Management (3) Types, sources, acquisition, and documentation of spatial data. Spatial database management methods and strategies for data sharing. 2 hours lecture and 2 hours lab. Prereq: Geography 411 or consent of instructor.
415 Quantitative Methods in Geography (3) Geographic application of statistical techniques, point pattern analysis, and analysis of areal units. Prereq: Mathematics 115 or Statistics 201 or consent of instructor.
421 Geography of Folk Societies (3) Geographical study of folk culture, traditional material culture and rural settlement, examples from eastern North America and selected foreign areas.
423 Geography of American Popular Culture (3) Geographical study of regional variation in popular cultures, youth cultures in United States. (Same as American Studies 423.)
432 Dendrochronology (4) Principles, techniques, and interpretation in tree-ring science. Applications in geography, climate, ecology, forestry, archaeology, and earth sciences. 3 hours and 2 hours lab per week. Prereq: 131-132 or consent of instructor.
433 The Land-Surface System (3) Characteristics of surface form, water, vegetation, and surface materials, and their regional interrelationships. People as evaluators and agents of change. Prereq: 131-132 or consent of instructor.
434 Climatology (3) General circulation system leading to world pattern of climates. Climatic change and modification, and interrelationships of climate and human activity. Prereq: 131 or consent of instructor.
435 Biogeography (3) Changing distribution patterns of plants and animals on variety of spatial and temporal scales. Effects of continental drift, Pleistocene climatic change, and human activity on world biota. Prereq: 131-132 or consent of instructor.
436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues from physical and economic geographical perspectives. Prereq: 131-132 or consent of instructor.
439 Plant Geography of North America (3) Characteristics and distribution of major plant communities of Canada, the U.S., Mexico, and Central America. Relationships to climate, soil, fire, and human disturbance. Long-term history and future prospects. Prereq: 131 or 132 or coursework in botany or consent of instructor.
441 Urban Geography of the United States (3) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities in the United States. Writing emphasis course. (Same as Urban Studies 441.)
442 Urban Social Geography (3) Geographical study of urban culture; social production of neighborhoods; social and behavioral aspects of territoriality, residential mobility, segregation, and the rise of post-industrial and global cities (Same as Urban Studies 442.)
443 Rural Geography of the United States (3) Geographical appraisal of rural areas of the United States, including small towns and urban fringes. Problems and potentials of rural America. Writing-emphasis course.
449 Geography of Transportation (3) Examination of transportation systems, their effects on trade patterns, land use, location problems, and development.
450 Process Geomorphology (3) (See Geology 450.)
454 Terrain Analysis (3) Analysis of landscape history from digital elevation datasets and traditional topographic maps. Basement materials and structures; and erosional and depositional evidence, including fluvial, glacial, aeolian, and shoreline features, of past climatic and biological regimes. Prereq: 131-132 or Geology 101-102 /107-108.
466 Teaching and Learning Geography (3) Preparation of prospective teachers in content, skills, strategies, and understandings needed for effective teaching and assessment of geography in K-12 schools. Course organization and content based largely on that of National Geography Standards.
495 Special Topics in Geography (1-4) Topics vary. Prereq: consent of instructor. May be repeated with consent of instructor. Maximum 8 hours. Satisfactory/No Credit or letter grade.
500 Thesis (1-15) P/NP only.
501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. Registration required of resident graduate students whenever offered. May be applied toward graduate degree. May be repeated. Maximum 4 hours. Satisfactory/No Credit grading only.
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.
504 Introduction to Geographical Research (1) Research interests and methods of departmental faculty. Research frontiers in geography. Required of new graduate students. Satisfactory/No Credit grading only.
505 Directed Research (2-6) Research on problems as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hours. Satisfactory/No Credit or letter grade.
506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hours. Satisfactory/No Credit or letter grade.
509 Topics in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hours. Satisfactory/No Credit or letter grade.

510 Geographic Software Design (3) Algorithms for spatial analysis, software design, and program implementation in stand alone and distributed computing environments. Prereq: Consent of instructor.

513 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data. Prereq: 413 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

515 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography; research problems utilizing appropriate computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 415 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

517 Geographic Information Management and Processing (3) Concepts and methods in management of geographic information. Database design, manipulation, sampling and analysis. Prereq: Consent of instructor.

518 GIS Project Management (3) Interactions between management, technical, and application aspects of Geographic Information Systems project through simulated environment of real-world GIS sites. Prereq: 411 or consent of instructor.

519 Graduate Practicum in Cartography/Remote Sensing/GIS (2-6) Prereq: Written consent of department before registration. May be repeated with consent of instructor. Maximum 6 hours.

521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography. Prereq: 421 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

523 Topics in Physical Geography (3) Trends, problems, and methods in geomorphology or other areas of physical geography. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

524 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography. Prereq: 435 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

536 Topics in Watershed Dynamics (3) Trends, problems and methods in study of watershed processes. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

541 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 441 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

545 Topics in Population Geography (3) Human population dynamics and migration, spatial variation in population composition and housing. Demographic analysis techniques.

549 Topics in the Geography of Transportation (3) Examination of trends, problems, and methods in transportation geography and transportation networks. Prereq: 449 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hours.

591 Foreign Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. Satisfactory/No Credit or letter grade.

592 Off-Campus Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. Satisfactory/No Credit or letter grade.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. Satisfactory/No Credit or letter grade.

599 Geographic Concept and Method (3) Traditional and modern geographic thought; readings on nature, scope, problems, and methods of geography. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only.

609 Seminar in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

611 Seminar in Geographic Information Science (3) Prereq: 517, 518 or consent of instructor. May be repeated. Maximum 6 hours.

613 Seminar in Natural Hazards (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

621 Seminar in Dendrochronology (3) Prereq: 432 or consent of instructor. May be repeated. Maximum 6 hours.

622 Seminar in Physical Geography (3) Prereq: 533 or consent of instructor. May be repeated. Maximum 6 hours.

625 Seminar in Biogeography (3) Prereq: 535 or consent of instructor. May be repeated. Maximum 6 hours.

641 Seminar in Urban Geography (3) Prereq: 541 or consent of instructor. May be repeated. Maximum 6 hours.

642 Seminar in Rural Geography (3) Prereq: 443 or consent of instructor. May be repeated. Maximum 6 hours.

649 Seminar in Geography of Transportation (3) Prereq: 549 or consent of instructor. May be repeated. Maximum 6 hours.

663 Seminar in Geography of the American South (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

GEOLOGY (424)

401 Quantitative Methods in Geology (3) Applications of calculus and differential equations to problems in earth sciences. Examples of diffusion equation in hydrogeology; wave equation in geophysics; mechanical modeling and boundary conditions in structural geology and tectonics. Prereq: two 100-level geology courses and Mathematics 141, or consent of instructor.


411 Optical Mineralogy (2) Laboratory course on principles of optical mineralogy. Use of petrographic microscope to identify rock-forming minerals with applications to petrology and environmental mineralogy. Prereq: 310.

412 Elements of X-ray Diffraction (2) Laboratory course on principles and applications of X-ray diffraction. Phase identification, quantitative determination of mineral abundances in mixtures, and crystal structure determination. Prereq: 310.
440 Field Geology (5) Summer field course for advanced undergraduate geology majors and first-year graduate students in geology. Taught off-campus and requires full time of student. Synthesis of major aspects of geological sciences in societal context. Field techniques demonstrated, practiced, and applied to solution of geological problems. Prereq: Completion of major core courses and consent of instructor.

450 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery. 2 hours and one 2 hour lab. Prereq: two 100-level geology courses or consent of instructor. (Same as Geography 430.)

455 Basic Environmental Geology (3) Applications of geological sciences toward comprehension of effects of geological processes on humans and effects of human activities on earth’s environments. 2 hours and one 3 hour lab or field period. Prereq: one 100-level geology course or consent of instructor.

460 Principles of Geochemistry (4) Applications of chemical principles to geologic systems: problem-solving techniques. Phase diagrams, partitioning of trace elements, thermodynamic principles for evaluating stabilities of mineral assemblages, aqueous solutions, and applications of radiogenic and stable isotopes to geologic systems. 3 hours and one 2 hour tutorial. Prereq: Chemistry 120-130, Mathematics 141-142. Recommended prereq: Geology 330 or consent of instructor.

470 Applied Geophysics (3) Basic principles of geophysical exploration: applications to environmental problems. Seismic and electromagnetic methods. Prereq: 6 hours of geology courses numbered above 300 and Physics 135-136 or equivalent, or consent of instructor.

475 Physical and Chemical Systems of the Earth (3) Development of physical earth from solar nebula to present. Physical chemistry of the surface of the earth, terrestrial atmospheres, water, rocks, minerals, and their interactions. Interdependence of earthquakes, volcanism, plate tectonics, geodynamics, and isotopic processes of the interior of the earth. Historical perspective on major controversies of past and problems unresolved today. 2 hours and 1 discussion. Prereq: 16 hours of geology courses numbered 300 and above.

480 Principles of Economic Geology (4) Ore-forming processes, classification of mineral deposits, survey of different types of mineral deposits with examples, and metallogenic models. 1 hour and one 2 hour lab. Prereq: 310 and 330 or equivalents. Recommended prereq: 460.

485 Principles of Hydrogeology (3) Physical principles of flow, flow equations, geologic controls, aquifer analysis, water well design/testing, introduction to transport processes. Prereq: one 100-level geology course, Mathematics 141-142, and Physics 135 or 136 or equivalent, or consent of instructor. (Same as Civil Engineering 485).

486 Hydrogeology Laboratory (1) Application and demonstration of hydrogeological principles in field and laboratory. Prereq or coreq: 485 or Environmental Engineering 535 or consent of instructor.

500 Thesis (1-15) P/NP only.

501 Fractal Models in Earth Sciences (3) An introduction to the theory and methods of fractal analysis as applicable to earth sciences. Topics include deterministic and statistical fractals, self-affine fractals, multifractals, percolation, renormalization group theory, cellular automata, and methods of estimating fractal parameters (e.g., dimension and lacunarity). Applications to be discussed include: characterization of coastlines, drainage basins, and fracture networks; terrain simulation; modeling porous media and hydraulic properties; rock fragmentation; spatial variability of mineral deposits; and temporal variability of earthquakes and floods. Prereq: 401, or at least two Earth Science related courses, or consent of instructor.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Structure of the Southern and Central Appalachians (2) Structural development of Southern and Central Appalachians from extensional Late Proterozoic—early Paleozoic rift-drift-platform margin through processes related to compressional events producing accretionary elements that formed Appalachians throughout the Paleozoic. Comparisons to similar orogens. Prereq: 370.

510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques in clay mineral studies. 2 hours and 1 lab. Prereq: 310 and 568 or equivalent.

530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metamorphic rocks, magmatic and subsolidus processes and physical conditions. Laboratory involves petrographic study of crystalline rocks in thin section. 3 hours and 1 lab. Prereq: 410.

535 Applied Ground Water Hydrology (3) (See Environmental Engineering 535.)

539 Geologic Applications of Remote Sensing (3) An introduction to the use of visible, infrared, microwave/radio, and nuclear remote sensing techniques in the geologic study of the Earth. Topics covered include mineral spectroscopy, light scattering models, instrumentation for remote sensing, calibration and atmospheric removal, multi- and hyperspectral image cube analysis, and ground-truthing techniques. Emphasis on working directly with remote sensing data to solve geologic problems. 2 lecture hrs and one 2-hour lab. Prereq: 310; Mathematics 141-142; and Physics 135; or consent of instructor.

540 Seminar in Local Geology (1) Introduction of geology of Southern Appalachians. 1 hour plus field trips.

544 Paleopedology (3) Field, microscopic, and geochemical analysis of fossil soils (paleosols) and comparison with modern analog soils; interpretation of changes in paleoweathering processes, paleoclimate, and paleoatmospheric chemistry over 4.6 billion years of earth history based on paleosols. Prereq: 340 or equivalent, general chemistry, or consent of instructor.

545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of terrigenous clastic rock types; physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. 3 hours and 1 lab. Prereq: 340 or equivalent.

546 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonate sediments and diagenesis of resultant rocks; field and laboratory analysis of sample material and preparation of scientific reports. 3 hours and 1 lab.

556 Ice-Age Environments and Global Climate Change (3) (See Ecology and Evolutionary Biology 556.)

557 Quaternary Ecology (3) (See Ecology and Evolutionary Biology 557.)

561 Organic Geochemistry (3) Fundamentals of organic geochemistry: primary production, diagenesis, and preservation of organic matter in the sedimentary rock records; and reconstruction of ancient geologic environments using biomarker compounds. 3 lecture hours. Prereq: Chemistry 120-130 or equivalent or consent of instructor.

563 Stable Isotope Geochemistry (3) Theoretical aspects of isotope fractionation and applications to geologic systems. Isotope exchange, variations in natural waters, diagenetic, hydrothermal and metamorphic systems. Prereq: General Chemistry or equivalent.


568 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, x-ray fluorescence, and atomic absorption spectrophotometry techniques. 2 hours and 1 lab. Prereq: 310 or consent of instructor.
570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; recent literature. 3 hours and 1 lab or seminar. Prereq: 370 or equivalent, or consent of instructor.

572 Fracture Analysis (3) Field and subsurface characterization, and mechanical development of natural fractures: role in groundwater flow. Prereq: Structural Geology or equivalent, or consent of instructor. (Same as Civil Engineering 572.)

575 Tectonics (4) Evolution of Earth’s lithosphere in context of plate tectonics theory. Formation of continents through comparative anatomy of mountain belts, including Appalachians, Alps, Urals, Caledonians, Cordillera, Andes, and Himalayas. 3 hours and 1 seminar. Prereq: Structural Geology or consent of instructor.

576 Reflection Seismology (3) Imaging subsurface features using reflected seismic waves. Energy sources, modes of wave propagation, field procedures, computer data processing, and pitfalls. Applications to tectonic and environmental problems. Prereq: 470 or consent of instructor.

585 Contaminant Hydrogeology (3) Physical transport processes, isotopes and groundwater age dating, processes influencing inorganic, organic and microbial contaminants, sampling and monitoring methods, remediation of contaminated groundwater, aquifer protection. Prereq: 485 or 535; 460; or Environmental Engineering 553 or equivalent, and consent of instructor.

586 Field and Laboratory Methods in Hydrogeology (3) Research methods. Measurement of hydraulic properties, drilling, sampling and instrumentation, tracer experiments. Formulating hypotheses and research plans. Prereq or coreq: 485 or Environmental Engineering 553; and consent of instructor.

590 Special Problems in Geology (1-3) Directed study or special topics. Prereq: Consent of instructor. May be repeated. Maximum 10 hours.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

595 Selected Topics in Geology (1) Presentation of research by faculty and visiting scientists. Registration required each semester for resident full-time graduate students, except in summer and when registered for 596. Satisfactory/No Credit grading only.

596 Geology Colloquium (1) Preparation and oral presentation of scientific material. Grade based on content, preparation, presentation, and instructor critique in departmental seminar. Taken only once during residence for each graduate student.

600 Doctoral Research and Dissertation (3-15) P/NP only.

630 Seminar in Petrology (3) May be repeated with consent of department. Maximum 9 hours.

640 Seminar in Sedimentary Geology (3) May be repeated with consent of department. Maximum 9 hours.

650 Seminar in Geomorphology and Quaternary Geology (3) May be repeated with consent of department. Maximum 9 hours.

660 Seminar in Geochemistry (3) May be repeated with consent of department. Maximum 9 hours.

670 Seminar in Structural Geology (3) May be repeated with consent of department. Maximum 9 hours.

675 Seminar in Geophysics (3) Advanced treatment of selected topics in geophysics. Prereq: 470 or consent of instructor.

685 Seminar in Hydrogeology (3) May be repeated with consent of department. Maximum 9 hours.

GERMAN (433)

331-332 Elements of German for Upper-Division and Graduate Students (3,3) Elements of language, elementary and advanced readings, and a final 10,000 word translation project. Open to graduate students preparing for language examinations, and upper-division students desiring reading knowledge of the language. No credit for students having completed 101-102. 332 may be repeated. Maximum 6 hours. Undergraduate credit only.

411-412 Advanced Conversation and Composition (3,3) Prereq: 311-312 or equivalent or consent of department.

415 Special Topics (3) Topics vary. May be repeated. Maximum 6 hours.

416 Metropolis Revisited (3) The 20th Century German or Austrian metropolis in the mirror of history, literature, theory, art, architecture, and music. Taught in English. Prereq: German 101-102 or simultaneous enrollment in that sequence and consent of instructor.

419 German Fairy Tales and Literary Fantasies (3) How and why forms of literary fantasies ranging from apocalyptic dreams to enchanted visions have changed over the centuries. Strong interdisciplinary component, tracing interconnections between philosophy, psychology, religion and literary history, as well as exploring the relationship between literary, musical and artistic representations of specific themes. Prereq: 6 hours of 300 courses or equivalent, excluding 331-332.

420 Selected Topics in German Literature from 1750 to the Present (3) Prereq: 6 hours of 300-level courses (excluding 331-332 and courses in English translation) or equivalent.

425 Introduction to Descriptive Linguistics (3) (See French 425.)

426 Methods of Historical Linguistics (3) Phonetics, distinctive feature analysis, sound change types, nature of sound change, principles of reconstruction, and fundamental assumptions about language change through time. Survey of non-phonological linguistic change, language families, Proto-Indo-European, and other proto languages. Prereq: 6 hrs of upper division foreign language courses (excluding courses in translation or graduate reading courses). (Same as French 426; Linguistics 426; Russian 426; Spanish 426.)

431 Images of Nature and the Body in German Culture (3) Representations of nature from idyllic refuge and object of praise to scientific object and precarious resource. Other themes include sexuality, the body, childhood, and aging. Discussions based on literary and documentary texts and films. Prereq: 6 hours of 300 courses or equivalent, excluding 331-332.

432 German Creative Thinking: Interdisciplinary Dialogues (3) Interdisciplinary connections between German literature and art, music, philosophy, theatrical praxis, psychology, dance, anthropology, history, and the sciences. Comparative analyses of literary and non-fictional texts, films, and other media. Prereq: 6 hours of 300 courses or equivalent, excluding 331-332.

433 Nation, Race, and Ethnicity (3) Examination of cultural constructions of nation, race, and ethnicity and how they have challenged each other and developed in German speaking countries since the eighteenth century. Close study and analysis of fiction, non-fiction, and films that address controversial topics such as assimilation, integration, racial/ethnic identity formation and multiculturalism. Prereq: 6 hours of 300 courses or equivalent, excluding 331-332.

434 Extraordinary Wo(Men)-Outcasts, Rebels, Martyrs and Saints (3) Examination of German texts and visual media that have challenged mainstream thinking throughout the centuries. Strong interdisciplinary component, focusing on literary and artistic forms that depict struggles involving religion, politics and gender. Prereq: 6 hours of 300 courses or equivalent, excluding 331-332.
435 Structure of the German Language (3) Contrastive English-German segmental and suprasegmental phonemes, contrastive English-German linguistic structures, selected topics in advanced German grammar and syntactic analysis. Prereq: 6 hours of upper-division German language courses (excluding courses in translation and graduate reading courses). (Same as Linguistics 435.)

436 History of the German Language (3) Development of German language from Indo-European through Proto-Germanic, Old High German, Middle High German to New High German. Internal and external linguistic history of Germanic speech. Prereq: 6 hrs of upper-division German language courses (excluding courses in translation or graduate reading courses). (Same as Linguistics 436.)

485 Business German (3) Survey of German used in fields of business, government, administration, and economics. Prereq: 6 hours of upper-division German excluding courses in translation and 331 and 332.

494 German Community Service Practicum (1) Supervised by the director of the Lower-Division German program, students either assist German classes at local schools or perform supervised service with local institutions that promote awareness of German culture among the general public. Prereq. 18 hours of upper-division German courses and consent of program chair. Maximum of one hour credit per semester. May be repeated for a maximum of 3 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 German Phonetics and Advanced Grammar (3) Advanced work in phonetics, pronunciation, and selected topics in German grammar. For teachers and prospective teachers. Prereq: Consent of instructor.

512 Teaching a Foreign Language (3) Practical application of methods for teaching and evaluating basic language skills and foreign language skills, and cultural knowledge through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all MA and PhD students holding GTAs, except those whose previous training or experience warrants excuse by department.

519 Bibliography and Methods of Research (3) Critical research tools and scholarly contributions in German literature and language. Practical exercises on compiling of scholarly data using computer-based and non-computer sources.

540 Evaluation in Health Promotion and Health Education (3) Drug and alcohol abuse problems and suspected causes; pharmacology of drugs and effects on society; strategies for intervention and education.

541 Medieval German Language and Literature (3) Introduction to Middle High German.

545 Substance Use and Abuse (3) Drug and alcohol abuse problems and suspected causes; pharmacology of drugs and effects on society; strategies for intervention and education.

546 Aging and Health (3) Aging process in health perspective as related to health promotion and wellness of aged.

550 Studies in German Literature (3) Content varies. May be repeated. Maximum 6 hours.

552 German Enlightenment, Rococo, and Sturm und Drang (3) Content varies. May be repeated. Maximum 6 hours.

554 German Realism and Naturalism (3) Content varies. May be repeated. Maximum 6 hours.

555 Modern German Literature 1890-1945 (3) Content varies. May be repeated. Maximum 6 hours.

556 Modern German Literature 1945-Present (3) Content varies. May be repeated. Maximum 6 hours.

560 German Literary Theory and Criticism (3)

561-562 Directed Readings in German Language and Literature (3,3)

563-632 Seminar in German and Germanic Philology (3,3)

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

621-622 Seminar in German Literature (3,3) May be repeated. Maximum 18 hours.

630 Doctoral Research and Dissertations (3-15) P/NP only.

631-632 Seminar in German and Germanic Philology (3,3)

640 Consumer Health (3) Survey of major consumer health care providers and health care services; selecting, purchasing, evaluating and financing medical and health care services/products. (Same as Public Health 400.)

645 Women's Health (3) Factors influencing women's health and women consumers in nation's health service delivery systems. Health problems/concerns of women and techniques for prevention, maintenance and/or correction. (Same as Women’s Studies 425.)

646 Aging and Health (3) Aging process in health perspective as related to health promotion and wellness of aged.

650 Thesis (1-15) P/NP only.

652 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

653-654 Seminar in German and Germanic Philology (3,3)

656 Evaluation in Health Promotion and Health Education (3) Evaluation principles and methodologies as related to health promotion programs, processes and programs. Construction of instruments for use in assessing health education outcomes.

670 Special Topics (1-3) For graduate students, in-service teachers and other health professionals. Health/wellness or health promotion issues. May be repeated. Maximum 12 hours.
585 Seminar in Gerontology (1) Scope of gerontology as discipline and as related to other academic and professional disciplines. Speakers both internal and external to the University of Tennessee, Knoxville. Prereq: Consent of instructor. May be repeated. Maximum 3 hours. Satisfactory/No Credit grading only. (Same as Sociology 585; Psychology 585; Exercise Science 585; Nursing 585; Public Health 585; Social Work 585; Sociology 585.)

590 Research Methods in Health (3) Basic research techniques in variety of health settings. Development of research skills and problem identification for research topic. (Same as Public Health 590.)

593 Directed Independent Studies (1-3) Individual identification and study of health/wellness or health promotion problem/issue. Specific proposal to instructor before registration. May be repeated. Maximum 12 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Internship/Research in Safety and Health (3-6) (See Safety 601.)

610 Critical Analysis of Writing and Research (3) Analysis of writing and research in health related areas.

620 Advanced Research Techniques in Health (3) Advanced theory and techniques of research design and methodologies in health discipline. Prereq: 590, 610.

650 Health Aspects of Gerontology (3) Knowledge and understanding of biological, psychological and sociological aspects of aging as related to health and wellness of individual. (Same as Public Health 650.)

655 Seminar in Nation’s Health (3) Comprehensive study of definition, determinants, resources and health status of nation. (Same as Public Health 655.)

660 International Health (3) Study of quality of health, health promotion and health services in countries throughout world. (Same as Public Health 660.)

**HIGHER EDUCATION ADMINISTRATION (461)**

455 Seminar in Student Leadership (1) Topics to be assigned. To develop knowledge and skills in leadership roles for resident assistants, student government leaders, student activities, and other student organizations. May be repeated. Maximum 3 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

513 Administrative and Organizational Theory (3) (See Educational Administration 513.)

514 Leadership Themes in Literature (3) Review and analysis of selected literature works-Novels, biographies, poetry, plays, essays, personal letters and speeches, history-for lessons that enhance understanding of leadership role, values, and effectiveness.

516 Research Methods (3) (See Educational Administration 516.)

534 Program Evaluation in Education (3) (See Curriculum, Educational Research, and Evaluation 534.)

536 Policy Issues in Higher Education Quality Assurance (3) Exploration of historic and contemporary approaches to definition and demonstration of quality in education and examination of contemporary policy issues related to quality assurance.

537 Student Assessment in Higher Education (3) Outcome assessment in American higher education: origins of assessment policies, rationales for assessment policy and practice, constructs and outcomes typically assessed, methods for conducting assessment, and uses of assessment data. Philosophies, priorities, and values, recent assessment efforts in higher education.

542 The College Student and the Court (3) Legal precedent affecting student personnel services in public higher education. Student discipline, housing, dress, organizations, activities fees, tuition and related federal regulations.

543 American Higher Education in Transition (3) History, philosophy, purposes, functions, organizations and programs in American higher education.

570 Student Affairs Administration in Higher Education: Theory and Practice (3) Historical, philosophical and organizational perspective. Functional areas comprising field and major issues.

572 Student Development Theory and Practice in Higher Education (3) Theoretical framework of college student personnel services and practical application of theory in student services environment. Applicable administrative theory, human development theory and evaluation assessment techniques.

574 The College Student (3) Critical examination of the characteristics and concerns of current college students in relation to the direction and provision of student services and student personnel administration.

593 Independent Study (1-3) Consent of instructor required. May be repeated. Maximum 9 hours.

595 Special Topics (1-3) May be repeated. Maximum 12 hours.

599 Internship in College Student Personnel (1-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

600 Doctoral Research and Dissertation (3-15) P/NP only.

604 Seminar in Educational Administration and Policy Studies (1-4) Directed readings and research in educational administration. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

605 Advanced Seminar in Administrative Theory (3) Interdisciplinary seminar. Readings selected by faculty for research and scholarly value from early to current classic theoretical studies and current periodical literature in administrative and organizational theory. (Same as Educational Administration 605.)

606 Leadership Forum (2) (See Educational Administration 606.)

614 Statistics for Educational Administrators (3) (See Educational Administration 614.)

615 Research Design (3) (See Educational Administration 615.)

616 Research Methods (3) (See Educational Administration 616.)

617 Case Study Methods in Educational Research (3) (See Educational Administration 617.)

619 Administration and Governance of Higher Education (3) Trends, structure and process of collegiate governance. Development of understanding of administrative theory and practice in higher education.

629 Seminar in Policy Issues in Education (3) (See Educational Administration 629.)

640 Policy Issues in College and University Law (3) Legal precedent affecting organizations, administration, and finance of higher education. Academic freedom, faculty termination, religion, tort liability, administrative law, academic due process and affirmative action in employment.

645 Curriculum and Instruction in Higher Education (3) Examination of teaching, learning and curriculum in higher education.
650 Fiscal Policy Issues in Higher Education (3) Revenue sources, appropriation process, budget procedures, cost analysis, and fiscal management in public and independent colleges and universities.

658 Conflict Management (3) Social conflict and its management. Causes of interpersonal, inter-group, and organizational conflict, skills and strategies used to manage conflict, conflict management models associated with different sectors of human activity, and current organizational practices for managing destructive conflict. (Same as Educational Administration 658.)

670 Values and Ethics in Educational Leadership (3) Examination of moral and ethical dimensions of the work of educational leaders. (Same as Educational Administration 670.)

680 Administration of Complex Organizations (3) (See Educational Administration 680.)

693 Independent Study (1-3) May be repeated. Maximum 12 hours.

695 Special Topics (1-3) May be repeated. Maximum 12 hours.

HISTORY (462)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Foundations of Graduate Study in History (3) Assumptions and methods of historians. Required of all candidates for advanced degrees.

511 Teaching World History (3) Methodology, conceptualization, historiography, textbook selection and syllabus construction to prepare students to teach courses in world history.

512 Teaching Western Civilization (3) Methodology, conceptualization, historiography, textbook selection and syllabus construction to prepare students to teach courses in western civilization.

513 Teaching United States History (3) Methodology, conceptualization, historiography, textbook selection and syllabus construction to prepare students to teach courses in U.S. history.

515 Introduction to American History to 1840s (3) Survey of major themes, methodologies, and interpretations in early American historiography.

516 Introduction to American History, 1840s–present (3) Survey of major themes, methodologies, and interpretations in modern American historiography.

521 MA Readings (3) Directed readings in preparation for MA examinations. Open only to master’s candidates in history. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

531 Topics in Premodern Europe (3) Reading seminar: secondary sources on premodern European movements and trends. Focus varies. May be repeated. Maximum 15 hours.

532 Topics in Modern Europe (3) Reading seminar: secondary sources on movements and trends that are multinational in focus. Focus varies. May be repeated. Maximum 15 hours.

533 Topics in European National History (3) Reading seminar: secondary sources on intra-national topics, usually British, Russian, German or French. Focus varies. May be repeated. Maximum 15 hours.

541 Topics in Early American History (3) Reading seminar: secondary sources on early North American history. Focus varies. May be repeated. Maximum 15 hours.

542 Topics in 19th-Century United States (3) Reading seminar: secondary sources on 19th-century United States. Focus varies. May be repeated. Maximum 15 hours.

543 Topics in 20th-Century United States (3) Reading seminar: secondary sources on 20th-century U.S. Focus varies. May be repeated. Maximum 15 hours.

544 Topics in U.S. Environmental History (3) Reading seminar: secondary sources on U.S. environmental history. Focus varies. May be repeated. Maximum 15 hours.

551 Topics in the History of Foreign Relations (3) Reading seminar: secondary sources on foreign relations. Focus varies. May be repeated. Maximum 15 hours.

552 Topics in Military History (3) Reading seminar: secondary sources on military history; military operations, social impact of war and naval strategy in foreign policy. May be repeated. Maximum 15 hours.

555 Topics in United States Social and Economic History (3) Reading seminar: secondary sources on U.S. social and economic history. Focus varies. May be repeated. Maximum 15 hours.

556 Topics in European Social and Economic History (3) Reading seminar: secondary sources on social or economic history of European nations. Focus varies. May be repeated. Maximum 15 hours.

557 Topics in Cultural and Intellectual History (3) Reading seminar: secondary sources on cultural and intellectual history. Focus varies. May be repeated. Maximum 15 hours.

558 Topics in United States Regional and Local History (3) Reading seminar: secondary sources on regions, states and cities of the South. Focus varies. May be repeated. Maximum 15 hours.

559 Topics in Jewish History (3) Reading seminar: secondary sources on Jewish history. Focus varies. May be repeated. Maximum 15 hours.

561 Topics in Latin American History (3) Reading seminar: secondary sources in Latin America. Focus varies. May be repeated. Maximum 15 hours.

562 Topics in Asian History (3) Reading seminar: secondary sources on Asian history; East Asia and Middle East. Focus varies. May be repeated. Maximum 15 hours.

580 Topics in History (3) Reading seminar: secondary sources for new topics. Focus varies. May be repeated. Maximum 15 hours.

585 Topics in World History (3) Reading seminar in transnational themes involving analysis of two or more world cultures. Focus varies. May be repeated. Maximum 9 hours.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

600 Doctoral Research and Dissertation (3-15) P/NP only.

621 Directed Readings (3) Directed readings to prepare candidate for doctoral comprehensive examination. May be repeated. Maximum 1 per doctoral field. Satisfactory/No Credit grading only.

631 Seminar in Pre-Modern European History (3) Research seminar in primary sources. Focus varies. May be repeated. Maximum 15 hours.

632 Seminar in Modern European History (3) Research seminar in primary sources culminating in scholarly paper in modern European history. Focus varies. May be repeated. Maximum 15 hours.
641 Seminar in 17th- and 18th-Century America (3) Research seminar in primary sources. Focus varies. May be repeated. Maximum 15 hours.


651 Seminar in Military and Foreign Relations History (3) Research seminar in primary sources culminating in scholarly paper in military or foreign relations history. Focus varies. Not restricted by national grouping. May be repeated. Maximum 15 hours.

658 Seminar in United States Regional and Local History (3) Research seminar in primary sources culminating in scholarly paper in regional and local history. Focus varies. May be repeated. Maximum 15 hours.

HOTEL, RESTAURANT, AND TOURISM (514)

423 Marketing for Hospitality and Tourism (3) Marketing principles and practices specifically applied to the hospitality and tourism industry. Includes the analyses of various hospitality and tourism marketing strategies and the implications of those strategies. Develops the use of marketing tools as an integral part of the hospitality and tourism operation. Prereq: 210, 211, 224, Marketing 300 or consent of instructor.

435 Conventions and Meetings: Pursuit and Attainment (3) Discussion of types of conventions/meetings, roles of meeting planners, identifying decision makers, site selection, negotiating, budgeting, marketing and gaining commitment from group. Prereq: 210, 211, 390 or consent of instructor.

500 Thesis (1-15) P/NP only.

501 Professional Project (3-6) Application-oriented, capstone project to show competence in major academic area. Enrollment limited to hotel, restaurant and tourism students in non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Trends and Issues in Service Management (3) Examination of current and emerging trends and issues in the consumer product and services industry. Implications of trends and their managerial and strategic applications in services management. (Same as Recreation and Leisure Studies 510.)

523 Tourism Analysis (3) Trade theory and regional analysis methodologies applied to tourism and the service industry, including travel balance account, interregional transactions flow, economic impacts, environmental economics, demand theory and forecasting.

524 Tourism Destination Development (3) Relationship of economic theory and planning principles to tourism development. Includes the application of pre-feasibility analysis to tourism projects and the evaluation of various types of tourism and components of tourism.

532 Human Resource Management in Services Industry (3) Analysis of significant organizational processes and practices in management of human resources within consumer product and service industry.

534 Special Topics in Foodservice and Lodging Administration (1-3) Lecture/discussion format. Contemporary developments and trends in industry. Prereq: Consent of instructor. May be repeated.

535 Directed Study in Foodservice and Lodging Administration (1-3) Problems selected for study by student with guidance of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

537 Seminar in Foodservice and Lodging Administration (1) May be repeated. Satisfactory/No Credit grading only.

542 Advanced Hotel Administration (3) Strategic management of hotel organizations. Theoretical and applied literature on formulation and implementation of strategy: external and internal factors relevant for business and corporate level decisions. Consideration of role of marketing in hotel firms. Analysis of industry and case studies. Prereq: 531, 532.

547 Field Experience (3-9) Experience in food- or lodging-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. Satisfactory/No Credit grading only.

600 Doctoral Research and Dissertation (3-15) P/NP only.

614 Trends and Issues in Hospitality and Tourism (3) Examination of contemporary issues in hospitality and tourism.

615 Literature and Thought in Hospitality and Tourism (3) Evaluation of hospitality and tourism management literature with emphasis upon research literature, development of scholarly thought, and identification of potential areas of further study.

HUMAN ECOLOGY (520)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

HUMAN RESOURCE DEVELOPMENT (529)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (3) May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

509 Implementation of Human Resource Development Systems (3) The internship provides experiential learning for students who come to human resource development without practical real world experience. The internship is an opportunity to apply classroom knowledge, obtain additional human resource experience, and reflect on the knowledge and experience. The corporate experience provides additional human resource knowledge and assists the student in research and career advancement. Prereq: 510.

510 Foundations of Human Resources (3) Students develop a working definition and understanding of the foundations that grid the academic discipline and profession of Human Resources. Students develop knowledge of the historical, theoretical, and philosophical foundations as well as the core models of learning, performance, change and management that promote best practices in the field. Students are introduced to the disciplines of training and development, human expertise, organizational development, and management including human resource management goals and activities.

513 Special Topics in Human Resource Development (1-3) Topics vary in research, theory and current issues in Human Resources. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

514 Individual Study in Human Resource Development (3) Prerequisite: Consent of supervising instructor. Approval form must be filed in office of the Program Liaison. May be repeated. Maximum 6 hours.

517 Career Development (3) Examination of processes and practices that facilitate the individual’s leadership development, performance improvement and career goals in relation to the organization’s present and future human resource needs, including identification of personal responsibilities and organizational opportunities through successful career development systems.

518 Performance Improvement Systems and Technologies (3) Provides studies of concepts, strategies, tools, and trends of performance improvement technologies. Major emphasis will be on the planning, facilitating, and implementation of performance technologies that support human resource functions and facilitate their value to organizations. Prereq: 510.

519 Human Resource Problems (3) Accommodates experiential learning for students who have a background in human resource development. In an employment context, students identify, analyze design, develop, implement, and evaluate a practical human resource development intervention. Prereq: 510 and 511.

520 Collaborative Strategies in Human Resource Development (3) Examines the strategies for collaboration and teambuilding within organizational systems. The course assists human resource professionals understand the processes associated with teambuilding including defining types of teams, rewarding and evaluating team performance, operating principles and communication within teams. The primary focus of this course will be creating the high performance team. Prereq: 563.

556 Organizational Development Strategies (3) Overview of the roles, strategies, and challenges of organizational development with a focus on the dynamics of organizational change and the internal integration of organizational culture in a global context. Coreq: 510

557 Design Strategies (3) Design methodology for business and industry interventions; development of instructor-based, technology-based, and self-directed training for training and development and consulting. Coreq: 510.

559 Evaluation Strategies (3) Evaluation strategies for professional settings. This course examines the importance of evaluation, how to conduct appropriate evaluations, instrumentation and analysis strategies, how to assess the return-on-investment, and guidelines for creating an evaluation report. Prereq: 557.


563 Organizational Communication Strategies (3) Students investigate organizational communication theory, purposes, channels, practices, styles, approaches, skills, and tools. Process improvement strategies span internal, and external communication and target oral, written, and nonverbal communications that occur in face-to-face, technology-mediated, and blended organizational communication contexts.

600 Doctoral Research and Dissertation (3-15) P/NP only.

602 Proseminar I in Human Resource Development (3) Basic thought, concepts, and issues required for advanced graduate study in human resource development. Must be taken during first year of study in program. Consent of instructor for non-HRD students.

603 Proseminar II in Human Resource Development (3) Basic thought, concepts, and issues required for advanced graduate study in human resource development. Must be taken during first year of study in program. Consent of instructor for non-HRD students.

605 Seminar in Organizational Theory and Environmental Context (3) Organizational structure and basic systems influencing individual, group and organizational behavior with an emphasis on environmental context impacting worker performance and opportunities for learning transfer. Ecological approach to organizational effectiveness is addressed. Prereq: 602 and 603.

606 Research in Human Resource Development (3) Theory and application of qualitative approaches to social science and human resource development research. Emphasis is on ethnographic methods to obtain in-depth information about behaviors and beliefs of people in natural settings. Use of methods; structured interviews using heuristic elicitation methodology, participant/observation and case studies. Prereq: 602 and 603.

607 Seminar in Organizational Communication Processes (3) Students study how the elements and complexities of organizational communication lead to potential miscommunications. This course involves analysis of contemporary and leading-edge organizational communication systems and processes. Students address prevention and minimization of destructive system and process complexities, and maximization of constructive elements; and explore organizational and individual accountability for creating, sustaining, and improving organizational communication systems, processes, and environments. Prereq: 602 and 603.

608 Seminar in Work/Life Interface Issues (3) Interface of work/life topics; how does work and life issues interconnect and influence each other from a psychosocial perspective? The goal of the course will be to help human resource professionals better understand and address the critical linkages between work and life to encourage personal and professional well-being. Prereq: 602 and 603.

609 Seminar in Technological Frameworks for Human Resource Development (3) Provides instruction and discussions on technology and human performance issues in today’s organization. Topics include technology diffusion, performance improvement technologies, and privacy and ergonomic issues in utilizing technologies to improve human performance in organizations. Prereq: 602 and 603.

611 Internship in Human Resource Development (3) Field experience in relevant organizations. Prereq: Consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

613 Seminar in Selected Topics (3) Topics in human resource development. May be repeated. Prereq: 602 and 603.

INDUSTRIAL AND ORGANIZATIONAL PSYCHOLOGY (568)

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is complete. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.
525 Research in Industrial/Organizational Psychology (1-3)
Available only to students admitted to program or by prearrangement with program director. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

567-568 Proseminar in Industrial/Organizational Psychology (3,3) Basic thought, concepts, and issues required for advanced graduate study in industrial and organizational psychology. Must be taken during first year of study in program. Consent of instructor required for non-program students.

569 Applied Measurement for Industrial/Organizational Psychology (3) Basic techniques for collection and evaluation of individual and organizational data using both classical and modern psychometric techniques. Relevant statistical models: reliability analysis, and exploratory and confirmatory factor analyses.

600 Doctoral Research and Dissertation (3-15) P/NP only.

605 Advanced Research Methods in Psychology (3) Critical analysis of new and evolving techniques for psychological research; new statistical and psychometric methods.

610 Individuals in Organizations Seminar (3) Bridging principles and processes which link individual attributes with more macro organization concerns: culture, climate, and group decision-making.

611 Seminar in Organizational Leadership (3) Current theories, concepts, and issues associated with psychology of organizational leadership. Prereq: 567-568 or consent of instructor.

612 Seminar in Work Motivation (3) Current theories, concepts, and issues associated with psychology of work motivation. Prereq: 567-568 or consent of instructor.

613 Seminar in Performance Appraisal (3) Current issues, problems, and research in performance appraisal and criterion development; applications in compensation. Prereq: 567-568 or consent of instructor.

614 Seminar in Employee Selection (3) Current issues, concerns, and methods used in employee selection. Prereq: 567-568 or consent of instructor.

615 Seminar in Organizational Training and Development (3) Current issues, problems, and research in training and development. Prereq: 567-568 or consent of instructor.

625 Research in Industrial/Organizational Psychology (1-3)
Available only to students admitted to program or by prearrangement with program director. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

626 Topics in Industrial Psychology (3) Topics vary. May be repeated. Maximum 9 hours.

627 Topics in Industrial Psychology (3) Topics vary. May be repeated. Maximum 9 hours.

628 Personality Assessment (3) Review of key domains of social cognition: measurement systems which use individual differences in social-cognitive biases as basis for measuring personality.

635 Ethical and Professional Issues in Industrial/Organizational Psychology (3) Issues involved with ethical practice in research, academic, organizational, and consulting situations.

690 Supervised Practicum, Internship or Field Training in Industrial/Organizational Psychology (1-15) One credit hour per 30 hours of practice. Satisfactory/No Credit or letter grade.

### INDUSTRIAL ENGINEERING (556)

**Note:** Any 400-level course required in the Bachelor of Science in industrial engineering program at the University of Tennessee, Knoxville, may not be used for graduate credit in the MS program.

#### 401 Integrated Manufacturing Systems (3)
NC and CNC machine tools, robotics and related material handling systems, hard automation, alternative integrated manufacturing systems, and manufacturing information/control systems. Prereq: 330.

#### 402 Production System Planning and Control (3)

#### 405 Engineering Economic Analysis (3)
Introduction to engineering economy and application in engineering practice. Time-value of money and discounted cash flow techniques. Decisions among engineering alternatives: design options, equipment selection, break-even points, and similar situations. Cost estimating and consideration of taxes and inflation. Analyzing uncertainty in economic estimates using nonprobabilistic techniques. Prereq: Junior standing or consent of instructor.

#### 421 Information Systems Analysis and Design (3)
Systems engineering approach to analysis and design of systems of information. Topics include: system development life cycle, system analysis methodologies, data analysis techniques, system design, joint application design, and rapid application design. Lab introduces analysis and design software tools. Prereq: Senior standing or consent of instructor.

#### 422 Senior Industrial Engineering Problems Analysis (3)
Application of industrial engineering to field assignments in local organizations, problem definitions, analysis and presentation. Prereq: Expected term of graduation or consent of instructor.

#### 423 Industrial Safety (3)

#### 427 Introduction to Lean Systems (3)
Introduces a framework to implement improvements within an enterprise. This framework will focus on designing both the physical system and the associated information system. The students will be introduced to the basic concepts of facilities design based upon process design and requirements. The design of the physical and information systems will be based on integrating the concepts, terminology, and tools of lean enterprise and Six Sigma. Activities will include case studies, industry-based projects, and the preparation of written engineering reports. Prereq: Senior standing in major or consent of instructor. Coreq: 306, 402

#### 440 Process Improvement Through Planned Experimentation (3)
Fundamentals of continuous improvement, advanced statistical process control techniques, and strategies for short production runs. Use of experimental design techniques to improve processes: single and multiple-factor designs, blocking and confounding, and fractional designs. Full factorial designs compared to fractional designs to balance experimental efficiency with loss of information. Lab component utilizes statistical and simulation software to provide hands-on experience. Prereq: 300.

#### 455 Human-Computer Interaction (3)
Introduction to the analysis, design, production, and implementation of systems requiring interaction between humans and computers (HCI). Includes human sensory systems, human memory capacity, computer hardware/soft-
ware requirements, input/output device design, and error message handling. Prereq: Junior standing in major and computer program-
ing skills; or consent of instructor.

483 Introduction to Reliability Engineering (3) (See Nuclear Engineering 483.)

484 Introduction to Maintainability Engineering (3) (See Nuclear Engineering 484.)

500 Thesis (1-15) P/NP only.

501 Design Project (1-3) Enrollment limited to industrial engineer-
ing students in non-thesis program. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the stu-
dent not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Industrial Engineering Methods Review (3) Survey of indus-
trial engineering tools and techniques applied to analysis, design, and improvement of manufacturing systems. Required of dual degree students who do not have an undergraduate degree in indus-
trial engineering. May not be counted toward degree requirements. Prereq: Admission to dual MS-MBA program. Satisfactory/No Credit grading only.

504 Product Development Process (1) (See Mechanical Engineering 504.)

506 Product Selection and Evaluation (2) (See Mechanical Engineering 506.)

508 Integrated Product, Process and Manufacturing System Design (3) Different manufacturing system configurations. Relationships between product design and processing requirements, design specifications and manufacturing costs. Finalizing design specifications and selecting processes. Analysis of manufacturing system costs. Presentation of factors affecting manufacturing sys-
tem design. Case studies and team projects. Prereq: Consent of instructor. (Same as Mechanical Engineering 508.)

509 Multidisciplinary Project (1) Venue for multidisciplinary student teams to coordinate design and manufacturing tasks of product to be developed. Project management (budget and schedule), assignment of tasks for team members, and concurrent design and manufacturing. Design concepts and product feature reviewed by potential customers/investors. Prereq: Consent of instructor. May be repeated. Maximum 3 hours. (Same as Aerospace Engineering 509; Biomedical Engineering 509; Chemical Engineering 509; Electrical and Computer Engineering 509; Materials Science Engineering 509; Mechanical Engineering 509; Nuclear Engineering 509.)

511 Business Planning and Commercialization (3) Complex issues of product development and business planning required to deliver new product from concept to market. Strategic issues that emerge during product development cycle, beginning with concept to product development to commercialization to eventual product introduction or dismissal. Management practices for successful product development and product management. Prereq: Consent of instructor.

513 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, application of opera-
tion research models, and use of these to design manufacturing facility. Prereq: 403 or consent of instructor.

514 Advanced Information Systems Analysis and Design (3) Systems analysis and systems control concepts applied to systems of information. Role of Industrial engineering in office and factory of future. Management support systems, decision support systems, and integrated support systems.

515 Advanced Production and Inventory Systems (3) Advanced topics in production planning and inventory systems. Material requirements planning: production planning and master scheduling; just-in-time concepts; distribution requirements planning; and other selected topics. Prereq: 402 or consent of instructor.

516 Statistical Methods in Industrial Engineering (3) Application of classical statistical techniques to industrial engineering problems. Statistics and statistical thinking in managerial context of organization-
al improvement; descriptive statistics and distribution theory; relation-
ship between statistical process control techniques and classical statis-
tical tools; parameter estimation and hypothesis testing; goodness-of-
fit testing; linear regression and correlation; analysis of variance; sin-
gle and multiple factor experimental design. Prereq: Probability and Statistics for Scientists and Engineers, or equivalent.


518 Advanced Engineering Economic Analysis (3) Application of engineering economic analysis in complex decision situations. Inflation and price changes; uncertainty evaluation using non-prob-
abilistic techniques; capital financing and project allocation; evalu-
ations involving equipment replacement, investor-owned utilities, and public works projects; probabilistic risk analysis including computer simulation and decision trees; multi-attribute decision analysis; and other advanced topics. Prereq: 405 and Probability and Statistics for Scientists and Engineers, or equivalent.

519 Human Factors Engineering and Ergonomics (3) Application of human factor and ergonomic concepts and principles to design and analysis of manned systems and products. Human as biomechanical system; human information processing; minimization of human error; anthropology; anatomy and physiology; physical and mental workload; effects of environmental factors: temperature, lighting, weightlessness, and vibration on humans; manual materials handling and back injuries; design of workstations and office ergonomics; design of displays and controls; hand tool design; and cumulative trauma injuries. Prereq: Probability and Statistics for Scientists and Engineers I or consent of instructor.

520 Human Factors and Product Safety Engineering (3) Role of human factors and safety engineering, legal implications in product design, product liability, system safety, and system failure analysis. Product testing, reliability, and system safety analysis techniques. Case histories of accident investigations, reconstruction, causality, and product liability litigation. Prereq: 519 or consent of instructor.

521 Advanced Human Factors Engineering Methodology (3) Advanced methodologies used in human factors engineering. Observational methods; function/task analysis; computerized human factors design methods; human reliability and error predic-
tion; evaluation of human-machine interface; modeling techniques; questionnaire and survey design; experimental design, and other selected topics. Prereq: 519 or consent of instructor.

522 Optimization Methods in Industrial Engineering (3) Classical optimization applied to constrained and unconstrained, non-linear, multi-variable functions; search techniques; decision making under uncertainty; game theory; and dynamic programming. Prereq: Operations Research or Engineering Management 537.

524 Advanced Integrated Manufacturing Systems (3) Different types of manufacturing systems. Integrated application of numerical control and automation. Conversion from functional layouts to cell-
ular manufacturing. Process planning for discrete products, meas-
urement and reverse engineering principles and other selected topics. Prereq: 401 and 508, or consent of instructor.

525 Systems Modeling and Simulation (3) Modeling of discrete systems using current simulation software and Monte-Carlo simula-
tion. Problem definition, input distributions, output data analysis, model validation and verification, variance reduction techniques,
animation of models, and design of simulation experiments. Case studies in variety of domains for simulation modeling. Prereq: Consent of instructor.

526 Advanced Applications of Systems Modeling and Simulation (3) Modeling of discrete, continuous, and combined systems using current simulation software. Development of flexible simulation models to enhance accessibility of simulation models for experimentation. Development of distributed simulation models to represent and test production and supply chain systems. Prereq: 306 or 525. (Same as Management Science 526.)

527 Lean Production Systems (3) Characteristics and performance of mass and lean production systems. Lean production concepts and principles. Planning, designing and implementing lean production systems: line balancing, set-up time reduction, cost management, maintenance support and other selected topics. Application at enterprise level to achieve strategic competitive goals. Prereq: 515 or consent of instructor.

550 Graduate Seminar (1) A seminar to guide and familiarize graduate students of engineering to the process of thesis and/or dissertation research. This includes selection of committee members, research management and guidelines, basics of data analysis and presentation, and guidelines for writing grant and research proposals. Prereq: Admission to graduate program. Satisfactory/No Credit grading.

552 Advanced Linear Programming and Extensions (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis; and quadratic, separable, integer, and goal programming. Prereq: 301.

554 Advanced Development of Information Systems (3) Presents algorithms commonly needed to implement advanced information systems. Different types of data structures are presented in an attempt to find the model that best suits a given problem. Includes in-depth discussion of Visual Basic modules. Involves the transformation of problems into programming paradigms, and encodes solutions using the Microsoft Visual Basic 6 rapid application development tool. Activities will include case studies and demonstrations to supplement lectures. Practical problems and projects will be assigned. Prereq: 514 or consent of instructor.

555 Advanced Topics in Human–Computer Interactions (3) This course is a combination seminar/hands-on all phases of the product development lifecycle, examining the impact of human-computer interactions (HCI design course that covers) at each. It focuses on a user-centered approach to product design, addressing and applying usability to physical designs and web designs. The course includes lectures, discussions, demonstrations and field trip to a local usability lab. Prereq: 455 or consent of instructor.

556 Data Mining in Engineering and Manufacturing (3) This course will include the following components: the process of knowledge discovery; popular data mining tools such as classification, regression, and clustering; advanced data mining techniques; application of data mining in manufacturing, engineering design, and security; and research project. Prereq: 516 or equivalent course.

591-592-593 Special Topics in Industrial Engineering (1-3, 3, 3) Individual or group research projects. Prereq: Consent of instructor. May be repeated.

594 Culminating Integrated Project Report (3) (See Mechanical Engineering 594.)

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Operations Research Models in Engineering Economy (3) Mathematical programming techniques applied to capital budgeting; advanced topics in multiple attribute decision analysis; Bayesian analysis of sequential decision making; artificial intelligence in complex decision analyses. Prereq: 518, 523.

602 Nonlinear Optimization (3) (See Management Science 651.)


691-692-693 Advanced Topics in Industrial Engineering (3, 3, 3) Forum to study individually or in groups. Prereq: Graduate standing and consent of instructor. May be repeated with consent of instructor.

INFORMATION MANAGEMENT (558)

541 Advanced Database Systems (3) Illustrates and applies advanced database techniques including data modeling, database design, SQL, stored procedures, multi-user databases and web databases. Also covered are data security and control issues related to multi-user databases. In addition to MS Access, this course makes use of the Oracle database to introduce concepts and implement assignments. A database project is a major component of this course. Prereq: 341 or consent of the instructor.

542 Application Security and Controls (3) Introduces students to data security, systems controls, and privacy issues regarding Internet applications. Prereq: 541 or consent of instructor.

543 Systems Audit Security and Controls (3) Discusses information systems security, auditing/assurance, planning, and control issues. The course examines security and control issues primarily at the operating system level. Prereq: 541 or consent of instructor.

549 Enterprise Planning, Security and Controls (3) Examines the use of enterprise information systems to achieve strategic and operational advantage, to support managerial decision-making, and to achieve operational control. Prereq: 541 or consent of instructor.

INFORMATION SCIENCES (560)

450 Writing About Science and Medicine (3) (See Journalism and Electronic Media 450.)

500 Thesis (1-15) P/NP only.

502 Registration and Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Information Environment (3) Generation, production, management, dissemination, and use of information. Roles of information in society, information seeking and user behavior, information industry, economics of information products and services, technological and organizational change, information professions, and issues.

520 Information Representation and Organization (3) The structure and organization of intellectual content regardless of format. Emphasis on how content is created, exchanged, and stored so it can be found. Includes standards and best practice for describing and characterizing intellectual content.

521 Cataloging and Classification (3) Basic library-oriented cataloging and classification techniques, tools, and supporting operations. Descriptive cataloging, choice and form of non-subject entries, subject heading work, general classification, authority control, bibliographic utilities, online library catalogs.

523 Abstracting and Indexing (3) Philosophies, standards, and procedures for manual and automatic document indexing, back-of-the-book indexing, vocabulary control, thesaurus construction, and abstracting.
530 Information Access and Retrieval (3) Information access, retrieval, and use. Information seeking, user interfaces, information services and tools. Database structure, search engines, query logic, and evaluation of retrieval system performance.

531 Sources and Services for the Social Sciences (3) Information sources in political science, sociology, psychology, geography, history, anthropology, business, and education.

532 Sources and Services for Science and Engineering (3) Information sources in engineering, physical and life sciences.

533 Sources and Services for the Humanities (3) Information sources in philosophy, religion, fine arts, performing arts, literature and language. Organization and management of regional collections.

534 Government Information Sources (3) Selection, acquisition, organization, and utilization of government information in variety of formats from legislative, judicial and executive branches of federal, state, local, and international government and intergovernmental agencies.

535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, e.g., non-bibliographic formula and structure databases, contents-page/full-text databases, patents; document delivery alternatives, evaluation, and testing.

536 The Information Society (3) Competing theoretical positions and definitions regarding the existence and importance of the information society; historical evolution and selected key contributors of information society theories; issues of globalization including critical perspectives of economic, social, political, and cultural aspects.

537 Information Industry (3) Issues and trends concerning information industry: products and services. Standards, enabling technologies, choice of distribution media, entrepreneurial opportunities. Legal, ethical, and quality concerns.

538 Economics of Information (3) Costing and pricing of information; value of information and value added services; cost-benefit analysis and tradeoffs; policy issues related to economic aspects of information exchange and transfer.

539 Information Policy (3) Role of government in creation and exchange of information; review of key national and international policy areas relevant to information creation, production, and distribution; development of information policy for organizations.

540 Research Methods for Information Professionals (3) Research methods in a variety of information environments; primary and secondary research; research project design; research results interpretation; analysis of published research; techniques supporting research process.

541 Management of Information Organizations (3) Supervisory and management concepts, strategies, and techniques applicable to information professionals working in libraries, archives, records management, and other information organizations.

542 School Library Media Centers (3) Planning, implementing, and evaluating school library programs. Curricular involvement, role of technology, site-based management, relationships with district and state services.

543 Academic Libraries (3) Mission, status, and history of academic libraries and academic librarianship in community colleges, colleges and universities; trends in higher education, information technology, and government’s impact on public, technical, and administrative services. Prereq: 550 or consent of instructor.

544 Specialized Information Agencies and Services (3) Development and present status, scope and objectives. Information resources external to organization. Prereq: 550 or consent of instructor.

545 Public Library Management and Services (3) Development, roles, political environment, governance, organization, fiscal management, services, marketing, and performance evaluations. Prereq: 550 or consent of instructor.

546 Scientific and Technical Communications (3) Evolution of scientific and technical communication; current trends; role of formal and informal communications; major STI organizations and their roles.

547 Knowledge Management for Information Professionals (3) Covers classic theories of knowledge and theories of first and second-generation knowledge management paradigms. Introduces related disciplines and the knowledge lifecycle, types of knowledge, organizational learning, intellectual capital, communities of practice, knowledge ecologies, knowledge audits, knowledge sharing and repurposing of information, uses of information technology, and roles of information professionals in developing knowledge management initiatives.

548 Library Services for a Diverse Society (3) Examines the issues of diversity and multiculturalism in libraries and librarianship. Considers general issues affecting institutions in addition to libraries. Examines specific social characteristics and the social/cultural groups constructed around these characteristics. Considers the needs of such groups, and library responses to these needs, and how to create a more diverse library profession.

549 Development and Management of Collections (3) Selecting and preserving a variety of items (tangible and intangible) to meet needs of particular users; community analysis; policies and procedures; evaluation; purchasing.

550 Contemporary Book Publishing (3) Creation, design, production, marketing, and distribution; various types of publishers.


552 Business Intelligence for Information Professionals (3) Principles and practices of gathering and synthesizing business intelligence: including competitive intelligence, environmental scanning, and issues management; information evaluation and synthesis; role of strategic information in modern organizations.

553 Information Network Applications (3) Scholarly and community-based electronic communications. National and international standards, tools, resources; identification, analysis, evaluation, and management of tools and resources; construction of local technologies as developed and applicable.


555 Resources and Services for Young Adults (3) Critical survey of books and related materials for young adults; personal, vocational, and recreational needs and interests. Evaluation, selection, and utilization for school and public libraries.

556 Programming for Children and Young Adults (3) Philosophy and objectives of public and school library services for children and young adults. Reading, listening, and viewing guidance for individuals and groups. Program planning, implementation, and evaluation. Prereq: 571 or 572.
574 Resources and Services for Adults (3) Examines strategies and procedures for developing programs in libraries. The course provides public service librarians with the knowledge and skills to create, evaluate, and improve programs with some emphasis on reader’s advisory. Prerequisite: 560.

575 Valuing Diversity: International and Intercultural Resources for Youth (3) Examines texts and materials for youth that reflect the contemporary settings and lives of young people from all over the world. This course will review the scholarship of literature and film to determine how to recognize stereotypes; how to understand publishing worlds; and how to recognize universal themes that transcend ethnicity, religion, gender, class, and nationhood.

576 Storytelling in Libraries and Classrooms (3) Examines the history of those who influenced the programming and styles of storytelling. Additionally, the course will offer techniques and sources for selecting, preparing and telling stories to library and classroom audience.

580 Information Science Theory (3) Definitions of information, information sciences, and information technology; theories of information, information representation, retrieval, and transfer; standards and technologies for information processing and distribution; research front; bibliometrics and infometrics; relationships with other disciplines.

582 Information Systems Planning and Evaluation (3) Information systems used in libraries and information agencies. Emphasizes planning, evaluation and system implementation. Covers usability engineering, interface design, and human computer interaction.

583 Information Systems Problems and Principles (3) Use of systems theory and analytical tools for understanding and improving information systems. Emphasizes the interaction between technology, processes, and stakeholders. Focuses on problems identification and problem-solving techniques, system design representations, object-oriented system design, system prototyping, and project management.

584 Database Management Systems (3) Defining data needs, data structures, role of operating systems in data management, file organization, database management systems, logical data models, internal data models, database administration and evaluation. Design and implementation of application using database management system.

585 Information Technologies (3) Evolution, trends, capabilities, and limitations of technologies applied to information capture, storage, preservation, access, and distribution.

586 Information Retrieval Systems (3) Historical perspective on information retrieval research; statistical and probabilistic retrieval techniques; cognitive user modeling; expert intermediary systems; associations, relations and hypertext.

587 Mining the Web (3) Covers strategies for mining the Web, Web engines and directories, cognitive accessibility, Web design and development, and usability engineering.

588 Human-Computer Interaction (3) Survey of human-computer interaction and introduction to human and technological factors of importance to design of usable information systems. Basic phenomena of human perception, cognition, memory, and problem solving, and relationship to user-centered design. Methods and techniques for interaction design and evaluation.


590 Problems in Information Sciences (3-6) Prerequisite: Consent of instructor. May be repeated. Maximum 6 hours.

591 Independent Project or Research (3) Prerequisite: Consent of instructor. May be repeated. Maximum 6 hours.

594 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose area coincides with interests of student. Prerequisite: Consent of advisor and research director. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

595 Student Teaching in School Library Information Center (9) Planned professional semester: full day school library work and classroom observation activities. Satisfactory/No Credit grading only.

596 Field-Based Experience in School Library Information Centers (2) Prescribed activities to gain competencies in a school library information center setting. Must be taken twice. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

599 Practicum (3-6) Opportunity to translate theory into practice under guidance of qualified information professionals. Prerequisite: Completion of core and pertinent advanced courses relevant to student’s practicum design. Minimum 3.0 cumulative GPA. Written consent of advisor and approval of practicum coordinator. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

601 Advanced Seminar in Information Sciences (3) Theories, research, and traditional practices of information representation, organization, and access and retrieval. Research opportunities and methods. Relationship to and interaction with other disciplines.

INSTRUCTIONAL TECHNOLOGY (569)

521 Computer Applications in Education (3) Use and integration of technology in educational settings to support teaching and learning. Prerequisite: Basic computer operations or consent of instructor.

566 Administering Instructional Media Programs (3) Leadership roles and responsibilities of professional media administrator in variety of organizational settings.

569 Media and Technology Production Techniques (3) Workshop strategy: basic photography, audio production, multi and single camera TV production, basic digital video editing, and other media/technology techniques important for improving communication in variety of presentation or instructional settings.

570 Instructional Systems Design (3) Application of theory and research of instructional systems design to solve instructional problems in educational settings.

571 Desktop Publishing for Educators (3) Use of computer-based desktop publishing and graphics software and related hardware in designing and producing instructional and informational products. Prerequisite: 521, 570, or consent of instructor.

573 Introduction to Multimedia in Instruction (3) Selected computer-based multimedia production tools and use to produce instructional materials based on specific learner characteristics and objectives. Prerequisite: 521 or consent of instructor.

575 The Internet: Implications for Teaching and Learning (3) Investigation of Internet, its origin and historical development. Hands-on use of Internet for consuming, sharing, and publishing information. Relevant issues regarding legal and ethical issues, evaluation, responsible use, proprietary rights. Participants will need unrestricted access to a personal computer connected to the Internet to complete all course activities. Prerequisite: Admission to an ITES program or permission of instructor.

576 Advanced Interactive Multimedia for Instruction (3) Design and production of educational and interactive Web sites using advanced software. Development of effective interactive methods for enhancing teaching and learning supported by principles of planning, designing, creating, testing, and evaluating. Prerequisites: 521, 570, 573, 575.
577 Internet-Mediated Collaborative Learning (3) Use of the Internet to conduct collaborative learning activities among diverse, geographically-distributed participants. Participants will need unrestricted access to the Internet to complete all course activities. Prereq: 575 or 521.

578 Web Design (3) Design and development of instructional Web sites using basic design principles and visual Web editor software. Prereq: 575.

669 Instructional Media Research (3) Identification, location, and collection of developmental and experimental research on instructional media. Application of research.

678 Seminar in Instructional Technology (1) Readings and discussions based on current literature, research, theories and practices in instructional technology. Prereq: Consent of instructor. May be repeated. Maximum 3 hours.


680 Designing Problem-Based Learning Environments (3) Development and integration of problem-based learning pedagogy into curriculum. Examination of literature to understand theoretical perspective for design of this type of learning environment. Prereq: 521, 570, 573, 575, or consent of instructor.

INSTRUCTIONAL TECHNOLOGY AND EDUCATIONAL STUDIES (570)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only.

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

594 Supervised Readings (1-3) May be repeated. Satisfactory/No Credit or letter grade.

595 Special Topics (1-3) May be repeated. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Foundations of Research, Scholarship & Doctoral Study (3) Introduction to PhD program concentrations in ITES: research requirements, meaning of scholarship in academe and issues/problems in education. Prereq: Admission to a PhD program in ITES.

689 Internship (1-3) Experiences in application of principles and practices of curriculum development and instructional improvement. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

693 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

694 Supervised Reading (1-3) May be repeated. Satisfactory/No Credit or letter grade.

695 Special Topics (1-3) May be repeated. Satisfactory/No Credit or letter grade.

ITALIAN (584)

401 Dante and Medieval Culture (3) Introduction to significance of this great Italian writer. Writing-emphasis course. Prereq: 212 or consent of instructor.

402 Petrarch and Boccaccio (3) Writing-emphasis course. Prereq: 212 or consent of instructor.

403 Literature of the Rinascimento (3) From Pulci to Tasso, Quattrocento and Cinquecento. Prereq: 212 or consent of instructor.

406 The Modern Italian Novel (3) From Manzoni to Calvino. Prereq: 212 or consent of instructor.

409 Directed Readings (3)

410 Italian Theatre (3) Survey of Italian theatre from Renaissance to present. Prereq: 212 or consent of instructor.

421 Topics in Italian Literature and Cinema (3) Examination of Italian literature and cinema from 1930 to the present focusing on literary works translated into English and adapted into film. Objectives of the course are to investigate the relationship between literature and cinema and to achieve a greater understanding of Italian culture since 1930. Films will be shown in Italian with English subtitles. Writing-emphasis course. May be repeated. Maximum 6 hours. (Same as Cinema Studies 421.)

510 Readings in Italian Literature (3) Topics vary. May be repeated with consent of department.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

JAPANESE (589)

451 Readings in Pre-Modern Japanese Literature (3) (See Asian Languages 451.)

452 Readings in Modern Japanese Literature (3) (See Asian Languages 452.)

JOURNALISM AND ELECTRONIC MEDIA (592)

400 Mass Communication Law and Ethics (3) Emphasis on legal issues affecting print and electronic media, including libel, privacy, copyright, free press/fair trial, governmental regulations of advertising, electronic media and public relations. Also includes ethical standards and practices. Prereq: Consent of instructor. (Same as Legal Studies 400.)

412 Opinion Writing (3) Analysis of editorial positions and practices. Writing editorials/columns for newspapers, magazines, corporate publications, and electronic media (radio, television, cable, Internet), with emphasis upon study and use of rhetorical devices and logic. Prereq: Consent of instructor.

414 Magazine and Feature Writing (3) Techniques of writing features and in-depth articles for mass circulation and specialized magazines or newspapers. Organizing and presenting material, with attention to problems in areas such as business, science, agriculture, and the humanities. Prereq: 203 or consent of instructor.

415 Magazine Industry Workshop (3) Introduction to the magazine industry including management, design, writing and editing, and interactivity. Analysis of print and electronic format magazines. Planning new products for the marketplace. Prereq: 414 or consent of instructor.

430 Public Affairs Reporting (3) Reporting (including database reporting) and writing about courts, government and public agencies. Event and issue-oriented journalism of politics and public affairs. Prereq: 315.
433 Editing and Layout for Print/Web (3) Editing and layout for newspapers, magazines and online publishing. Prereq: 203 or consent of instructor.

440 Corporate Video (3) Examination of the special requirements of business, industrial, educational and medical uses of video. Includes management, budgeting, planning, producing, and evaluating projects. Students learn digital video production and non-linear editing. Prereq: 435 or consent of instructor.

444 Journalism as Literature (3) Study of writers from the 17th century to the modern era whose works have endured as both journalism and literature. An emerging genre called literary journalism will be examined as a means of cultural reporting with a personal narrative style. Prereq: Consent of instructor.

450 Writing About Science and Medicine (3) Writing workshop to analyze examples of successful science writing and write series of articles for general public based on scientific journals, news conferences, technical meetings and interviews. Prereq: Consent of instructor. (Same as Information Sciences 450.)

451 Environmental Writing (3) Writing for news media (including the Internet) on such environmental issues as sprawl, forests, air pollution, energy, and invasive species. Students hear presentations from and interview experts in environmental science and reporting. Exemplary environmental writing is analyzed. Prereq: Consent of instructor.

455 Issues in Science Communication (3) Topics vary. Prereq: Consent of instructor. May be repeated.

456 Science Writing as Literature (3) Survey of important science writing for the general public across the spectrum of science, engineering, and medicine. Works by authors such as Arthur C. Clarke, Stephen J. Gould, and Richard Selzer will be analyzed for literary qualities in a quest to understand why some science writing succeeds. Prereq: Consent of instructor.

457 Media and Society (3) Media processes and effects on society. Major theories/research are introduced and applied to current issues. Prereq: 200 and 275 or consent of instructor.


465 Media and Diversity (3) Media coverage and portrayal of various social groups based on gender, class, and race/ethnicity. Effects of media on public perceptions and attitudes toward these groups. Discussion of historical and legal implications of media effects.


470 Cable, Broadband, and Interactive Digital Media (3) History and structure of cable television and other broadband delivery systems (DBS, Internet, etc.). Development of digital broadcasting, interactive television, and other broadband media systems and digital technologies. Regulatory, policy, programming, and management issues arising from new media and digital technologies. Prereq: 275 or consent of instructor.

475 Sports Writing (3) Writing sports stories, features and columns. Sports writing is considered from the standpoint of sports reporters, sports information specialists and others with an interest in writing about sports.


488 Web Publishing (3) Cross-disciplinary approach to design and production of on-line publications. Emphasis on researching, planning, site content and design, and the economic, legal and ethical issues involved in online publishing. Prereq: Senior standing and consent of instructor. Prereq: Consent of instructor.


491 Foreign Study (1-15) Advance approval of hours and topics by advisor required for registration. May be repeated. Maximum 15 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when the student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 International Communication (3) Studies the development and impact of international and trans-national media systems. Traces history of efforts to reach beyond national borders, and the implications for individuals, societies, global cultures, and political economies. Comparative analysis of media (print, broadcast, cable, satellite, Internet), media practices, and flow of information throughout the world. Prereq: Consent of instructor or admission to program.

512 Mass Media Research Methods (3) Applications of communication research techniques for management. Gathering and analysis of data for assessing media audiences and message impacts. Prereq: Consent of instructor or admission to program.

520 Seminar in Political Communication (3) Relationships among mass media, public relations and government and their roles in democratic society. Governmental public relations, political campaigns, coverage of military, executive, legislative and judicial branches of government, special interest groups and public access to government information.

525 Public Opinion (3) Role of press in developing and influencing public consensus. Social theories of public opinion and analysis of media’s response. (Same as Public Relations 525.)

535 Publications Management (3) Problems in management, production, market analysis, and design. Techniques of writing, editing, and presenting comprehensive articles and other material, regional and specialized magazines. Individual editorial projects. Prereq: 485 or consent of instructor.

550 Writing And Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science, technical, general publications. Prereq: Consent of instructor.

551 Seminar in Science, Society, and the Mass Media (3) Investigation of interplay between scientific community and mass media: how scientific information reaches public and impact of journalism on scientific practice. Prereq: Consent of instructor.

552 Seminar in Health Communication (3) Methods, problems, and issues of communication in health field. Media’s reporting of health issues. Setting of media’s “health agenda”; strategic uses of media in social marketing efforts; public communication of complex social/medical issues. Prereq: Consent of instructor.

553 Seminar in Risk Communication (3) Interaction of scientists, journalists, and public on scientific, technological, and medical risks; analysis of methods for enhancing public understanding. Prereq: Consent of instructor.
555 Seminar in Media Economics and New Technology (3)
Electronic and print media ownership, finance and corporate structure. Roles of new technologies and marketing techniques in changing media content and function in future. Prereq: Consent of instructor or admission to program.

560 Advanced Web Publishing (3) Electronic research and publishing. Social, legal and ethical challenges surrounding online publishing. Project planning and storyboarding techniques for designing and creating site on Web. Prereq: 488


570 Advanced Media Audience Analysis (3) Various techniques used by media companies and consultants in audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq: 302 or consent of instructor.

580 Seminar in Visual Communication (3) Behavioral aspects of communication with images. Theories of psychological effect in color, shape, texture, and other design elements.

585 Advanced Electronic Media Management (3) Financial management of broadcast, cable, and Internet operations: budgeting, financial planning, accounting, and related techniques. Theoretical perspectives in organization and management of commercial and non-commercial operations. Prereq: 485 or consent of instructor.

590 Project (3) Capstone project under guidance of faculty. Applications of principles from previous coursework. Satisfactory/No Credit grading only.

593 Seminar in Journalism And Electronic Media Issues (3) Contemporary topics in communications. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

597 Independent Study (3) Prereq: Consent of instructor.

598 Internship (3) Full-time (30-40 hours per week) work experience in news, production, or sales and management with non-university professional organization. Educational experience beyond that available at university. Final term paper. No retroactive credit for previous work experience. Prereq: Senior or graduate standing, completion of core curriculum and at least 15 hours of Journalism and Electronic Media courses, GPA 3.0 or better, and consent of unit head.

JUDAIC STUDIES (595)
405 Modern Jewish Thought (3) (See Religious Studies 405.)

425 Early Christian and Byzantine Art, to 1350 (3) (See Art History 425.)

431 Medieval Art of the West, 800-1400 (3) (See Art History 431.)

LATIN AMERICAN STUDIES (600)
456 Latin American Government and Politics (3) (See Political Science 456.)

465 Latin American Film and Culture (3) (See Cinema Studies 465; Spanish 465.)

479 Enchanted Texts in Hispanic Literature (3) (See Spanish 479.)

510 Special Topics (3) May be repeated. Maximum 6 hours.

LAW (613)

801 Civil Procedure I (3) Binding effect of judgments, selecting proper court (jurisdiction and venue), ascertaining applicable law, and federal and state practice.


803 Contracts I (3) Basic agreement process and legal protections afforded contracts: offer and acceptance, consideration and other bases for enforcing promises; the Statute of Frauds, unconscionability and other controls of promissory liability. Introduction to relevant portions of Article 2 of the Uniform Commercial Code.

804 Contracts II (3) Continuation of Contracts I. Issues arising after contract formation: interpretation, duty of good faith; conditions, impracticability and frustration of purpose; remedies; third party beneficiaries; assignment and delegation. Considerable coverage of Article 2 of the Uniform Commercial Code with respect to remedies, anticipatory repudiation, impracticability and good faith.

805 Legal Process I (3) Lawyer-like use of cases and statutes in prediction and persuasion. Analysis and synthesis of common law decisions; statutory interpretation; fundamentals of expository legal writing and legal research.

806 Legal Process II (3) Continuation of Legal Process I. Formal legal writing, appellate procedure, and oral advocacy.

807 Torts I (3) Intentional torts, defenses and privileges related to intentional torts; negligence: standard of care, professional malpractice, and liability of owners and occupiers of land; defenses based on plaintiff’s conduct; contributory and comparative negligence, assumption of risk, failure to take precautions, and avoidable consequences; causation, proximate cause; duty rules; and questions of joint and several or several liability.

808 Torts II (3) Vicarious liability and related concepts; strict liability for dangerous animals and abnormally dangerous activities; products liability; nuisance, defamation and invasion of privacy; economic torts: misrepresentation and interference with contract and prospective opportunities; immunities: those of government, governmental employees, charities and family members, and damages.

809 Criminal Law (3) Substantive aspects of criminal law; general principles applicable to all criminal conduct; specific analysis of particular crimes; defenses to crimes.

810 Property (4) Introductory course treating issues of ownership, possession, and title in the areas of: landlord-tenant relations; estates in land and future interests; co-ownership and marital property; real estate sales agreements and conveyances; title assurance and recording statutes; servitudes; and selected aspects of nuisance law, eminent domain and zoning.

812 Constitutional Law (4) Fundamental principles of American constitutional law: federalism, separation of powers, equal protection of law, and constitutional protection of other fundamental individual rights.

813 Evidence (4) Rules regulating introduction and exclusion of oral, written and demonstrative evidence at trials and other proceedings, including relevance, competence, impeachment, hearsay, privilege, expert testimony, authentication, and judicial notice. Coreq: 920 for students electing concentration in advocacy.

814 Legal Profession (3) Legal, professional and ethical standards applicable to lawyers. Not open to students who have taken 815.

815 Introduction to Advocacy and Professional Responsibility (3) Theory and morality of advocacy in adversarial system, and legal, ethical, and professional standards applicable to lawyers and especially lawyers as advocates.
818 Fundamentals of Income Taxation (3) Introduction to basic statutory analysis, fundamental principles of federal individual income tax, and pervasive income tax concerns that arise in practice. Federal concept of gross income, pattern of exclusions, exemptions and deductions from gross income used to arrive at tax base; special treatment of capital gains and losses; and rate structure.


821 Administrative Law (3) Administrative agency decision-making processes and judicial review of administrative decisions: procedural standards for informal and formal administrative adjudication and rule-making (attention to federal Administrative Procedure Act); constitutional due process standards in administrative settings; and availability, scope and timing of judicial review of agency actions.

822 Legislation (3) Interpretation and drafting of statutes, legislative process, and legislative power; comparison of judicial views on legislative process with both realities of legislative process and applicable constitutional principles.


827 Business Associations (4) Legal problems associated with the formation, operation, and dissolution of unincorporated and incorporated business firms; legal rights of duties of firm participants (principals and agents; partners, joint venturers, limited partners, limited liability partners, and members and managers of limited liability companies; and corporate shareholders, directors, and officers) and others with whom those participants interact in connection with the firm’s business.

828 Corporate Finance (3) Legal issues arising in conjunction with the purchase, sale, and repurchase of securities in capital formation and investment transactions, including: private and public debt, equity, and convertible securities offerings; dividends and other shareholder distributions; and mergers and acquisitions. Prereq: 827.

830 Securities Regulation (3) Basic structure and operation of the federal securities laws, including legal issues associated with: primary and secondary public and private securities offerings; Section 11 of the Securities Act of 1933, as amended, Rule 10b-5 under the Securities Exchange Act of 1934, as amended, and other antifraud provisions; periodic reporting and other disclosure requirements; the regulation of proxy solicitations, tender offers, and securities transactions involving officers, directors, and other insiders; and the regulation of stock markets and professional service providers in the securities industry. Prereq or coreq: 827.

833 Representing Enterprises (3-5) Capstone course for concentration in business transactions. Simulated business transactions and completion of major planning drafting project. Transactions vary: formation of new business, acquisition of existing business, development of real estate project, various financing transactions and corporate reorganization. Prereq: Completion of all courses for concentration in business transactions.

834 Antitrust (3) Federal antitrust laws; monopolization, price-fixing, group boycotts, and anticompetitive practices generally; government enforcement techniques and private treble damage suits.

840 Commercial Law (4) Basic coverage of most significant provisions of Uniform Commercial Code: security interests in personal property (Art. 9 of U.C.C. and relevant Bankruptcy Code provisions); commercial paper, including checks, notes and other negotiable instruments (Arts. 3 and 4 of U.C.C.); sales of goods, including coverage of portions of Art. 2 of U.C.C. not covered in Contracts.

842 Contract Drafting Seminar (2) Practical fundamentals of drafting contracts of different types.

843 Debtor-Creditor Law (3) Basic elements of federal bankruptcy law: claims, property of estate, automatic stay, trustee's avoidance powers, assumption and rejection of contracts, priority of distributions, and distinction between liquidation and rehabilitation. Enforcing judgments outside of bankruptcy.

844 Business Reorganizations and Workouts (3) An examination of reorganization under chapter 11 of the United States Bankruptcy Code from petition date to confirmation of a plan of reorganization as well as coverage of the use of extensions, compositions, workouts and other non-bankruptcy methods of adjusting the rights or parties to business transactions. Although not required as prerequisites, an understanding of the subject matter of Commercial Law and especially Debtor/Creditor law is strongly recommended. The course satisfies the expository writing requirement.

847 Advanced Constitutional Law (2-3) Advanced study of issues in American constitutional law. Specific course offerings vary. Subjects include: constitutional structure of American governmental institutions, federalism, separation of governmental powers: relationship between legislative and executive branches, relationship among states and between states and federal government, and constitutional amendment process; state constitutional law, Tennessee constitution and differences between state and federal constitutional law; Bill of Rights and 14th Amendment to Constitution: constitutional rights as protected by Bill of Rights and 14th Amendment. Prereq: 812. May be repeated under different topic.

848 Civil Rights Actions (3) Litigation to vindicate constitutional rights in private actions against the government and its officials, as well as rights protected by other civil rights legislation: elements of cause of action under 42 U.S.C. sec. 1983; actions against federal government officials under the Bivens doctrine; institutional and individual immunities; relationship between state and federal courts in civil rights actions; and remedies for violations of constitutional and other civil rights.

849 Discrimination and the Law (3) Comparison of race, sex, and other forms of discrimination with respect to education, employment, housing, political participation and other social and economic activities; historical landmarks and current issues in discrimination law.

850 Supreme Court (3) History of Supreme Court and of procedures by which Court arrives at decisions; influences of justices’ ideology and role of Court in political system.

854 Investigatory Criminal Procedure (3) Police practices and constitutional rights of persons charged with crimes: arrest; search and seizure; identification; interrogation and confessions; electronic eavesdropping; and right to counsel.

855 Adjudicatory Criminal Procedure (3) Pre- and post-trial procedures in criminal case: bail; preliminary hearing; grand jury; prosecutorial discretion; discovery; speedy trial; plea bargaining; jury trial; and double jeopardy. Federal Rules of Criminal Procedure.

859 Criminal Law Seminar (2) Advanced problems in criminal law and administration of justice. Prereq: 809.

862 Family Law (3) Survey of laws affecting formal and informal family relationships: premarital disputes; ante nuptial contracts; creation of common law and formal marriage; legal effects of marriage; support obligations within family; legal separation, annulment, divorce, alimony, and property settlements; child custody and child support; abortion; illegitimacy.

863 Children and the Law (3) Legal relationships between children, families and state; juvenile justice; foster care; adoption; educational issues; special education; child abuse and neglect; health care and income maintenance; advocacy for children and families.
866 Environmental Law and Policy (3) Study, through methods of public policy analysis, of responses of legal system to environmental problems: environmental litigation; Clean Air Act; Clean Water Act; National Environmental Policy Act; and selected regulatory issues.

867 Environmental Law Seminar (2) Selected topics in environmental law.

873 American Legal History (3) Selected topics in American legal history.

877 Jurisprudence (3) Critical or comparative examination of legal theories, concepts, and problems: legal positivism; natural law theory; legal realism; idealism; historical jurisprudence; utilitarianism; Kantianism; sociological jurisprudence; policy science; and critical studies.

879 Law and Economics (3) Relationship between legal and economic thought; application of basic economic concepts to legal problems; economics in legal decision making; scholarly support for and criticism of economic analysis of law. Designed for students with no undergraduate background in economics or mathematics.

881 Law and Literature (3) Reading literary works, development of philosophy and reading technique applicable to both law and life.

886 Public International Law (3) Law-creating processes and doctrines, principles and rules of law that regulate mutual behavior of states and other entities in international system.

887 International Business Transactions (2-3) Doing business with foreign persons and in foreign countries; acquisition and use of property within foreign country; regulation of international business transactions by international organizations and foreign governments; analysis of international conventions and laws of foreign countries affecting business and comparison of those conventions and laws with United States law.

895 Labor Relations Law (3) Political, social and economic influences in development of federal labor relations laws; employee rights of self-organization; union and employer unfair labor practices; strikes, lockouts, boycotts, and collective bargaining processes; enforcement of collective agreements; individual rights of employees; federal preemption and state regulation.

896 Employment Law (3) Legal regulation of employment relationship: legal, social and economic influences in employee-employer relationship; employment discrimination; legally prescribed minimum standards of compensation and safety; restraints on termination of employment; regulation of retirement systems.

898 Arbitration Seminar (2) Arbitration of labor agreements; judicial and legislative developments; nature of process; relationship to collective bargaining; selected arbitration problems on various topics under collective agreements; and role of lawyers and arbitrators. Prereq: 895.

899 Labor Relations Seminar (2) Selected labor relations law problems. Prereq: 895.

905 Advocacy Clinic (6) Supervised fieldwork requiring students to assume substantial responsibility for representing clients with various civil and criminal legal problems. Exploration and development of fundamental professional skills involved in practicing law: interviewing and counseling clients, negotiating with other attorneys, planning for transactions and dispute resolutions, initiating and defending claims, conducting factual investigations, and presenting evidence. Prereq: 920 and third-year standing. May not receive credit for both 905 and 946 or both 905 and 947.

908 Mediation Clinic (3) Mediation process, theory, strategy, tactics and skills through readings, simulations, and service as mediators in general sessions court and other settings: mediation ethics, relationship of mediation to other dispute resolution methods, roles of attorneys in mediation, and writing of mediation agreements.

915 Conflict of Laws (3) Jurisdiction, foreign judgments, and conflict of laws.

916 Federal Courts (3) Jurisdiction of federal courts; conflicts between federal and state judicial systems.

918 Remedies (3) Judicial remedies: damages, restitution, and equitable relief; availability, limitations and measurement of various remedies; comparison of contract, tort and property-related remedies.

920 Trial Practice (3) Litigation through simulation, trial problems and preparation: basic trial strategy; professional responsibility; fact investigation and witness preparation; discovery and presentation of evidence; selection and instruction of juries; opening and closing arguments. Written work: pleadings, motions, interrogatories or memoranda. Coreq: 813 for students electing concentration in advocacy. Prereq: 813 for all other students.

921 Pre-Trial Litigation (3) Civil pre-trial process. Drafting of actual pre-trial documents in civil cases: complaint, motions for preliminary injunction, class certification papers, motions to dismiss and for summary judgment, and various discovery papers.

922 Advanced Trial Advocacy (3) Study and development of trial skills: trial preparation, advanced direct and cross-examination, expert witnesses, jury selection, jury instruction, technology in courtroom, and motion practice. Prereq: 920.

927 Interviewing, Counseling and Negotiation (3) Development of conceptual and practical frameworks for understanding interviewing, counseling and negotiation, and lawyer's role in tasks. Readings of different methods, strategies and perspectives from recent literature involving lawyering skills. Simulations and videotape critiques, drafting of documents. Relevant ethical issues and techniques of dispute resolution. Not open to students who have taken 904 or 906.

928 Case Development and Resolution (4) Theory and development of skills for case development and management: interviewing, counseling, and fact investigation. Ways of resolving disputes without litigation. Not open to students who have taken 927.

935 Gratuitous Transfers (3) Gifts; will substitutes; nature, creation, termination and modification of trusts; intestate succession; execution, revocation, probate and contest of wills; statutory protections against disinheriteance; and introduction to powers of appointment, basic problems of will construction, powers of attorney, and planning for disability and death.


940 Land Finance Law (3) Financing devices: mortgages, deeds of trust and land contracts; problems of priorities; transfer of secured interests when debt assumed or taken subject to security interest; default, exercise of equity of redemption and/or statutory right of redemption; mechanics' and material men's liens; contemporary developments in areas as condominiums, cooperatives, housing subdivisions, and shopping centers.


943 Land Use Law (3) Private land use controls: nuisance, easements, real covenants, equitable servitude and home owner associations; public land use controls: zoning, subdivision controls, eminent domain, and regulatory takings.
946 Business Law Clinic (6) Supervised fieldwork assuming substantial responsibility for representing clients with various business and transactional matters. Exploration and development of fundamental professional skills involved in practicing business and transactional law. Interviewing and counseling clients, negotiating with other attorneys and parties, planning, negotiating and documenting transactions and dispute resolutions, conducting factua investigations and legal audits of businesses, and monitoring and ensuring compliance with federal, state and local statutes, rules and regulations. Prerequisites: 818, 826, 827, 972. Prerequisite or corequisite: 842. 826 may be waived for those with sufficient business background. May not receive credit for both 946 and 906.

947 Prosecution Externship (6) Supervised fieldwork required to be admitted to practice as prosecutor and to assume substantial responsibility for prosecution of criminal cases in state or federal courts. Classes on Tennessee or federal criminal law and procedure and prosecution function. Under direct supervision of full-time, experienced prosecutor and other professional prosecutors in office. Assist in investigation of crimes, interview and preparation of witnesses, drafting of relevant documents, negotiation and formal presentation of guilty pleas, presentation of cases to grand jury, and representation of government in preliminary hearings and felony trials. Prerequisites: Third-year standing, 813, 920, and either 854 or 855, and consent of instructor. May not receive credit for both 947 and 906.

950 Computers and Law (3) Impact of computers on law and practice of law: expert systems; legal skills required in building expert systems; common law office uses of computers; and computerized research. Preparation of lawyers to think effectively concerning use of computers. Prior computer experience not necessary.

956 Entertainment Law (3) Role of law and lawyer in entertainment industry. Course content varies. Music industry; music copyright laws; artist/manager relationships; recording contract negotiations; industry labor unions; and performing right organizations.

957 Law, Science and Technology (3) Legal implications of advanced technologies; adaptation of law to challenges posed by new kinds of knowledge and new ways of doing things. Biotechnology, regulation of scientific research, space law, legal issues relating to new information technologies, nanotechnologies, and others designated by instructor.

958 Women and the Law (3) Treatment and status of women in American legal system: women as political actors, as family members, as participants in workforce, as targets of violence and as members of legal profession; introduction to current competing approaches to gender justice.

959 Intellectual Property (3) Intellectual property and related interests under federal and state law: patents; trademarks; trade secrets; copyright; right of publicity; unfair competition.

960 Employee Benefits Law (2-3) Employee Retirement Income Security Act, federal law governing employee benefit plans sponsored by private employers. Applied problem method of instruction: questions, issues, and problems involving employee benefit plans likely to arise in general litigation or business transaction practice. For three credit hours, includes Chapter 400 of Internal Revenue Code.

962 Law and Medicine Seminar (2) Effects of legal rules on delivery and quality of medical care: nature of physician-patient relationship; unauthorized practice of medicine; medical education, licensing and specialization; hospital staff privileges; medical malpractice liability: standard of care, proof, causation, defenses, and damages; protection of patient autonomy: consent, informed consent, conception and abortion, choice of treatment, and death and dying; control of communicable diseases; organ transplantation and medical resource allocation.

970 Income Taxation of Business Organizations (3) Survey and comparative analysis of federal patterns of income taxation of partnerships, subchapter C corporations, subchapter S corporations, and limited liability companies; introduction to transactional analysis and business planning. Required written exercises: drafting of portions of partnership agreements, opinion letters, and legal memoranda. Prerequisite: 818.

973 Wealth Transfer Taxation (3) Taxation of gratuitous transfers of wealth during life (gift tax) and at death (estate tax) and of generation skipping transfers. Prerequisites or corequisites: 935.

975 Tax Theory (3) Method and purposes of governmental revenue collection through examination of economic and political theory; comparative analysis of various actual and proposed patterns of taxation: income tax, consumption tax, sales tax, and value-added tax. Required preparation of expository essay on an aspect of tax theory chosen by student. Limited enrollment.

978 Transactional Tax Planning (3) Advanced study of taxation of business organizations: tax treatment of business acquisitions, tax planning for financially troubled entities, and review of recent transactional and planning for financially troubled entities, and review of recent transactions involving cutting-edge tax planning and shaping changes in law. Limited enrollment. Prerequisite: 818 and 972.

980 Insurance (3) Types of insurance: life, property, health, accident and liability insurance; regulation of insurance industry; interpretation of insurance contracts; insurable interest requirement; conditions, warranties and representations; coverage and exclusions; duties of agents; excess liability; subrogation; and bad faith actions against insurers. Liability insurance defense problems: duty to defend, notice and cooperation issues, and conflicts of interest.

983 Products Liability (3) Scope of doctrine and theories of recovery; potential plaintiffs and defendants; statutory and contractual limitations on recovery; damages; causation; and defenses.

985 Workers’ Compensation (3) Workers’ Compensation system for compensating victims of work-related accidents and diseases: requirements for covered employer-employee relationship; accidental injuries or occupational diseases arising out of and in course of employment; causation; nature of medical, disability, and death benefits; exclusiveness of compensation remedy against employer and co-employees; and rights and liabilities of non-employers: administrative and procedural aspects of Workers’ Compensation practice; and various laws of tax reform measures.

990 Issues in the Law (3) Selected topics. May be repeated.

991 Issues in the Law Seminar (2) Selected topics. May be repeated.

993 Directed Research (1-2) Independent research and writing under direct supervision of faculty member. Proposals must be approved by supervising faculty member and by the Dean or the Dean’s designee. Minimum of once each semester during last two years of study. Prerequisite: Second-year standing.

994 Independent Study (1-4) Independent study under direct supervision of faculty member. Proposals must be approved by supervising faculty member and by the Dean or the Dean’s designee. Minimum of once each semester during last 3 semesters of study.

995 Transactions: The Tennessee Journal of Business Law (1-2) Performance of duties of staff member or editor of Transactions: The Tennessee Journal of Business Law. Responsibilities vary each semester: writing of case synopsis, writing of article, and/or performing other assigned duties related to operation. Members of Transactions who are not on senior editorial board receive one hour of credit for successfully completing two consecutive semesters of service. Members of senior editorial board receive two hours of credit for each full year of satisfactory service. May be repeated. Satisfactory/No Credit grading only. Does not count toward total number of elective upper-division courses taken Satisfactory/No Credit.
996 Law Review (1) Performance of duties as staff member or editor of Tennessee Law Review. Responsibilities vary each semester as specified in Tennessee Law Review Policy Manual: writing of case note, comment or article, and/or performance of other assigned duties related to operations of Tennessee Law Review. Completion of potentially publishable comment or article for Tennessee Law Review satisfies expository writing requirement. May be repeated. Satisfactory/No Credit grading only. Does not count toward total number of elective upper division courses taken Satisfactory/No Credit.

997 Moot Court (1) Participation as member of faculty-supervised interscholastic moot court competition. May be repeated. Satisfactory/No Credit grading only. Will not count toward total number of elective upper division courses taken Satisfactory/No Credit.

998 Planning and Drafting Project (1) Preparation and completion of planning and drafting project under faculty supervision in conjunction with substantive courses when such planning and drafting option is provided by course instructor. May be repeated.

LEGAL STUDIES (617)

400 Mass Communications Law and Ethics (3) (See Journalism and Electronic Media 400.)

430 United States Constitutional Law: Sources of Power and Restraint (3) (See Political Science 430.)

431 United States Constitutional Law: Civil Rights and Liberties (3) (See Political Science 431.)

435 Criminal Law and Procedure (3) (See Political Science 435.)

442 Administrative Law (3) (See Political Science 442.)

445 Administration of Justice (3) (See Political Science 445.)

451 Criminal Justice (3) (See Sociology 451.)

455 Society and Law (3) (See Sociology 455.)

470 International Law (3) (See Political Science 470.)

490 Language and Law (3) (See English 490.)

496 The Rhetoric of Legal Discourse (3) (See English 496.)

LIFE SCIENCES (621)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Graduate Research Participation (3-12) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated. Maximum 12 hours.

505 Research Rotation (2) Laboratory rotations with faculty member on clearly defined projects. Written proposal and oral report. May be repeated. Maximum 8 hours.

507 Bioinformatics and Computational Biology (1-3) Topics to be covered include the application of computing, modeling, data analysis, and information technology to fundamental problems in the life sciences. May be repeated. Maximum 12 hours.

510 Special Topics in Life Sciences (1-3) Specializations in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethology; plant, physiology and genetics; and physiology. May be repeated. Maximum 9 hours.

515-516 Introduction to Genome Science and Technology I, II (1,1) 515—Introduction to research in genome science and technology concentration. 516—Science and ethics of practice of science. Satisfactory/No Credit grading only.

520-521 Genome Science and Technology I, II (4,4) 520- Overview of genomics, advanced genetics principles. 521- Analytical technologies and special techniques.

540-541 Colloquium (1,1) Invited speakers. Topics announced in advance. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

550 Mammalian Genetics and Genomics (3) Genetic variation, inheritance, phenotypic traits, molecular genetics and genomics, mutagenesis in laboratory rodents and other mammals. Prereq: 520-521.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

595-596 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in variety of special topics to be chosen by instructor. May be repeated. Maximum 12 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

615 Journal Club in Genome Science and Technology (1) Reading and discussion based on current literature. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

695-696 Advanced Topics in Genome Science and Technology (1-3) Tutorials or lectures on variety of advanced topics to be chosen by instructor. May be repeated. Maximum 12 hours.

LINGUISTICS (623)

400 Topics in Linguistics (3) Content varies. May be repeated. Maximum 6 hours.

411 Linguistic Anthropology (3) (See Anthropology 411.)

423 The Development of Diachronic and Synchrohnic Linguistics (3) Development of Western linguistic thought from Hebrews and Greeks through modern times. Readings from Boas, Sapir, Bloomfield, and others. Prereq: 9 hours of courses required for Linguistics major (300-level or above) or consent of instructor.

425 Introduction to Descriptive Linguistics (3) (See French 425.)

426 Methods of Historical Linguistics (3) (See German 426.)

429 Romance Linguistics (3) (See French 429.)

431 Topics in Hispanic Linguistics (3) (See Spanish 430.)

435 Structure of the German Language (3) (See German 435.)

436 History of the German Language (3) (See German 436.)

471 Sociolinguistics (3) (See English 471.)

472 American English (3) (See English 472.)

474 Teaching English as a Second or Foreign Language I (3) (See English 474.)

476 Second Language Acquisition (3) (See English 476.)

477 Pedagogical Grammar for ESL Teachers (3) (See English 477.)

485 Special Topics in Language (3) (See English 485.)

490 Language and Law (3) (See English 490.)

510 Special Topics (3) May be repeated. Maximum 6 hours.

575 Issues in Second/Foreign Language Rhetoric and Composition (3) (See English 575.)
LOGISTICS (626)

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Logistics and Operations Management (3) (See Operations and Management Science 540.)

546 Logistics and Supply Chain Strategy (3) Development of strategy for logistics systems and supply chain processes. Executive-level integration of logistics strategy with marketing, production, finance, and other decision areas. Prereq: 510 and Business Administration 511, 512, 513, and 514.


593 Independent Study (3-6) Directed research and study. Prereq: Consent of instructor. May be repeated.

599 Special Topics in Logistics (3-6) Seminar designed to study specific current problem areas in logistics. Topic announced prior to offering. Prereq: Consent of instructor. May be repeated.

600 Doctoral Research and Dissertation (3-15) P/NP only.

611 Theoretical Foundations (3) (See Marketing 611.)

612 Quantitative Research Methods (3) (See Marketing 612.)

613 Supply Chain Management Thought (3) Survey of concepts and research methods of interorganizational systems. Supply chains will be studied from multiple perspectives including the following: institutional design and structure, transaction cost economics, operations and logistics cost economics, exchange behaviors and strategies, supply chain relationship types, and evaluation of supply chain performance.

614 Evolution of Logistics Thought (3) Survey of concepts, frameworks, theory, research issues, and empirical research in content areas related to logistics and supply chain management. Conceptual foundations, issue controversies, and future directions.

615 Logistics Models (3) Analysis of contemporary models and methodologies in logistics research, topical coverage at discretion of instructor.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and faculty. May be repeated. Prereq: Consent of instructor.

MANAGEMENT (625)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

511 Organizational Theory: Integrated Structure and Behavior (3) Cases, group projects, discussion; organizational theories, organizational effectiveness; contextual factors of organizations: environment, size, technology; organizational structure configurations, organization design; social influences on organization effectiveness: motivation, leadership, group behavior, intergroup relations, organization change and development.

521 Human Resource Management (3) Personnel functions and human resources management. Community relations, recruiting, selection, training, performance evaluation, wage and salary administration, legal framework as it affects personnel.

531 Management of Technology-Based Organizations (3) Role of technology and innovation in formulation and implementation of strategy. Management of research and development function and coordination with other functions. Management of scientists and engineers.

551 Management of New Ventures (3) Integration of various functional disciplines and their application to general management of ventures formed both within larger corporations and independently. Preparation of a venture plan, case analysis.

571 International Management (3) Analysis of environment of international business firms and impact of internal and external factors on managerial decisions.

593 Directed Independent Study (1-3) Topic of mutual interest. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

595 Selected Topics in Current Management Issues (3) In-depth consideration of current issues. Managerial impact of emerging topics. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only.

MANAGEMENT SCIENCE (627)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

526 Advanced Applications of Systems Modeling and Simulation (3) (See Industrial Engineering 526.)

531 Mathematical Programming (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis, linear fractional, piecewise-linear, separable and integer programming, transportation linear programs. Prereq: Fundamentals of matrix algebra.

532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory. Prereq: Statistics 563 and Mathematical Analysis or consent of instructor.

533 Computational Mathematical Programming (3) Computational aspects of mathematical programming models, in particular for large systems. Prereq: 531 and proficiency in computer language.

534 Management Science Methods in Business (3) Application of methods from 531, 532, and 533 to real world problems in business/industry.

551 Leveraging Information Through Descriptive and Prescriptive Modeling (3) Concepts and tools for emulating business operations (descriptive modeling) and for determining optimal operational or tactical strategies (prescriptive modeling). Visualization, optimization, and simulation concepts reinforced through hands-on experience with technologies: geographic information systems (GIS), spreadsheet-based models, simulation packages, and supply chain optimization software.

593 Management Science Problems (1-6) Directed study on subject of mutual interest.

600 Doctoral Research and Dissertation (3-15) P/NP only.
621 Network Flows (3) Treatment of network optimization algorithms, transportation and transshipment models and primal-dual and primal-basis tree methods. Prereq: 531 or equivalent.

631 Integer Programming (3) Theoretical and computational aspects of linear programming with integer variables, branch and bound, cutting plane, and group theoretic algorithms. Prereq: 531 or equivalent.

651 Nonlinear Optimization (3) Kuhn-Tucker theory in nonlinear programming, solution procedures for constrained and unconstrained nonlinear programs, search techniques, quadratic programming, duality and sensitivity analysis. Prereq: 531 or equivalent, proficiency in computer language. (Same as Industrial Engineering 602.)

681 Special Topics (3) Prereq: 531, 532 and consent of instructor. May be repeated. Maximum 9 hours.

691-692 Management Science Seminar (1,1) Subjects selected from current literature. Satisfactory/No Credit grading only.

MARKETING (632)

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Principles of Marketing Management for Non-MBA Students (3) For students from other disciplines interested in obtaining knowledge of marketing discipline at graduate level.

520 Marketing and Customer Value (3) Frameworks, techniques, and processes required for customer relationship management and demand planning in organizations. Twin problems of analyzing markets and customers and translating these analyses into actionable marketing strategies. Prereq: Business Administration 511, 512, and 513 or consent of instructor.

530 MBA Marketing Concentration (6) Product management: Complex, interdisciplinary nature of product development and product management. Strategic issues during product life cycle, from idea conception to product development to commercialization to eventual product dismissal. Integrated communications: Strategies and tactics associated with communicating value to customers. One-to-one marketing approaches, role of personal selling in communication mix, and advertising and promotions management. Global marketing management: Cross-national forces that enable firms to design and maintain competitive marketing and supply chain networks across multiple geographic locations. Prereq: 520 and Business Administration 511, 512, 513, and 514.

593 Independent Study (3) Directed research and study. Prereq: MBA Core and consent of instructor. May be repeated. Maximum 6 hours.

599 Special Topics Seminar (3) Topics vary: market forecasting, market segmentation, services marketing, marketing channels, and related issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

611 Theoretical Foundations (3) Theoretical foundations and frameworks common to business research. Historical and philosophy of science perspectives. (Same as Logistics 611.)

612 Quantitative Research Methods (3) Quantitative research process: problem formulation, Measurement reliability, validity and scale development, Experimental design and analysis, survey design and analysis, sampling, ethical considerations, and international issues in quantitative research. (Same as Logistics 612.)

613 Qualitative Research Methods (3) Examination of qualitative research theoretical foundations and methodologies. Application of qualitative research methods to theory building research. Topics include formulating research questions, designing qualitative research studies, sampling, data generation techniques, data analysis techniques, evaluating qualitative research, and writing qualitative research reports.

614 Contemporary Marketing Thought (3) Representative topics comprising content of marketing knowledge: macromarketing; markets, channels, and competitor behavior; marketing strategy; marketing mix tools; and ethical issues in marketing. Examination of research for contributions to advancing knowledge and opportunities for new research.

615 Consumer Behavior Research (3) Theoretical perspective and research processes describing people in their roles as buyers, users, and evaluators of goods and services. Includes coverage of both end user consumers and industrial buyers. Topics of interest include motivation, personality, attitude formation and change, information processing, choice, decision making for buying and selling activities as well as operational management decision making processes, consumption, post-purchase consumption, cultural and demographic differences, consumer socialization, and ethical considerations.

616 Measurement (3) Measurement and measurement process: design and development of tools, process of testing, and determination of reliability and validity.

617 Special Topics (3) Topics vary: marketing strategy, advanced consumer behavior, research methodology, influence and persuasion theory and strategy, pricing issues, international marketing issues, and nonprofit organization marketing issues.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and staff member. May be repeated.

MATERIALS SCIENCE AND ENGINEERING (638)

405 Structural Characterization of Materials (4) X-ray diffraction and fluorescence; scanning and transmission electron microscopy; microanalytical techniques.

421 Mechanical Behavior of Materials II (3) Description of stress and strain; linear elastic constitutive equations; isotropic and anisotropic moduli in various materials; yield criteria; brittle fracture; crazing; plastic strain constitutive equations; forming operations and limit criteria. Prereq: 302, Engineering Science 321.

429 Introduction to Ceramic Matrix Composites (3) Characteristics of composites: ceramic matrix composites; macro-mechanics and materials design; overview of fabrication techniques; microstructural characterization; physical and mechanical property evaluation; current and potential applications. Prereq: 201 and Engineering Science 321 or equivalent.


472 Fundamental Principles of Composite Materials (3) Establishment of physical principles basic to design, manufacture and application of fiber reinforced polymers, metals and ceramics. Prereq: 302 or equivalent.

474 Biomaterials (3) Metals, polymers and ceramics used in orthopaedic, cardiovascular, and dental surgical implant devices; corrosion and degradation problems; material properties of primary importance; tissue response to synthetic materials. Prereq: 201. Recommended for engineering science and mechanics majors.
Analytical and experimental analysis of defects in crystals and time-dependent behavior. Prerequisite: Fundamentals of Materials Science and Engineering I (3). Fundamentals of Materials Science and Engineering II (3) (See Chemical Engineering 507.)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Graduate Seminar in Materials Science and Engineering (1) Prerequisite: Admission to graduate program. May be repeated. Satisfactory/No Credit grading only.

504 Graduate Seminar in Polymer Engineering (1) Prerequisite: Admission to graduate program. May be repeated. Satisfactory/No Credit grading only.

505 Engineering Analysis (3) (See Chemical Engineering 505.)

507 Application of Linear Algebra in Engineering Systems (3) (See Chemical Engineering 507.)

509 Multidisciplinary Project (1) (Same as Industrial Engineering 509.)

511 Fundamentals of Materials Science and Engineering I (3) Chemical bonding, structures, defects, scattering, thermodynamics, diffusion, phase diagrams, microstructures, and phase transformations.

512 Fundamentals of Materials Science and Engineering II (3) Physical properties: electrical and thermal conduction, elementary quantum physics, band theory, dielectric materials, magnetic and optical properties. Mechanical behavior: stress and strain at a point, elastic constitutive equations, phenomenological bulk behavior, and deformation mechanisms.


516 Mechanical Metallurgy (3) Deformation and fracture of metals and alloys: dislocation theory, strengthening mechanisms, macro-scale descriptions of plasticity, fracture mechanics, fatigue, and time-dependent behavior. Prerequisite: 512.

522 Defects in Crystals (3) Analytical and experimental analysis of defect interactions in solids. Prerequisite: 421 or consent of instructor.

524 Metallurgical Thermodynamics (3) Applications of chemical thermodynamics to metallurgical problems: refining, oxidation, surface treatments, alloy systems. Prerequisite: 570 or equivalent.

525-526 Welding Metallurgy (3,3) Welding processes; physical metallurgy of welding; phase transformations; heat flow; residual stresses; theories of hot cracking, cold cracking and porosity formation; applications to process utilization.

528 Ceramic Matrix Composites: Material and Mechanics (3) (See Engineering Science 528.)

531 Advanced Corrosion (3) Analyzes of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to pitting, crevice, fretting, wear, fatigue and stress corrosion. Prerequisite: 470 or consent of instructor.

532 Metallurgy of Deformation and Fracture (3) Analysis of effect of stress state, strain rate, environment, temperature and metallurgical structure on mechanical behavior. Brittle fracture, creep, stress rupture and fatigue. Prerequisite: Prior course in mechanical behavior.

540 Basic Polymer Chemistry (3) Synthesis, reactions and degradation of polymers. Molecular characterization: solution methods and spectroscopy. Prerequisite: Semester of organic chemistry and thermodynamics or equivalent.

541 Polymer Rheology (3) Deformation and flow of polymeric materials. Development of empirical models, linear viscoelasticity and finite strain constitutive equations; material functions, temperature dependence and rheometry with applications to synthesis and processing. Elementary kinetic theory of elastic dumbbell suspensions. Prerequisite: Chemical Engineering 240 or equivalent. (Same as Chemical Engineering 541.)

542 Further Topics in Polymer Processing (3) Description and analysis of selected polymer processing operations. Prerequisite: 541.


544 Polymer Solution Thermodynamics and Characterization (3) Theories of solutions, statistical thermodynamics. Characterization, treatment of chromatography, viscosity, light scattering and osmotic pressure. Prerequisite: Undergraduate physical chemistry.

545 Polymer Engineering Processing and Characterization Laboratory (3) Polymer film casting, film blowing, mixing and extrusion are operated and studied. Flow rates, temperatures, pressures and velocity profiles are acquired and used in finite element modeling and simulation to correlate the polymeric material properties and morphology. Supporting instrumentation includes linear viscoelastic rheometry, capillary viscometry, SEM, OM, FTIR, etc. Fundamentals of processing-structure-property relationships are documented in a literature review paper. Prerequisite: Consent of instructor.

546 Mechanical Properties of Solid Polymers (3) Types of mechanical behavior; Hookean and rubber elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss tangent; experimental methods. Introduction to mechanical properties of polymeric composites.

549-550 Laboratory Methods in Polymer Engineering (1,2) Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, calorimetry, rheometry, mechanical properties of solid polymers, polymer processing operations. Corequisite: 540 or consent of instructor. 549-Satisfactory/No Credit grading only.

552 Fiber Science (3) Physical properties, mechanical properties and microstructure of polymeric fibers; relation to end-use properties. Prerequisite: Organic chemistry and thermal physics or equivalent.

553 Nonwovens Science and Technology I (3) Nonwoven fabric technology; different web forming processes; and relationships among the chemical, morphological and mechanical properties of fibers and orientation in webs to final performance properties of bonded structures. Prerequisite: Organic chemistry or consent of instructor.

554 Nonwovens Science and Technology II (3) Interrelations between mechanics of production and mechanical properties of nonwoven fabrics; characterization of fiber morphology and web structure; chemistry of nonwoven binders and finishes; and engineering of specific fabric properties. Prerequisite: 553 or equivalent.

555 Laboratory Methods in Nonwovens Processing and Characterization (3) Laboratory experience in nonwovens fabrication processes and characterization techniques. Effect of processing conditions on structure development and properties of different types of webs. Prerequisite: 552 and 553.
560 Principles of Ceramic Processing (3) Treatment of ceramic processing; raw materials preparation and characterization; powder consolidation; drying, firing, sintering techniques, mechanisms and kinetics. Prereq: 360 or equivalent.

570 Optical Microscopy (4) Basic compound and polarizing microscopy for imaging. Optical property measurements, and structure elucidation. Other methods of optical microscopy. 3 hours and 2 labs. Prereq: Physics 232 and 240 or equivalent.

572 X-Ray Diffraction (3) Symmetry of crystals, space group theory, reciprocal lattice and application to definition of structures; powder and single crystal x-ray techniques; introduction to crystal structure determination; characterization of orientation; application to inorganic, metallic and polymer structures.

575 Surface Characterization (3) Analytical techniques for characterizing surfaces of textile materials. Applications of well-established techniques: spectroscopy and microscopy. Prereq: 552.

576 Special Topics in Materials Science and Engineering (3) Topics of current significance and interest. Prereq: Consent of instructor. May be repeated.


594 Culminating Integrated Project Report (3) (See Mechanical Engineering 594.)

600 Doctoral Research and Dissertation (3-15) P/NP only.

621 Theoretical Metallurgy (3) Topics in solid state physics as applied to metallurgy; introduction to quantum theory, specific heats, electron theory of solids, electrical and thermal conductivity, magnetic properties, theories of alloy formation. Prereq: Consent of instructor.

625 Materials Lifetime Science and Engineering I (3) Fundamentals of aqueous and high-temperature corrosion and fatigue; methods of materials lifetime modeling. Prereq: 531 and 532, or consent of instructor.

626 Materials Lifetime Science and Engineering II (3) Interactions between corrosion and fatigue at ambient and high temperatures; lifetime modeling of materials simultaneously subjected to corrosion and fatigue. Prereq: 625.

627 Case Studies in Materials Lifetime Science and Engineering (3) Studies of, and participation in, industrial analyses of lifetimes of structural materials subjected to aqueous-corrosion/fatigue and high-temperature-oxidation/fatigue, performed as part of the student's industrial and national-laboratory internship programs. Prereq: 531 and 532, or consent of instructor.

628 Graduate Seminar in Materials Lifetime Science and Engineering (1) Seminars by students, faculty, and visiting scholars on materials lifetime science and engineering; processes, mechanisms, and materials lifetime modeling. Prereq: 531 and 532, or consent of instructor. Satisfactory/No Credit grading only.

630 Thin Film Materials Processing (3) Students learn materials issues and thin film processing techniques used to manufacture semiconductor devices. Topics include basic vacuum technology, plasma physics, sputtering, evaporation (resistive, electron beam, laser ablation), chemical vapor deposition, and etching. The mechanisms of each process are explored and relevant material chemistries are discussed. Thin film growth models are also explained and processing variables are related to material properties. Prereq: Permission of instructor.

632 Advanced Topics in Intermetallic Compounds and Composites (3) Thermodynamics, mechanical behavior, corrosion and oxidation, and modeling of intermetallic compounds and composites. Prereq: 476 or permission of instructor.

633 Design of Intermetallic Compounds and Composites (3) Team-based design projects, including literature review, material selection, material/component design and fabrication, material properties, and theoretical modeling. Prereq: 476 and 632, or permission of instructor.


642 Advanced Topics in Polymer Processing (3) Application of theories of rheological behavior and of structure development to analysis of polymer processing operations. Prereq: 541. (Same as Chemical Engineering 642.)

643 Phase Transformations in Polymers (3) Glass transition and glassy state; annealing of polymeric glasses; crystallization of polymers; nucleation, growth and morphology; secondary nucleation theory; solidification of copolymers; crystallization under stress. Prereq: 543.

644 Optoelectronic Processes in Polymeric Materials (3) This course introduces fundamental molecular orbital and energy band theories and discusses (1) optical and electronic properties of polymeric materials, (2) principles, design and characterization of polymer optoelectronic devices, and (3) applications of laser spectroscopy in polymer characterizations. The focus is to understand electron related processes and optoelectronic characterizations of polymeric materials and devices. The fundamentals of laser spectroscopy are also explained in determining structure-property relationships in polymer research. Prereq: 543 or equivalent, and permission of instructor.

672 Introduction to Transmission EM and Electron Diffraction (3) Fundamentals of electron scattering, reciprocal space, the Ewald Sphere construction. Basic electron optics, operation of the transmission electron microscope TEM (includes some laboratory sessions) and sample preparation. The kinematical theory of imaging of perfect and imperfect crystals in the TEM. Problems with the kinematic theory. Introduction to the dynamical theory of TEM imaging. The effect of inelastic scattering in the TEM. Fundamentals of analytical electron microscopy. The Scanning Transmission Electron Microscope (STEM) and its relation to the TEM. Prereq: Either 405, 511, or 572; and permission of instructor.

673 Introduction to Scanned Probe Microscopies (3) A survey of techniques for surface imaging and characterization. Young’s Topografiner, field emission, and the beginning of scanning tunneling microscopy (STM). Practical operation of the STM (includes laboratory sessions). Image resolution and interpretation in the STM, analytical STM imaging. The theory and control of feedback loops in SPM. The generalized Scanning Probe Microscope (SPM) and the Atomic Force Microscope (AFM). Theory of operation of AFM, limits to resolution, and image interpretation (includes laboratory session). Important variants of the SPM including scanning capacitance, scanning near field optical, and scanning thermal microscopes. The metrology of nanoscale structures. Prereq: Permission of the instructor.

676 Advanced Topics in Materials Science and Engineering (3) Latest developments and/or advanced special topics. Prereq: Consent of instructor. May be repeated.

678 Seminar in Recent Advances in Materials Science and Engineering (3) Directed and independent study of advanced topics. Prereq: Consent of instructor. May be repeated.

MATHEMATICS (641)

400 History of Mathematics (3) Development of major ideas in mathematics from ancient to modern times and influence of ideas in science, technology, philosophy, art, and other areas. Writing emphasis course: at least one in-class essay examination and 3000 words of writing outside classroom. Prereq: 251 (or 257) and 300.
401 Mathematics and Microcomputers (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts and problems in mathematics. Does not satisfy the major requirements for a BS or MS in mathematics. Prereq: 141 or 147.

403 Mathematical Methods for Engineers and Scientists (3) Matrix computations, numerical methods, partial differential equations, Sturm-Liouville Theory and special functions used in engineering and science. Does not satisfy major requirements for a BS or MS in mathematics. Prereq: 231, 241, and familiarity with operating system and programming language.

404 Applied Vector Calculus (3) Topics from multivariable and vector calculus; line and surface integrals, divergence theorem and theorems of Gauss and Stokes. Prereq: 241 or 247.

405 Models in Biology (3) Difference and differential equation models of biological systems. May not be counted toward graduate degree. Prereq: 142 or 148 or 152.


421 Combinatorics (3) Introduction to problems of construction and enumeration for discrete structures: sequences, partitions, graphs, finite fields and geometries, or experimental designs. Prereq: 323 or consent of instructor.

423 Probability I (3) Axiomatic probability, multivariate distributions, conditional probability and expectations, methods of moment generating/characteristic functions. Laws of large numbers and central limit theorem. Prereq: 300-level probability or consent of instructor.

424 Probability II (3) Elements of stochastic processes: Random walk, Markov chains and Poisson processes. Other topics as selected by instructor. Prereq: 423.

425 Statistics (3) Derivation of standard statistical distributions: t, F and χ²; independence of sample mean and variance; basic limit theorems; point and interval estimation, Bayesian estimates; statistical hypotheses, Neyman-Pearson theorem; likelihood ratio and other parametric and non-parametric tests; sufficient statistics. Prereq: 423 or consent of instructor.


445-446 Advanced Calculus I, II (3,3) Theory of sequences, series, differentiation, and Riemann integration of functions of one or more variables. Prereq: 241 or 247 and 300, or consent of instructor.

447-448 Honors: Advanced Calculus I, II (3,3) Honors version of 445-446. Prereq: 341 or consent of instructor.

453 Matrix Algebra II (3) Matrix theory including Jordan canonical form. Prereq: 251 or 257.

455-456 Abstract Algebra I, II (3,3) Algebraic structures: groups, rings, fields, vector spaces and linear transformations. Prereq: 251 or 257 and 300, or consent of instructor.

457-458 Honors: Abstract Algebra I, II (3,3) Honors version of 455-456. Prereq: 351 or consent of instructor.

460 Geometry (3) Axiomatic and historical development of neutral, Euclidean, and hyperbolic geometry stressing proof technique and critical reasoning. Models of Non-Euclidean geometries. Prereq: 300 or consent of instructor.

461 Topology (3) Topology of line and plane, separation properties, compactness, connectedness, continuous functions, homeomorphisms, continua and topological invariants. Prereq: 241 or 247 and 300, or consent of instructor.

471 Numerical Analysis (3) Computation, instabilities, and rounding. Interpolation and approximation by polynomials and piecewise polynomials. Quadrature and numerical solution of initial and boundary value problems of ordinary differential equations, stiff systems. Prereq: 371 or consent of instructor. (Same as Computer Science 471.)


475 Industrial Mathematics (3) Modeling, analysis, and computation applied to scientific/technical/industrial problems. Prereq: 231 and familiarity with an operating system and a programming language (e.g. 171, 371, or Computer Science 102.)

490 Readings in Mathematics (1-3) Open to superior students with consent of department head. Independent study with faculty guidance. Prereq: Consent of faculty mentor to supervise independent work. May be repeated. Maximum 9 hours.

499 Seminar in Mathematics (1-3) Topics vary. Requires out-of-class projects and in-class presentations by students. Credit hours announced for each seminar. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

504 Discrete Mathematics for Teachers (3) Mathematical logic and methods of argument, sets, functions and relations, combinatorics. Normally first graduate course for students seeking MM degree. For students in Master of Mathematics program and for students in graduate programs in College of Education, Health, and Human Sciences. May not apply toward MS degree in mathematics. Prereq: 1 year calculus or equivalent.

505 Analysis for Teachers (3) Development of differential and integral calculus, proofs of basic theorems. For students in Master of Mathematics program and for students in graduate programs in College of Education, Health, and Human Sciences. May not apply toward MS degree in mathematics. Prereq: 1 year calculus or equivalent.

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to algebra of integers and polynomials. For students in Master of Mathematics program and for students in graduate programs in College of Education, Health, and Human Sciences. May not apply toward MS degree in mathematics.

509 Seminar for Teachers (3) For students in Master of Mathematics program and for students in graduate programs in College of Education, Health, and Human Sciences. May not apply toward MS degree in mathematics. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

510 Applied Mathematics Laboratory (1) Computer applications in applied mathematics: software packages for matrix analysis, symbolic algebra, and differential equations. Coreq: 511 or 512. May be repeated.


513-514 Mathematical Principles of Fluid Mechanics (3,3) Equations of motion, incompressible and compressible potential flow, shock waves, viscous flows. Navier-Stokes equations, Prereq: 431, 435, and 445-446 or 404, or consent of instructor.

515-516 Analytical Applied Mathematics (3,3) Analysis of advanced techniques in modern context for applied problems: dimensional analysis and scaling, perturbation theory, variational approaches, transform theory, wave phenomena and conservation laws, stability and bifurcation, distributions, integral equations. Prereq: 446 or 448, 453, and either 511-512 or both 431 and 435.

517-518 Mathematical Methods in Physics (3,3) (Same as Physics 571-572.)

519 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hours.

521-522 Enumerative Combinatorics (3,3) Sieve methods, recursion, generating functions, and permutation groups applied to enumeration of discrete structures. Incidence algebras and combinatorics of partially ordered sets.

523-524 Probability (3,3) Pertinent facts from measure theory, definition of abstract probability spaces; Kolmogorov’s existence theorem; series of independent random variables and laws of large numbers; general theory of distributions of random vectors and their characteristic functions; weak convergence concept, weak compactness and Levy’s continuity theorem in Euclidean spaces; infinitely divisible distributions and central limit problem; general concept and properties of conditional expectation, martingales, Doob’s martingale and optional sampling theorems. Prereq: 445-446. Recommended prereq: 423.

525-526 Statistics (3,3) Pertinent facts from probability theory; formulation of statistical models; sufficiency, Fisher-Neyman factorization theorem, exponential families, Bayesian models; methods of estimation and optimality theory; uniform minimum variance unbiased estimates, asymptotic efficiency and optimality; the confidence procedures and hypothesis testing; optimal tests and confidence intervals, the Neyman-Pearson lemma, uniformly most powerful tests; general theory of distributions, tests for linear models; non-parametric models, rank methods for comparison, linear regression and independence, robust tests; topics from decision theory. Prereq: 445-446. Recommended prereq: 425.

527 Stochastic Modeling (3) Models in probability applied to real world situations; queuing theory; branching processes; Monte Carlo simulation. Prereq: 445-446 or consent of instructor.

529 Seminar in Stochastics (1-3) May be repeated. Maximum 12 hours.


533 Calculus of Variations (3) Necessary conditions for extrema, Euler’s equation, broken extremals, Weierstrass-Erdmann conditions. Sufficient conditions for extrema-Legendre’s and Jacobi’s conditions, conjugate points. Multiple integrals. Prereq: 431.

535-536 Partial Differential Equations (3,3) First order equations, classification of equations and properties of elliptic, hyperbolic, and parabolic equations in several variables. Prereq: 445-446 and 231 or consent of instructor.

537-538 Mathematical Principles of Continuum Mechanics (3,3) Conservation principles, equations of equilibrium and motion for fluids and elastic solids, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory. Prereq: 431, 435, 446 or 448, or consent of instructor.

539 Seminar in Differential Equations (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

545-546 Real and Complex Analysis (3,3) Measure theory, Lebesgue integration, Hölder and Minkowski inequalities, Radon-Nikodym theorem, Fubini’s theorem, holomorphic functions, Cauchy’s theorem, Maximum Modulus theorem, Schwarz’s lemma, normal families, Riemann mapping theorem.

547-548 Applied Linear Analysis (3,3) Banach and Hilbert spaces, linear operators and spectral theory with applications to integral and differential equations, optimization, numerical analysis, and quantum mechanics, Sobolev spaces and embedding theorems. Prereq: 445-446.

549 Seminar in Analysis (1-3) May be repeated. Maximum 12 hours.

551-552 Modern Algebra (3,3) Groups, rings, modules and linear algebra, fields and Galois theory. Must be taken in sequence. Prereq: 455-456 or consent of instructor.

553 Linear Programming (3) Theory and applications. Prereq: Consent of instructor or 453 and programming ability.


555-556 Number Theory (3,3) Introduction to algebraic number theory. Prereq: 455-456 or consent of instructor.

559 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hours.


567-568 Differential Geometry (3,3) Classical differential geometry in two and higher dimensions: curves and surfaces in Euclidean space, Gauss map, curvature, Gauss-Bonnet theorem, hyperbolic geometry. Manifolds and Riemannian metrics; connections, geodesics, Jacobi fields, sectional curvature. Differential forms and moving frames. Prereq: 445-446 or consent of instructor.

569 Seminar in Topology (1-3) May be repeated. Maximum 12 hours.


575 Matrix Theory and Techniques in Numerical Analysis (3) Advanced topics in study of iterative and direct methods for large systems of linear equations: sparse matrix analysis, relationship to modern computer architectures. Prereq: 453, 471-472, or consent of instructor. May be repeated. Maximum 9 hours. (Same as Computer Science 575.)

577 Optimization (3) Major topics in optimization with problems developed from real-world applications including constrained and unconstrained optimization with analysis of major algorithms and utilization of appropriate software. Prereq: Numerical Algorithms, 453, 445-446.

578 Numerical Methods for Partial Differential Equations (3) Numerical approximation of solutions of partial differential equations including conservation laws and hyperbolic, parabolic, and elliptic problems. Derivation, physical meaning, and implementation of schemes. Prereq: 435 or 512 or 515, Fortran or C, or consent of instructor.

579 Seminar in Numerical Mathematics (1-3) May be repeated. Maximum 12 hours.

581-582 Mathematical Ecology (3,3) Deterministic and stochastic models of populations, communities, and ecosystems. Prereq: 431, 453 or consent of instructor. (Same as Ecology and Evolutionary Biology 581-582.)

583 Mathematical Evolutionary Theory (3) Population genetics and evolutionary ecology. Prereq: 431, 453 or consent of instructor. (Same as Ecology and Evolutionary Biology 583.)

585 Optimal Control Theory (3) Deterministic optimal control. Examples involving calculus of variations, optimal trajectories, and engineering control problems. Introduction to stochastic control. Prereq: 431, 445-446 or consent of instructor.

589 Seminar in Mathematical Ecology (1-3) May be repeated. Maximum 12 hours.

593 Independent Study (1-15) See College of Arts and Sciences.

598 Graduate Reading in Mathematics (1-3) Independent study with faculty guidance. Prereq: Graduate standing and consent of instructor. May be repeated. Maximum 6 hours.

599 Seminar in Mathematical Presentations (1)

600 Doctoral Research and Dissertation (3-15) P/NP only.


619 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hours.

623-624 Advanced Probability (3,3) Selected topics in modern theory of probability and stochastic processes: Itô’s calculus and stochastic differential equations, integration prediction theory, ergodic theory, probability on algebraic structures, limit theorems, geometry and probability in Banach spaces, probability methods in analysis. Prereq: 523-524 or consent of instructor. May be repeated with consent of department. Maximum 12 hours.

629 Seminar in Combinatorics (1-3) May be repeated with consent of department. Maximum 12 hours.

631-632 Advanced Ordinary Differential Equations (3,3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests and preparations of students. Prereq: 531-532 or consent of instructor. May be repeated with consent of department. Maximum 12 hours.

635-636 Advanced Partial Differential Equations (3,3) Selected topics in classical and modern theoretical partial differential equations. Prereq: 541-542 or 547-548 or consent of instructor. May be repeated with consent of department. Maximum 12 hours.


643-644 Harmonic Analysis (3,3) Fourier series and Fourier transforms on Euclidean spaces or topological groups; convergence, summability, uniqueness, inversion, duality, Plancherel transform, Hilbert transform, Hardy-Littlewood maximal function, interpolation of operators, or Fefferman-Stein duality. Prereq: 541-542 and 543. May be repeated with consent of department. Maximum 12 hours.

649 Seminar in Analysis (1-3) May be repeated with consent of department. Maximum 12 hours.

651-652 Advanced Modern Algebra (3,3) Selected topics in modern algebra or number theory. Prereq: 551-552 or consent of instructor. May be repeated with consent of department. Maximum 12 hours.

659 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 12 hours.

661-662 Modern Topology (3,3) Technical background to current literature in topology. Topics vary. May be repeated with consent of department. Maximum 12 hours.

663-664 Algebraic Topology (3,3) Homology, cohomology and homotopy theories: duality theorems and Hurewicz isomorphism theorem. Prereq: 561-562 and 1 year of abstract algebra, 455-456 or 551-552. May be repeated with consent of department. Maximum 12 hours.

667-668 Advanced Differential Geometry (3,3) Selected topics from Riemannian geometry and analysis on manifolds: Lie groups, metric geometry, spectrum of Laplacian, Hodge Theory, variational problems, curvature and topology of manifolds. Prereq: 567-568 or consent of instructor. May be repeated with consent of department. Maximum 12 hours.

669 Seminar in Topology (3) May be repeated with consent of department. Maximum 12 hours.


679 Seminar in Numerical Mathematics (1-3) May be repeated with consent of department. Maximum 12 hours.

681-682 Advanced Mathematical Ecology (3,3) Selected topics in theoretical and applied mathematical ecology: population, community, ecosystem ecology and applied topics such as demography, ecotoxicology, epidemiology, environmental change, and resource management. Prereq: 581-582. May be repeated. (Same as Ecology and Evolutionary Biology 681-682.)

MATHEMATICS EDUCATION (642)

485 Teaching Mathematics, Grades 7-12 (3) Preparation of teaching plans, evaluation, materials for teaching mathematics; teaching simulation and directed observation in schools. Prereq: Admission to teacher education.
522 Programs and Materials in School Mathematics (3) Examination, development and use of materials for creating an active learning environment for learning mathematics for all ages. Prereq: 485, 530, 543, or equivalent.

523 Diagnosis and Correction of Children’s Difficulties in Learning Mathematics (3) Children’s difficulties in learning mathematics and procedures for helping classroom teachers correct difficulties. Prereq: 522 or equivalent or consent of instructor.

530 Teaching Mathematics to Young Children: K-4 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. For those with little preparation in teaching elementary school mathematics.

542 Teaching Mathematics in Middle School: 5-8 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. For those with little preparation in teaching middle school mathematics.


581 Mathematics Curriculum (3) Past, present and future issues influencing mathematics curriculum in schools, elementary through college. Teacher’s role in curriculum development and implementation. Rationales for curriculum decisions. Prereq: 485, Elementary Education 505, or equivalent.

583 Teaching Mathematics in Senior High Schools and Community Colleges (3) Topics appropriate for high school and community/junior college mathematics curriculum. Special problems related to enrichment, problem solving, and use of microcomputers. Opportunities for special projects. Prereq: 485 or equivalent.

622 Research Trends in Mathematics Teacher Education (3) Analysis of current research trends in mathematics teacher education and impact of such research on development of teachers both preservice and in-service. Prereq: Minimum 9 hours of 500-level Mathematics Education courses.

683 Advanced Studies in Mathematics Education (3) Analysis of current research in mathematics education and implications of research for classroom practice. Prereq: Two graduate courses in mathematics education.

MECHANICAL ENGINEERING (650)

NOTE: Not all the courses listed below are available at both the University of Tennessee, Knoxville, and UTSI campuses.


452 Finite Element Analysis (3) Conversion of fundamental conservation principles in mechanics to simulation form via finite element implementation; applications in heat transfer, solid mechanics, mechanical vibrations, fluid mechanics and heat/mass transport. Extensive computer lab experiments using Matlab-based and commercial software systems. Prereq: 321, 344, 363.


475 Thermal Engineering (3) Thermal systems with emphasis on turbomachinery, heat exchangers, gas-vapor mixtures and psychrometry, fuels and combustion; chemical equilibrium; system analysis and design. Prereq: 344.

483 Introduction to Reliability Engineering (3) (See Nuclear Engineering 483.)

484 Introduction to Maintenance Engineering (3) (See Nuclear Engineering 484.)

494-495 Selected Topics in Mechanical Engineering (1-1-1-4) Problems and topics related to developments and practice in mechanical engineering. Prereq: Consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

504 Product Development Process (1) Basic elements in product development process and project management. Business and engineering interrelations to development and commercial manufacturing of new products. Multidisciplinary teams to explore possible new product opportunities. Prereq: Consent of instructor. (Same as Industrial Engineering 504.)


506 Product Selection and Evaluation (2) Development of operational requirements and features for new product having potential for business venture. Market potential, design feasibility and manufacturing requirements. Design alternatives created and evaluated against set of performance requirements determined from market analysis. Preferred product concept selected by end of semester. Prereq: 504. (Same as Industrial Engineering 506.)

507 Application of Linear Algebra in Engineering Systems (3) (See Chemical Engineering 507.)

508 Integrated Process and Manufacturing System Design (3) (See Industrial Engineering 508.)

509 Multidisciplinary Project (1) (See Industrial Engineering 509.)

510 Prototype Development and Evaluation (3) Prototype of selected product made and tested against required operating conditions. Design changes implemented to meet customer’s needs. Fabrication drawings and manufacturing plans finalized for introduction of product to marketplace. Prototype development managed using project management plan. Prereq: 555.


512 Heat Transfer II (3) Analysis of steady-state and time-dependent heat conduction by numerical methods. Analysis of laminar and turbulent convection heat transfer in internal and external flows, forced and buoyancy driven flows. Prereq: 541.
514 Phase Change Heat Transfer (3) Mechanisms and modeling of nucleate, transition and film boiling processes; critical heat flux; forced convection boiling and post dry-out heat transfer; condensa-
tion processes; heterogeneous nucleation; dropwise and filmwise
condensation; flow condensation; liquid-solid phase change
processes; moving phase fronts; mathematical modeling. Prereq: 344, 511.

515 Numerical Heat and Mass Transfer (3) Discrete modeling of
Navier-Stokes equations and energy equation via control volume
methods. Difference methods for discretization of convective term,
iterative solution algorithms for pressure-linked equations modeling
forced and buoyancy driven flows. Computer project. Prereq: Undergraduate fluid mechanics and heat transfer.

519 Technology Product Development and Entrepreneurship (3) Technology and innovation, technology transfer, patent protection,
legal formation and intellectual property, knowledge management,
generation, and transmission, launching a technology based business,
 sources of capital, small business growth and operation. Multidisciplinary teams will develop a business based on a technological product. Prereq: 506 or consent of instructor.

521-522 Thermodynamics I and II (3,3) Macroscopic thermodynam-
is, including First and Second Law analyses, availability, phase and
chemical equilibrium criteria, combustion, gas mixtures, and property
relations, determination of thermodynamic properties from molecular
structure, spectroscopic data, kinetic theory, statistical mechanics,
quantum physics, Schroedinger equation. Prereq: 332.

523 Special Topics in Thermodynamics (3) Application of thermo-
dynamics to topics of current interest in mechanical engineering. 
Prereq: Consent of instructor.

525 Combustion and Chemically Reacting Flows I (3) Fundamentals: thermochemistry, chemical kinetics and conserva-
tion equations; phenomenological approach to laminar flames;
diffusion and premixed flame theory; single droplet combustion;
deflagration and detonation theory; stabilization of combustion
waves in laminar streams; flammability limits of premixed lam-
nar flames; introduction to turbulent flames. Prereq: 522, 541, or
c consent of instructor.

526 Combustion and Chemically Reacting Flows II (3) Advanced
topics: phenomenological approaches to turbulent flames; funda-
mentals of turbulent flow; application of probability density func-
tions to turbulent flames; turbulent reacting flows with premixed and/or non-premixed reactants; spray combustion models; fluidized
bed combustion; chemically reacting boundary layer flow; gas tur-
bine and/or rocket motor combustors; furnaces; introduction to
supersonic combustion and hypersonic flows. Prereq: 525.

527 Thermal Systems Analysis I (3) Application of basic princi-
plies of heat transfer, fluid mechanics, and thermodynamics to develop
solution models for parametric analysis of thermal systems problems via commercial software. Prereq: 344.

528 Thermal Systems Analysis II (3) Analysis of steady turbulent
convection heat transfer. Properties of radiating surfaces. Diffuse,
specular and directional interchange for gray and non-gray surfaces.
Interaction with other heat transfer modes. Emphasis on model
development and parametric analysis of thermal systems using commercial software. Prereq: 527.

531 Advanced Biomechanics I (3) (See Biomedical Engineering
531.)

533 Dynamics (3) Kinematics and dynamics of particles in three
dimensions. Rotating coordinate systems. Hamilton’s principle.
Lagrange’s equations of motion. Kinematics and dynamics of rigid
bodies. Prereq: Mathematics 431 or Engineering Analysis, under-
graduate vibrations course. (Same as Aerospace Engineering 533; Engineering Science 533.)

534 Mechanical Vibrations (3) Vibrations of linear, discrete,
undamped and damped systems. Lagrange’s equations for holonom-
ic systems. Modal analysis. Laplace transform. Response to
mechanical transients. Prereq: Undergraduate vibrations course. 
(Same as Aerospace Engineering 533; Biomedical Engineering 534; Engineering Science 534.)

537 Mechanical Systems Analysis (3) Application of basic princi-
ples of rigid body dynamics, strength of materials, and continuum
mechanics to development of models for parametric analysis of
mechanical systems using commercial software. Prereq: 231, 321.

539 Continuum Mechanics (3) (See Engineering Science 539.)

541 Fluid Mechanics I (3) Derivation of equations governing flow of
inviscid and viscous fluids (conservation of mass, Newton’s sec-
cond law, conservation of energy). Equations of state and constitutive
relations. Euler and Navier-Stokes forms and nondimensionaliza-
tion. Exact solutions and introduction to potential and boundary-
layer flows. Prereq: Fluid mechanics. (Same as Aerospace 
Engineering 541; Biomedical Engineering 541; Engineering Science 541.)

542 Fluid Mechanics II (3) Equations of viscous fluid flows. Basic
concepts and equations of turbulent flow. Separation, stability and transition. Laminar and turbulent boundary-layer flows. Exact,
approximate, and numerical solutions. Prereq: 541. (Same as 
Aerospace Engineering 542; Engineering Science 542.)

547 Advanced Linear Control (3) Multivariable feedback systems;
transfer function and state-space techniques; stability of linear sys-
tems; optimality and robustness; control system design. Prereq: 507 or equivalent

551-552 Mechanical Engineering Design (3,3) Design of mechani-
cal engineering devices and systems. Prereq: Consent of instructor.

555 Human Vibrations Analysis and Protection (3) (See
Biomedical Engineering 555.)

559 Advanced Mechanics of Materials I (3) Elasticity in three di-
 mensions: equations of equilibrium, strain-displacement relations,
compatibility, constitutive equations. Energy methods. Beams on
elastic foundation, unsymmetrical bending, shear center, beam-
columns, buckling, plastic collapse. Prereq: Mechanical Engineering 321 (Same as Aerospace Engineering 559; Biomedical Engineering 559; Engineering Science 559.)

561 Finite Elements for Engineering Applications (3) (See
Engineering Science 551.)

562 Computational Fluid Dynamics (3) (See Engineering Science
552.)

563 Computational Solid Mechanics (3) (See Aerospace
Engineering 553; Engineering Science 553.)

567 Smart Structures and Materials (3) Constitutive modeling and
characteristics of piezoelectric materials, electrostrictive materials,
magnetostrictive materials, shape memory alloys, electrorheological and magneto rheological fluids, and electroactive polymers. Energy
methods for static and dynamic analysis of piezoelectric bimorph and
other smart systems. Prereq: 321, 363 or consent of instructor.

577 Neural Networks in Engineering (3) (See Engineering
Science 577.)

581 Rocket Propulsion I (3) Rocket propulsion fundamentals; ther-
modynamics of nonreacting and chemically reacting ideal gases,
rocket nozzle design; ideal rocket performance parameters; rocket
heat transfer; chemistry of propellants; liquid rocket engine sys-
tems; ground testing; introduction to solid propellant rockets.  
Prereq: Consent of instructor.
582 Rocket Propulsion II (3) Solid propellant rocket performance, homogeneous and heterogeneous propellant chemistry and combustion system performance, thermal decomposition and gas phase reaction models; effect of chamber pressure and additives on solid propellant burn rates, erosive burning; analysis of two-phase solid rocket exhaust flow. Introduction to nuclear and electric propulsion; electrical resistance and electric field (ion) engine performance, magnetohydrodynamic thrusters, traveling wave thrusters; exotic propulsion systems. Prereq: Consent of instructor.

584-585 Turbomachinery Systems I, II (3,3) Ideal cycle analysis of turbine engines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flowthrough theory, turbine engine component matching, transient operation, surge and rotating stall, engine control systems, structural considerations. Prereq: First year graduate standing and consent of instructor.

586 Mechanics and Control of Robotic Manipulators (3) Fundamentals of robotic manipulation: kinematics and dynamics of manipulators, control systems design, trajectory planning, advanced force and impedance control strategies. Prereq: 451, 533, or equivalent.

587 Dynamic Modeling and Simulation (3) Modeling and analysis of physical systems. Systems and parameter identification. Mathematical modeling methods and approximations. Digital simulation techniques and practices. Design and control applications. Prereq: 451 or equivalent. (Same as Biomedical Engineering 587.)

588 Introduction to Hybrid Electric Vehicles (3) Series, parallel, and dual configurations. Sizing and analysis of typical HEV components: motors, auxiliary power sources, on-board energy storage, and fuels. Steady-state HEV force and power modeling schemes. Power train design using various computer simulation tools. Prereq: Consent of instructor.

589 Hybrid Electric Vehicle Control Systems Design and Analysis (3) Dynamic modeling, simulation and analysis of complete hybrid electric vehicle systems. Linear control design techniques and discrete logic design applied to HEV power trains and operating mode controls. Digital and real-time control and hardware issues of automotive systems. Design and human factors engineering issues of vehicle controls and displays. Prereq: 588 or consent of instructor.

590 Selected Engineering Problems (2-6) Enrollment limited to students in problems program. Prereq: Consent of advisor. May be repeated. Satisfactory/No Credit grading only.

594 Culminating Integrated Project Report (3) Final phase of product development process. Multidisciplinary teams submit and defend comprehensive project report. Report includes all engineering and business considerations needed to convince potential investors to fund proposed business venture. Prereq: Consent of instructor. (Same as Chemical Engineering 594; Electrical and Computer Engineering 594; Industrial Engineering 594; Materials Science and Engineering 594; Nuclear Engineering 594.)

595 Seminar (1) All phases of mechanical engineering, reports on current research at the University of Tennessee, Knoxville, and the University of Tennessee Space Institute. May be repeated. Satisfactory/No Credit grading only.

599 Special Topics in Mechanical Engineering (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

610 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer; natural convection, multi-phase flow, high speed reacting and nonreacting flows, advanced boundary layer techniques, combustion, perturbation and variational methods of analysis, heat exchange theory and design. May be repeated. Maximum 9 hours. Prereq: Consent of instructor.

613 Advanced Radiation Heat Transfer (3) Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with conduction and convection heat transfer. Prereq: 511, 512.

621 Advanced Topics in Solid Mechanics (3) Advanced theory and applications in mechanics, dynamics, vibrations, and strength of materials. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

631 Advanced Biomechanics II (3) (See Biomedical Engineering 631.)

642 Advanced Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of pure substances, metastable states. Non-equilibrium thermodynamics. Prereq: Consent of instructor.

647 Nonlinear Control Systems (3) Qualitative behavior of nonlinear systems; Lyapunov stability theory; passivity and absolute stability theory; frequency domain methods; nonlinear feedback systems; nonlinear design techniques. Prereq: 547 or Electrical and Computer Engineering 512 or equivalent.

651-652 Advanced Topics in Computational Fluid Dynamics (3,3) (See Engineering Science 651-652.)

653-654 Advanced Topics in Computational Solid Mechanics (3,3) (See Engineering Science 653-654.)

659 Advanced Mechanics of Materials I (3) Plane stress and plane strain in rectangular and polar coordinates; stress functions. Torsion of noncircular sections. Disks, thick-walled tubes, thick-walled pressure vessels. Theory of rectangular and circular plates, plates with holes, axisymmetric shells. Stress concentrations. Prereq: Mechanical Engineering 559 or consent of instructor. (Same as Aerospace Engineering 659; Biomedical Engineering 659; Engineering Science 659.)


671 Advanced Topics in Applied Artificial Intelligence (3) (See Nuclear Engineering 671.)


MEDIEVAL STUDIES (674)

401 Dante and Medieval Culture (3) (See Italian 401.)

402 Petrarch and Boccaccio (3) (See Italian 402.)

431 Medieval Art of the West, 800-1400 (3) (See Art History 431.)

441 Northern European Painting, 1350-1600 (3) (See Art History 441.)

451 The Art of Italy, 1250-1450 (3) (See Art History 451.)

510 Special Topics (3) May be repeated. Maximum 6 hours.
**MICROBIOLOGY (684)**

410 Bacterial Physiology (3) Modern concepts of structure and function of bacterial cell. Prereq: 310.


420 Medical Microbiology (3) Disease-producing microorganisms, including bacteria, rickettsia, chlamydia and fungi. Prereq: 310.

429 Medical Microbiology Laboratory (2) Laboratory exercises in medically important areas of microbiology: microorganisms, pathogenesis and immunology. Prereq: 319, 430. Coreq: 420.

430 Immunology (3) Principles of inflammation and immunity; immunoglobulin structure and theories of formation and diversity; complement, hypersensitivities, cell cooperation and recognitions in immune mechanisms; soluble factors. Prereq: Biology 240.


470 Microbial Ecology (3) Physiological diversity and taxonomy of microorganisms from natural environments. Functional role of microorganisms in natural and simulated ecosystems. Prereq: 310.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

550 Molecular Epidemiology and Mycology (3) (See Entomology and Plant Pathology 550.)

575 Applied Microbiology and Bioengineering (3) (See Chemical Engineering 575.)

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

595 General Seminar (1) Lectures and seminars by invited speakers, faculty, and graduate students. May be repeated. Maximum 18 hours. Satisfactory/No Credit grading only.

596 Laboratory Rotation (1) Familiarization with research areas in department through series of rotations in laboratories of individual faculty members. May be repeated. Maximum 3 hours. Satisfactory/No Credit grading only.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Journal Club in Microbial Physiology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hours. Satisfactory/No Credit grading only.

602 Journal Club in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hours. Satisfactory/No Credit grading only.

603 Journal Club in Immunology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hours. Satisfactory/No Credit grading only.

604 Journal Club in Virology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hours. Satisfactory/No Credit grading only.

605 Journal Club in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hours. Satisfactory/No Credit grading only.

610 Topics in Microbial Physiology (1-3) Prereq: 410 or consent of instructor. May be repeated. Maximum 12 hours.

620 Topics in Microbial Pathogenesis (1-3) Prereq: 420, 430 or consent of instructor. May be repeated. Maximum 12 hours.

630 Topics in Immunology (1-3) Prereq: 430 or consent of instructor. May be repeated. Maximum 12 hours.

640 Topics in Virology (1-3) Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hours.

650 Topics in Microbial and Molecular Genetics (1-3) Prereq: 411 or consent of instructor. May be repeated. Maximum 12 hours.

670 Advanced Topics in Environmental Microbiology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

**MUSIC EDUCATION (707)**

510 Foundations of Music Education (3) Historical, philosophical and aesthetic bases. Prereq: Consent of instructor.

520 Research in Music Education (3) Definition of research problems, data collection and analysis, and research report writing. Application of knowledge of research techniques to analysis of existing research literature in music education. Prereq: Consent of instructor.


570 Studies in Multicultural Music Education (3) Study of music literature, art and customs of various cultures appropriate for students in K-8. Strategies and techniques for teaching music at this level.

571 Musical Repertoire Laboratory (1) Performance of music from various cultures: production of musicals appropriate for students in grades K-8. Singing, dancing, acting, costumes, set design, traditional and non-traditional instrumental ensembles. Limited to students majoring or concentrating in art, dance or theatre. Prereq or coreq: 570. May be repeated. Maximum 2 hours.

574 Analysis for Teaching for Professional Development (2) Strategies to document and analyze effectiveness of teaching and professional development. Study and application of various approaches. Coreq: 575.

575 Professional Internship in Teaching (1-8) Teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to post-baccalaureate students in professional year program. Prereq: Admission to Teacher Education program and consent of School of Music. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

580 Seminar in Music Education (3) Class investigation and individual reporting of pertinent topics and issues in music education. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

590 Special Topics in Music Education (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

591 Clinical Studies (4) Group and individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.

593 Special Problems in Music Education (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.
MUSIC ENSEMBLE (708)
Prerequisite: By audition or consent of instructor.
502 Jazz-Saxophone Ensemble (1) May be repeated. Maximum 4 hours.
503 Small Jazz Ensemble (1) May be repeated. Maximum 12 hours.
504 Jazz Ensemble (1) May be repeated.
505 Studio Orchestra (1) May be repeated. Maximum 12 hours.
506 Trombone Choir (1) May be repeated.
510 Percussion Ensemble (1) May be repeated.
511 Marimba Choir (1) May be repeated.
515 Chamber Music Ensemble (1) May be repeated. Maximum 12 hours.
530 Chamber Singers (1) May be repeated.
540 Opera Theatre (1) May be repeated.
550 Concert Band (1) May be repeated.
552 Symphonic Band (1) May be repeated. Maximum 12 hours.
553 Wind Ensemble (1) May be repeated. Maximum 12 hours.
554 Varsity Band (1) May be repeated.
559 Marching Band (1) May be repeated.
570 Symphony Orchestra (1) May be repeated.
580 Concert Choir (1) May be repeated.
583 Men’s Chorale (1) May be repeated. Maximum 4 hours.
589 Women’s Chorale (1) May be repeated.
599 Accompanying (1) May be repeated.

MUSIC GENERAL (698)
500 Thesis (1-15) P/NP only.
501 Graduate Recital (2)
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.
510 Music Bibliography (3) Bibliographic methodology in music.
511 Lecture Recital (2)
520 Musical Styles (3) Elements of design and their role in definition of musical styles. Prereq: Consent of instructor.
521 Special Topics in Performance (1-3) Prereq: Consent of school director.
540 Secondary Applied Music (1) May be taken by music majors desiring applied study on a 2nd or 3rd instrument. May be repeated for a maximum of 4 hours credit on each instrument. Admission by audition. Requires payment of Applied Music fee.

MUSIC INSTRUMENTAL (710)
490 Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of different styles to conductor’s art; musical analysis and practice in conducting. Prereq: Music Education 320 or equivalent.
580 Band History and Literature I (3) Antiquity to 1900.
581 Band History and Literature II (3) 1900 to present.
583 Recitative for Instrumental Conductors (1) Problems in conducting recitatives. Prereq: Consent of instructor. Satisfactory/No Credit grading only.
584 Practicum for Instrumental Conductors (1) Intern experience in field other than area of major interest. Satisfactory/No Credit grading only.
590 Advanced Instrumental Conducting (2) Physical techniques of conducting, study and analysis of scores, rehearsal techniques. Attention to individual problems. Requires Applied Music fee. Prereq: Consent of instructor. May be repeated. Maximum 8 hours.
595 Instrumental Conducting Performance (1) Preparation and juried performance of band or orchestral work(s). Prereq: Consent of instructor.

MUSIC JAZZ (711)
410 Advanced Improvisation (3) Further development of individual skills and solving individual problems in jazz improvisation. Prereq: 210 and 220.
420 Jazz Pedagogy (1) Methods and materials relating to teaching of jazz, designing and administering jazz programs, and rehearsal techniques for jazz ensembles. Prereq: Studio Music and Jazz major or consent of instructor.
520 Seminar in Jazz (3) Topic varies.

MUSIC KEYBOARD (712)
410 Organ Practicum (1) Improvisation, hymn playing, and accompanying on the organ. Prereq: Organ proficiency at the 200 level. May be repeated. Maximum 3 hours.
420-430 Piano Literature I,II (3,3) 420—From 1750 to middle 19th century; 430—Middle 19th century to present.
460-470 The Organ and Its Literature I,II (3,3) Development of organ and organ literature from Middle Ages to present; problems of style and interpretation; pedagogical literature and methods; organ design. Prereq/coreq: Musicology 220 and consent of instructor.
480 Teaching Class Piano (3) Historical survey and evaluation of teaching materials and methodology for college and/or adult beginning piano classes, with collateral teaching experience. Prereq: Consent of instructor.
485-495 Suzuki Piano Method I,II (2,2) Psychology, procedures, and literature of Suzuki piano method. Must be taken in sequence. Prereq: Consent of instructor.
490-491 Internship (2,2) Opportunity for pedagogy students to gain experience in teaching beginning students under supervision of experienced instructors. Weekly discussion seminars.
520 Piano Literature Seminar (3) Topics vary. May be repeated. Maximum 9 hours.
531-541 Recital Project (2,2) Preparation and accompaniment of full recital for accompanying concentrations only. 531—Vocal recital, 541—Instrumental recital. Prereq: Consent of instructor.
540 Advanced Piano Pedagogy (2) Topics vary. Evaluation and study of methods and materials for teaching piano at all levels. Supervised laboratory teaching. Prereq: Consent of instructor. May be repeated. Maximum 8 hours.
560 Organ Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hours.
MUSIC PERFORMANCE (713)

All performance courses require an audition and consent of instructor. May be repeated. Maximum 8 hours toward Master of Music degree.

403 Flute (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 304, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

404 Flute (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 403, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

405 Oboe (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 306, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

406 Oboe (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 405, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

410 Bassoon (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 311, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

411 Bassoon (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 410, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

415 Clarinet (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 316, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

416 Clarinet (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 415, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

420 Saxophone (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 321, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

421 Saxophone (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 420, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

425 Horn (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 326, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

426 Horn (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 425, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

430 Trumpet (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 331, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

431 Trumpet (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 430, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

435 Trombone (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 336, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

436 Trombone (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 435, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

440 Baritone (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 341, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

441 Baritone (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 440, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

445 Tuba (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 346, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

446 Tuba (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 445, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

450 Percussion (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 351, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

451 Percussion (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 450, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

455 Voice (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 356, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

456 Voice (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 455, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

460 Violin (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 361, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

461 Violin (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 460, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

465 Viola (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 366, grade of C or better. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

466 Viola (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 465, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

470 Cello (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 371, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.
471 Cello (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 470, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

472 Electric Bass (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 373, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

473 Electric Bass (1-3) By audition only. Prereq: Music General 101 or equivalent. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). Music Performance 472, grade C or higher. May be repeated. Maximum 8 hours.

474 String Bass (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 375, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

475 String Bass (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 474, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

480 Piano (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 381, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

481 Piano (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 480, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

483 Guitar (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 384, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

484 Guitar (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 483, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

485 Harpsichord (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 386, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

486 Harpsichord (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 485, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

489 Organ (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 390, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

490 Organ (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 489, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

494 Composition (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 395, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

495 Composition (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 494, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

496 Composition with Electronic Media (1-3) By audition only. Prereq: Music General 101 or equivalent; Music Performance 396, grade C or higher. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). May be repeated. Maximum 8 hours.

499 Improvisation (1-2) By audition only. Prereq: Music General 101 or equivalent and consent of instructor. Coreq: Ensemble appropriate to degree program (see School of Music Undergraduate Handbook). Cannot be used to satisfy applied music requirement. May be repeated. Maximum 4 times.

503 Flute (1-4)

505 Oboe (1-4)

510 Bassoon (1-4)

515 Clarinet (1-4)

520 Saxophone (1-4)

525 Horn (1-4)

530 Trumpet (1-4)

535 Trombone (1-4)

540 Baritone (1-4)

545 Tuba (1-4)

550 Percussion (1-4)

551 Accompanying and Coaching (1-4)

555 Voice (1-4)

560 Violin (1-4)

565 Viola (1-4)

570 Cello (1-4)

572 Electric Bass (1-4) May be repeated. Maximum 8 hours.

575 String Bass (1-4)

580 Piano (1-4)

583 Guitar (1-4) May be repeated. Maximum 8 hours.

585 Harpsichord (1-4)

590 Organ (1-4)

594 Composition (1-3)

595 Composition with Electronic Media (1-3)

599 Improvisation (1-4)

MUSIC TECHNOLOGY (717)

540 Computer Music Transcription (3) Projects in notation, playback, and publication of music incorporating elements of word processing, graphic design, sequencing, and page layout. Study of MIDI protocol as applied to computer music work station design. No credit toward Master of Music concentration in music theory with technology emphasis. Prereq: Consent of instructor.

550 Computer Projects (3) High-level programming languages used to design and implement computer-managed instruction; Internet development tools; writing of documentation for computer projects. Prereq: 540 or equivalent.

560 Technology in Music Research (3) Use of technology for research projects in music analysis or pedagogy: development and execution of research project. Prereq: 550.
MUSIC THEORY (714)

430-440 Counterpoint I, II (3,3) 430—Study of species counterpoint in modal and tonal styles, works of Palestrina and J.S. Bach. Prereq: 210 with grade C or higher. 440—Writing of contrapuntal forms of the 18th century and fugue analysis of works from the 10th through 20th centuries. Prereq: 430 with grade C or higher.

450 Choral Arranging (2) Analysis of scores and writing of arrangements for choruses. Prereq: 210 and 240 with grade C or higher, or consent of instructor.

520 Analytical Techniques (3) Analytical techniques, contemporary approaches. Tonal and neotonal music. Prereq: Consent of instructor.

530 Music Theory Pedagogy (3) Techniques, methods, and materials involved in college-level theory programs. Use of technology and review of existing software. Prereq: Consent of instructor.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of school director.

MUSIC VOICE (715)

410-420 Song Literature I, II (2,2) 410—German songs. 420—French, Italian, Russian, Scandinavian, Czecholeslovakian, British, and American art songs. Graduate credit not available for students in vocal performance.

425 Functional Diction for Singers (3) Comprehensive survey of singing diction in six languages: English, French, German, Italian, Latin and Spanish. Basic instruction in International Phonetic Alphabet; development of basic diction skills; overview of diction styles and traditions in each language; survey of diction resources and reference materials. Does not fulfill deficiency requirements for graduate students in voice or accompanying.

510 Vocal Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hours.

520 Performance Techniques for Singers (1) Improvisation, movement, and basic techniques for dramatic vocal performance. Prereq: Vocal major or consent of instructor. May be repeated for credit. Maximum 2 hours.

530 Opera Performance (2) Prereq: Consent of instructor. May be repeated. Maximum 4 hours.

540 Opera Production (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

550-560 Advanced Vocal Pedagogy I, II (2,2) 550—Study of vocal production, examination of different methods. 560—Study of teaching materials, observation of studio teaching, analysis of vocal problems in selected students, and supervised teaching.

565 Special Projects in Vocal Pedagogy (3) Course is available only for graduate students majoring in vocal pedagogy. Prereq: Consent of instructor.

570 Vocal Chamber Music Performance (2) Prereq: Consent of instructor.

575 Internship in Vocal Pedagogy I (1) Opportunity for vocal pedagogy students to develop and improve applied teaching skills through a shared practicum experience in a seminar setting. Includes supervised instruction. Available only for graduate students majoring in vocal pedagogy. Prereq: Consent of instructor. May be repeated. Maximum 2 hours.

580-585 Choral Literature I, II (2,2) Choral music from middle ages to present with consideration of historical development of major choral genres.

590 Advanced Choral Conducting (2) Expansion and continued refinement of conducting technique. Score reading and preparation, rehearsal techniques, and interpretation of styles and performance practices. May be repeated. Maximum 8 hours.

594 Project in Choral Conducting Performance (1-3) Public performance, critical document; recording project. Prereq: Consent of instructor. May be repeated.

595 Choral Conducting Seminar (3) Topics vary. Prereq: 590 or consent of instructor. May be repeated.

MUSICOCY (706)

410 Music History Genre (3) Topics vary. May be repeated. Maximum 6 hours.

420 History of Opera (3) Dramatic, vocal, and orchestral elements in opera of Italian, French, and German schools, 1600-present.

430 Symphonic Literature (3) Literature for orchestra from Baroque to present, evolution of symphony.

450 Composer Seminar (3) Life and works of single composer. Subjects vary.

460 Music Aesthetics (3) Nature of music and musical experience, sense perception and emotions, music, and role of artist in society. Aesthetic viewpoint of individuals and historical eras through selected writings.

480 Music in Christian Worship (3) Hymnody, liturgies, and liturgical music.

540 Music of the Medieval and Renaissance Periods (3) Survey of major musical phenomena from c. 900 to c. 1600. Chant, troubadour/trouve song, Notre Dame polyphony, Ars Nova, Ars subtilior, madrigal, chanson, mass and motet. Musical developments considered against historical, cultural, analytical, and literary frameworks.

550 Music in the Baroque Period (3) From c.1600 to 1750; rise of opera and oratorio, sacred and secular cantatas, instrumental forms, performance practice.

560 Music in the Classic Period (3) Evolution of classical style from pre-classic music to music of Haydn, Mozart, and early Beethoven.

570 Music in the Romantic Period (3) Nineteenth-century musical styles from Beethoven to post-romanticists.

580 Music in the 20th Century (3) From 1890, Debussy, to present, Stockhausen and others.

585 Topics in Music of the Americas (3) Topics vary.

586 Topics in Opera (3) Topics vary within operatic repertory from the 17th c. to the present including music and drama; interdisciplinary, race, or gender studies; realism; nationalism; expressionism; minimalism. May be repeated. Maximum 6 hours.

590 Introduction to Ethnomusicology (3) Ethnomusicology as scholarly discipline. History, theories, and methodologies as applied to study of music in culture. Prereq: 380 or equivalent.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of school director.

595 Seminar in Ethnomusicology (3) Topics vary. Prereq: 590 and consent of instructor.

596 Seminar in Historical Musicology (3) Topics vary; specific musical genre, composer, or phenomenon. May be repeated. Maximum 6 hours.

NUCLEAR ENGINEERING (716)

403 Nuclear and Radiological Engineering Laboratory II (3) Cross section measurements, diffusion properties of neutrons, shielding, dynamics and controls, alpha and beta spectroscopy, radiation fields and dosimetry. Prereq: 304.

404 Nuclear Fuel Cycle (3) Mining, milling, fabrication, in-core management, reprocessing, waste disposal, regulatory and radiation health issues and requirements. Prereq: 470 or equivalent.
406 Radiation Shielding (3) Types of radiation sources, fundamentals of gamma ray and neutron attenuation, biological effects, approximate methods of shield design, discrete ordinates, and Monte Carlo. Prereq: Physics 232.

421 Introduction to Nuclear Criticality Safety (3) Fundamentals of nuclear criticality safety; criticality accidents; safety standards; overview of experiments, computational methods, and applications. Prereq: 301.

431 Radiation Protection (3) External and internal dosimetry, biological effects of radiation, radiation detection, radiation risk assessment. Prereq: 301.

470 Nuclear Reactor Theory I (3) Fundamentals of reactor physics relative to cross sections, kinematics of elastic scattering, reactor kinetics, reactor systems and nuclear data. Analytical and numerical methods applicable to general criticality problems, eigenvalue searches, perturbation theory, and multigroup diffusion equations. Prereq: 301.

483 Introduction to Reliability Engineering (3) Probabilistic failure models, parameter estimation (maximum likelihood, Bayes techniques), model identification and comparison, accelerated life tests, failure prediction, system reliability, preventive maintenance and warranties. Prereq: Senior standing or consent of instructor. (Same as Chemical Engineering 483; Industrial Engineering 483; Mechanical Engineering 483.)

484 Introduction to Maintainability Engineering (3) Principles of maintenance and reliability engineering, and maintenance management. Information extraction from machinery measurements, rotating machinery diagnostics, nondestructive testing, life prediction, failure models, lubrication oil analysis, establishing predictive maintenance program, and computerized maintenance management systems. Prereq: Senior standing in engineering and consent of instructor. (Same as Chemical Engineering 484; Industrial Engineering 484; Materials Science and Engineering 484; Mechanical Engineering 484.)

494 Special Topics in Nuclear Engineering (3) Problems related to recent developments and practice. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 6 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

509 Multidisciplinary Project (1) (See Industrial Engineering 509.)

511-512 Transport Processes in Nuclear Engineering (3,3) Rheology of Newtonian and non-Newtonian fluids; integral and system conservation equations for single and multi-component fluids; in-depth development of differential conservation equations for mass, energy, and momentum; exact and approximate solutions of equations of motion; boundary layer analysis; numerical analysis of fluid flow and heat transfer.

521 Nuclear Systems Dynamics and Control (3) Introduction to state variable methods for system dynamics and control analysis and application of these methods to nuclear plant dynamics, simulation and control problems.


541 Reactor Fuel Management (3) Topics relative to in-core fuel management. Applicable topics in reactor physics, fuel depletion, isotopic inventories, reactivity control and numerical methods. Prereq: 470 or consent of instructor.


543 Selected Topics in Nuclear Criticality Safety (3) Criticality safety computational and experimental methods for enrichment, fabrication, storage, reprocessing, and transport applications; overview of safety practices and regulatory requirements. Prereq: 421 or consent of instructor.

550 Radiation Measurements Laboratory (3) Physics and electronics associated with radiation detection and measurement, methods of data analysis. Applicability of particular detector measurements and fundamentals of radiation detection instrumentation operation. Prereq: 551.


552 Radiological Assessment and Dosimetry (3) Transport of radionuclides in environment, food chain pathways, internal dosimetry and personnel dosimetry. Prereq: 551 or consent of instructor.

553 Radiation Risk Analysis (3) Methods for radiation risk prediction, survival analysis, parameter estimation, real data analysis, extrapolation techniques. Prereq: 552 or consent of instructor.

567 Medical Physics I (3) Ionizing radiation use in radiation therapy to cause controlled biological effects in cancer patients. Physics of interaction of various radiation modalities with body equivalent materials and physical aspects of clinical applications. Lecture and lab. Prereq: Consent of instructor.

568 Medical Physics II (3) Physics of ionizing radiation therapy with emphasis on quality assurance, treatment planning, radiation protection, and special treatment procedures. Lecture and lab. Prereq: 567.

571 Reactor Theory and Design (3) Analytical and numerical techniques for neutronics modeling of nuclear systems. Forward and adjoint Boltzmann transport equation, Multigroup diffusion theory. Core analysis methods and codes. Prereq: 470 or consent of instructor.

572 Nuclear System Design (3) Design and analysis of a nuclear system, interface with non-nuclear aspects of system design: system reliability and economics; class project. Prereq: Consent of instructor.

577 Neural Networks in Engineering (3) Neural network technology for use in intelligent systems; rationale for neural computing, structure of neural computing systems, programming. Prereq: Consent of instructor. (Same as Biomedical Engineering 577; Engineering Science 577; Mechanical Engineering 577.)

578 Fuzzy Systems in Engineering (3) Fuzzy numbers, fuzzy environment, uncertainty and randomness, approximate reasoning, fuzzy models and structures, decision process in fuzzy environment, fuzzy computing, fuzzy logic controllers, fuzzy expert systems and other engineering applications. (Same as Engineering Science 578.)

579 Advanced Monitoring and Diagnostic Techniques (3) Fundamentals of machinery monitoring and diagnosis and application of advanced statistical and artificial intelligence based techniques such as ridge regression, principal component analysis (PCA), linear and non-linear partial least squares (PLS), neural networks, and fuzzy logic. Prereq: Graduate standing or consent of instructor.

COURSES OF INSTRUCTION

582 Monte Carlo Analysis (3) Analysis of radiation transport problems in radiation shielding by Monte Carlo method, use of MCNP code system. Random sampling, evaluation of integrals, analog particle transport, techniques of variance reduction, forward and adjoint modes of analysis, importance function biasing, splitting/weight window survival biasing and contribution theory. Prereq: Consent of instructor.

585 Process System Reliability and Safety (3) Qualitative and quantitative techniques for assessing and improving process systems reliability and safety. Fault tree analysis and associated dependent failure analysis. Prereq: Consent of instructor. (Same as Chemical Engineering 585.)

594 Culminating Integrated Project Report (3) (See Industrial Engineering 594.)

597 Special Topics in Nuclear Engineering (3) Lectures and recitation on recent advances in nuclear engineering. Prereq: Consent of instructor. May be repeated with consent of department.

598 Nuclear Engineering Practice (3-9) Experience in solving and reporting on engineering problems. Prereq: Approval of department. May be repeated. Enrollment limited to alternative plan students. Satisfactory/No Credit grading only.

600 Doctoral Research and Dissertation (3-15) P/NP only.

611-612 Selected Topics in Reactor Theory (3,3) Transport theory, control rod theory, stochastic methods. Selected topics from literature. Prereq: 572.

621 Selected Topics in Radiation Protection (3) Prereq: 551, 552. May be repeated with consent of department.

653 Theory of Information Processing (3) Modern system theoretical methods for evaluating system performance from dynamic measurements. Prereq: 522 or equivalent.

671 Advanced Topics in Applied Artificial Intelligence (3) Recent advances in engineering applications of artificial intelligence. Prereq: 577. (Same as Engineering Science 671; Mechanical Engineering 671.)

697 Special Topics in Nuclear Engineering (3) Investigation of new developments. Prereq: Consent of instructor. May be repeated with consent of department.

NURSING (720)

400 Aging and Society (3) An examination of the health and social effects of longevity and the aging process including societal and personal attitudes about old age. Resources, trends, issues, and potentials of aging are explored. Volunteer community service, a service learning component, is required. Open to students in all colleges.

402 Gerontology Practicum (3) Off-campus supervised experience in gerontology. Offered as part of the gerontology minor. Open to students in all colleges. Prereq: Consent of instructor.

409 Genetic Disorders, Vulnerable Families and Health Advocacy (3) Examination of health and social implications of human genome project, with emphasis on genetic disorders that result in chronic illness or disability. Strategies for building collaborative partnerships to effect health advocacy for vulnerable populations. Prereq: Upper-division status.

500 Thesis (1-15) P/NP only.

501 Nursing Research: Methods, Design, and Analysis (3) Basic principles of research process in application to clinical questions; critical evaluation of nursing and health-related research. Prereq or coreq: Graduate level statistics.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

504 Advanced Health/Physical Assessment (3) Development of advanced clinical reasoning and assessment skills to determine client health status and needs. Application of physiological, pathophysiological, and psychosocial concepts with implications for advanced practice nursing. Didactic (2.5) and lab (.5). Prereq: Admission to MSN program or consent of instructor.

505 Advanced Clinical Pharmacology (3) Pharmacological agents utilized to treat common, recurrent health problems; indications, contraindications, side and interactive effects of commonly prescribed drugs. Prereq: Undergraduate pharmacology course or consent of instructor.


507 Concepts for Advanced Practice Nursing: Health Promotion and Health Policy (4) Exploration of advanced nursing practitioners' and their role in the dynamic health care system. Emphasis on health policy, health promotion and the organizational, social, ethical, political, economic, and technological factors that impact advanced practice nursing and the delivery/promotion of health care. Didactic (3) and Seminar (1).

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

510 Theoretical Foundations of Nursing (3) Historical evolution of nursing science; nursing’s metaparadigm and selected philosophies, conceptual models and theories as structures which guide critical thinking in analysis, reasoning, and decision making for advanced practice nursing. Prereq: Admission to MSN program or consent of instructor.

511 Statistical Applications to Nursing Research (3) Descriptive and inferential statistics: statistical concepts and applications to clinical settings and their applications to advanced practice nursing.

515 Advanced Pathophysiology for Nursing Practice (3) Advanced physiologic and pathophysiologic concepts, principles, and theories applied to deviations of human systems. Prereq: Undergraduate pathophysiology course.

516 Advanced Pathophysiology: Neurological/Cardiovascular with Anesthesia Implications (2) Review of anatomy and physiology and integration of pathophysiology involved in patients requiring anesthetic care for cardiac surgical procedures (both children and adults) with and without cardiopulmonary bypass, intercellular surgical procedures for vascular and mass occupying lesions, patients requiring somatosensory evoked potential monitoring, and patients requiring anesthesia for noncardiac and non-neurological procedures who present with either neurological and/or cardiovascular comorbidity. Prereq: 521. Coreq: 523.


519 Psychopharmacology in Advanced Practice (3) Examination of the neurobiological basis of psychiatric illness and the use of psychopharmacological agents to modify symptoms and outcomes. Evaluation of the role of psychoactive medications in relation to the use of other psychotherapeutic interventions. Prereq: Undergraduate pharmacology course or consent of instructor.


523 Advanced Principles of Nurse Anesthesia Practice (2) Advanced concepts/principles of anesthesia management and legal implications of nurse anesthesia practice.

524 Basic Principles of Anesthesia I (3) An introduction to the scientific principles upon which anesthesia administration is based. The focus of this course (part one of a two-part series) is on the sound elementary principles of safe anesthesia delivery for the beginning practitioner.

525 Basic Principles of Anesthesia II (3) A continuation of 524 (Basic Principles of Anesthesia I) which builds upon the previous course to provide advanced elementary scientific principles upon which nurse anesthetists implement plans of care which have been developed. The focus of this course (part two of a two-part series) is on the sound basic principles of safe anesthesia management for the beginning practitioner.

526 Professional Issues in Nurse Anesthesia (2) Exploration of historical and current issues surrounding nurse anesthesia education, practice, and the profession.

530 Adult Health Nursing I (6) Advanced nursing practice for health promotion, restoration, and maintenance of young, middle-aged, and older adults. Theories and research to advanced practice with individual clients in variety of settings. Didactic (2) and practicum (4). Prereq: 504, 505, 515. Prereq/Coreq: 507, 510.

531 Adult Health Nursing II (7) Continuation of 530. Delivery, provision, and management of health care for adult groups and communities. Didactic (2) and practicum (5). Prereq: 530, 501.

544-545-546-547-548-549 Clinical Nurse Anesthesia Practicum/Seminar I, II, III, IV, V, VI (2-11) Integration and application of theoretical foundations and development of clinical skills in nurse anesthesia practice under supervision of Certified Registered Nurse Anesthetist (CRNA) and/or anesthesiologist. Prereq for 544: Admission to nurse anesthesia concentration. Prereq for 545: 544, 521, 504, 505. Must be taken in sequence.

550 Nursing of Women and Children I (8) Advanced practice nursing for women and children; clinical experience in role of nurse practitioner or clinical nurse specialist in variety of settings. Health promotion and nursing interventions for actual or potential health problems of women, children, and families. Didactic (3) and practicum (5). Prereq: 504, 505, 515. Prereq/Coreq: 507, 510.

551 Nursing of Women and Children II (8) Continuation of 550. Role refinement of nurse practitioner or clinical specialist in health maintenance and restoration for women, children, and families. Didactic (3) and practicum (5). Prereq: 550, 501. Prereq/Coreq: 582.

552 Care of the Critically-III Neonate (3) Physiology and pathophysiology of the neonate and the recommended interventions in pathology. Focus I is on the high-risk neonate. Didactic and independent study. Coreq: 550.

560 Mental Health Nursing I (6) Theories of advanced therapeutic interventions for clients experiencing actual and potential mental health problems: advanced practice nursing in specialty of mental health; clinical practice with clients of various ages in acute care and community settings. Didactic (2) and practicum (4). Prereq: 504, 505, 515. Prereq/Coreq: 507, 510.

561 Mental Health Nursing II (7) Continuation of 560. Advanced practice nursing in community settings for families and groups with actual and potential mental health problems. Didactic (2) and practicum (5). Prereq: 560, 501. Prereq/Coreq: 582.

565 Teaching Practicum (1-6) Individually designed teaching experience in collegiate nursing program or nursing practice setting. Objectives to be developed collaboratively by student and faculty. Prereq/Coreq: 566 and consent of instructor. Satisfactory/No Credit or letter grade.

566 Educational Principles and Strategies (3) Exploration and analyses of selected education, curriculum; teaching-learning, measurement, and evaluation principles and theories as applied to instruction of undergraduate nursing students, staff development, and patient education. Prereq: Consent of instructor.

570 Family Nurse Practitioner I (6) Application of advanced health/physical assessment and diagnostic reasoning in nursing management and primary care of individuals and their families with actual and potential acute health problems; clinical experience in role of family nurse practitioner in variety of settings. Didactic (2) and practicum (4). Prereq: 504, 505, 515.

571 Family Nurse Practitioner II (3) Continuation of 570. Emphasizes increasing advanced nursing competencies in the management and primary care of individuals and their families in all developmental life stages; Prereq/Coreq: 507, 510.

572 Family Nurse Practitioner II Clinical (2) Continuation of 571. Clinical experience in a variety of settings emphasizing advanced nursing competencies in the management and primary care of individuals and their families in all developmental life stages. Practicum (2). Prereq: 571.

573 Family Nurse Practitioner III (8) Continuation of 572. Advanced nursing management of multiple/complex health problems of individuals and families in all developmental life stages; role refinement and exploration of major issues of the family nurse practitioner; clinical experience in a variety of settings. Didactic (2) and practicum (6). Prereq: 501, 572. Prereq/Coreq: 582.

577 Special Topics (1-3) Topic is determined by faculty and student interest. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

582 Scholarly Inquiry for Advanced Practice Nursing (3) Non-thesis option. Utilization of research process through experiential or critical evaluation of science in area of interest. Conducted under faculty guidance and culminating in scholarly product. Prereq or coreq: 501 or consent of instructor. May be repeated. Maximum 6 hours.

583 Directed Clinical Practice (1-10) Additional opportunities for advanced nursing practice. Objectives to be developed collaboratively by student and faculty. Prereq: Enrollment in or completion of graduate level courses in clinical nursing. May be repeated. Maximum 14 hours. Satisfactory/No Credit or letter grade.

585 Seminar in Gerontology (1) (See Health 585.)


593 Independent Study (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.
601 Philosophy and Theory for Nursing Science (3) Philosophical and historical context of knowledge for nursing science; in-depth analysis of health-related theories as frameworks for knowledge-building; concept development in theory building.

603 Nursing Research and Inquiry (3) Philosophical, theoretical and methodological bases for nursing inquiry. Prereq: 601.


606 Nursing Research Seminar (3) Selected topics pertaining to dissertation proposal process, research experience, and defense.

607 Qualitative Nursing Research (3) Critique and application of qualitative nursing research methods. Prereq: 601, 603.


609 Research Practicum (1-3) Supervised individual or group research experience under guidance of faculty. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

610 Nursing Science Seminar (2) Critical Analysis and synthesis of literature in selected focus area within nursing science. Prereq: Admission to doctoral program in nursing or consent of instructor.

612 Health and Nursing Policy/Planning (3) Policies affecting nursing education and practice; health policies and political processes; interactions between health professionals, consumer groups, and government in health policy development and health planning activities.

613 Nursing Leadership in Complex Systems (3) Analysis and evaluation of nursing leadership/management in complex professional, academic and health care systems.

614 Nursing Preceptorship (3) Individually-designed practicum, field, or internship experiences in variety of administrative, educational, research, or clinical practice settings. Prereq: 601.

NUTRITION (726)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

511 Advances in Carbohydrate, Lipid and Protein Metabolism (4) The physiological impact of dietary carbohydrates, lipids and proteins, with an emphasis on nutritional and hormonal regulation of intermediary metabolism, bioenergetics and gene regulation. Prereq: Advanced Nutrition course.

512 Advances in Vitamin and Mineral Metabolism (3) Advances in the requirements, utilization, metabolism and physiological impact of micro-nutrients with an emphasis on vitamins and minerals in the context of human nutrition. Prereq: Advanced nutrition course.

513 Community Nutrition I (3) Orientation to community; assessment of nutrition problems, needs, and resources; functional roles of public health nutritionist. Concurrent field experiences. Prereq: Advanced nutrition or consent of instructor.

514 Community Nutrition II (3) Planning, implementation, and evaluation of public health nutrition programs. Concurrent field experiences. Prereq: 513 or consent of instructor.

515 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor. Prereq: 513, 514 and consent of instructor. Satisfactory/No Credit grading only.

516 Maternal and Child Nutrition (3) Nutrition principles related to growth and development during pregnancy, infancy, and childhood to age 5, high risk conditions. Prereq: Advanced nutrition or consent of instructor.

517 Childhood and Adolescent Nutrition (3) Application of nutrition principles to school age children; effects of diseases on growth and health maintenance; nutritional assessment and counseling for nutrition. Prereq: Advanced nutrition or consent of instructor.

518 Nutrition and Aging (3) Nutritional problems of adults; nutritional requirements, dietary intakes; affects of nutrition on biological aging. Prereq: Advanced nutrition or consent of instructor.

520 Nutritional Ecology (2) Examination of issues in natural, political, physical, and social environments that impact availability of food and nutrients in U.S. food supply.

521 Physiological Basis for Diet and Disease (3) Altered nutrient needs as result of metabolic changes that occur in selected disease states. Prereq: Nutrition in Disease or consent of instructor.

522 Nutrition Counseling (2) Individual eating habits and disorders, evaluation strategies for effectiveness of helping process. Prereq: Nutrition in Disease or consent of instructor.

530 Molecular Application in Nutrient-Gene Interaction I (1) Theories and applications of gene regulation methodologies. Experimentation with DNA and RNA. RNA and DNA isolation and analysis to illustrate nutrient regulation of gene expression. Combination of lab/lecture.

540 Seminar in Nutrition (1) May be repeated. Satisfactory/No Credit grading only.

541 Research Methods (2) Basic principles of planning, conducting, and interpreting nutrition and foodservice systems administration research. Prereq: 6 graduate hours in nutrition and food system administration and statistics.

542 Advanced Experimental Nutrition (2) Application of research principles to individual project using experimental animals. Prereq/coreq: 541.

544 Survey Methods in Food and Nutrition (2) Application of survey research methods to nutrition projects: assessment of food consumption, nutrient intake, nutritional status, sociocultural-economic parameters, food production and service. Prereq/Coreq: 541.

547 Field Experience (3-9) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. Satisfactory/No Credit grading only.

548 Directed Study in Nutrition (1-3) Advanced study in nutrition. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

549 Special Topics (1-3) Recent advances in nutrition or food systems administration. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

602 Advanced Topics in Nutrition Science (1-3) Comprehensive individual study and group discussion of topics related to current problems in nutrition. Prereq: 512 or consent of instructor. May be repeated.

603 Current Trends in Food and Sociocultural Change (2) Critical evaluation of research. Prereq: 508 or consent of instructor.
OPERATIONS AND MANAGEMENT SCIENCE (738)

540 Statistics and Operations Management (3) Analysis of methods and models for understanding supply chain flows processes. Introduction to management strategies and techniques applicable to design of systems in logistics and operations processes. Prereq: Business Administration 511, 512, and 513 or consent of instructor. (Same as Logistics 510.)

541 Operations Management (3) Techniques applicable to design of systems in operations planning and control in manufacturing and service industries. Modeling real-world systems through problems definition, supporting data structure design, model design, solution, implementation, and maintenance. Prereq: 540 or Logistics 510 or permission of instructor.

PHILOSOPHY (745)

400 Special Topics (3) May be repeated when topic varies. Maximum 6 hours.

411 Modern Religious Philosophies (3) (See Religious Studies 411.)

419 Science as Method (3) (See Ecology and Evolutionary Biology 419.)

420 Topics in History of Philosophy (3) Figures or movements from antiquity through mid-twentieth century. Prereq: 6 hrs of philosophy or consent of instructor. May be repeated when topic varies. Maximum 9 hours.

435 Intermediate Formal Logic (3) Metatheory of formal logic and philosophy of logic. Prereq: Consent of instructor.

440 Contemporary Ethical Theory (3) Topics in meta-ethics or ethics. Prereq: 6 hrs of philosophy or consent of instructor.

443 Advanced Business Ethics (3) Advanced topics in business ethics. When content varies, may be repeated. Maximum 6 hours.

445 Advanced Environmental Ethics (3) Advanced topics in environmental ethics. When content varies, may be repeated. Maximum 6 hours.

446 Advanced Bioethics (3) Advanced topics in bioethics. When content varies, may be repeated. Maximum 6 hours.

462 Philosophy of Biology (3) Current issues: nature of natural selection, adaptation, and fitness; level of selection debate; nature of species; interaction of environment and organism, and others. Prereq: Upper-division coursework in philosophy or biology or consent of instructor.

472 Philosophy of Language (3) Problems of meaning, reference and truth. Relation between words and world. How sentences manage to be about the world. What is true? Prereq: 3 philosophy courses 200 level or above.

473 Philosophy of Mind (3) Problems of mind and body in relation to consciousness and personal identity. Prereq: 6 hours of philosophy or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Philosophical Research (3) Paper workshop (writing, revising papers, getting papers ready to publish). Does not count toward hours required for degree. May be repeated. Satisfactory/No Credit grading only.

520 Topics in Ancient or Medieval Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hours.

522 Topics in Modern Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hours.

524 Topics in Twentieth-Century Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hours.

528 Topics in Contemporary Philosophy (3) Intensive critical work on themes in late 20th-century philosophy. May be repeated. Maximum 9 hours.

540 Topics in Ethics or Value Theory (3) May be repeated. Maximum 9 hours.

542 Topics in History of Ethics (3) Dominant movements in history of ethics. May be repeated. Maximum 9 hours.

544 Topics in Applied Ethics (3) Single author, tradition, or topic in ethical theory, application to issues in health, business, technology, ecology, and other practical fields. May be repeated. Maximum 9 hours.

546 Orientation to Medical Ethics (3) Survey of ethical theories in application to issues in medical ethics.

548 MA Clinical Practicum (3) Series of clinical rotations at one or more local health care institutions. Open only to graduate students concentrating in medical ethics. Prereq: 547 and consent of Medical Ethics Committee and the UTMCK Graduate Education Committee.

575 Topics in Metaphysics and Epistemology (3) May be repeated. Maximum 9 hours.

577 Topics in Philosophy of Mind (3) Relation of mental to physical and of role of words in discourse for mental activities, thinking and feeling. May be repeated. Maximum 9 hours.

585 Special Topics (3) May be repeated. Maximum 9 hours.

587 Advanced Clinical Medical Ethics (3) Critical concepts in medical ethics, relationship of theory to practice, and professional roles and responsibilities for health care ethics consultant. Open only to PhD students concentrating in medical ethics. Prereq: Consent of Medical Ethics Committee.

588 PhD Clinical Practicum (9) Series of clinical rotations at one or more local health care institutions. Open only to PhD students concentrating in medical ethics. Prereq: 587 and consent of Medical Ethics Committee and the UTMCK Graduate Education Committee.

590 Topics in Social and Political Philosophy (3) Philosophical problems concerning social and political life: family, state, freedom, justice; major theoretical responses: anarchism, social contract, Marxism. May be repeated. Maximum 9 hours.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

620 Topics in Ancient or Medieval Philosophy (3) May be repeated. Maximum 9 hours.

622 Topics in Modern Philosophy (3) May be repeated. Maximum 9 hours.

624 Topics in Contemporary Philosophy (3) May be repeated. Maximum 9 hours.

640 Topics in Ethics or Value Theory (3) May be repeated. Maximum 9 hours.

646 Topics in Applied Ethics (3) Prereq: Consent of Medical Ethics Committee. May be repeated. Maximum 9 hours.
PHYSICS (773)

411-412 Introduction to Quantum Mechanics (3,3) Fundamental principles of quantum mechanics and methods of calculation. Solution of Schrödinger equation for simple systems. Application to atomic, molecular, nuclear, and condensed matter physics. Must be taken in sequence. Prereq: 240 or equivalent, Mathematics 435.

421 Modern Optics (4) Transmission of light in uniform, isotropic media; reflection and transmission at interfaces; mathematics of wave motion and interference effects. Rudiments of Fourier optics and holography. 3 hours and 3 labs. Prereq: 431 or 136 or 138 or 232, and consent of instructor.

431-432 Electricity and Magnetism (3,3) Electrostatics, magnetostatics, coupled electric and magnetic fields, Maxwell’s Equations, electromagnetic waves and radiation. Prereq: 136 or 138 or 232.

461-462 Modern Physics Laboratory (3,3) 461—Introduction to fundamental and modern techniques in experimental physics, and to theory and practice of measurement and data analysis. Selected experiments in nuclear, atomic, molecular and solid state physics, and modern optics. Prereq: 240 or 411. 462—Advanced experiments and experimental techniques in modern physics; experimental team work. Thorough quantum mechanical interpretation of results and preparation of scientific reports. 6 hours lab per week. Prereq: 461.

490 Senior Seminar (1-3) Topic of current interest. May be repeated with consent of department. Maximum 6 hours.

500 Thesis (1-15) P/NP only.

501 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prereq: Consent of department and research director. May be repeated with consent of department. Maximum 18 hours. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Physics Colloquium (1) Lectures and discussion on current research topics. Continuous registration required for current graduate students. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

505 Physics of Fluids (3) Fluid physics, overview of fluid mechanics and associated computational techniques; general description of laminar and turbulent flows; subsonic, supersonic and hypersonic flows; continuum, transitional and free-molecular flows; pipe flow, nozzle flow and sonic orifice expansion flows; reacting and nonreacting flowfields; shock-tube physics; and introduction to method of characteristics and Monte Carlo computational techniques.

506 Experimental Methods (3) Introduction to experimental methods of spectroscopy through hands on operation of FTIR, Raman, NMR, photoelectron, laser and mass spectrometers. Principles and hazards of cw and pulsed lasers, radiation detectors, photomultiplier tubes, image intensifiers, image converters; high-vacuum systems including cryogenic-based devices, data acquisition techniques including lock-in amplifiers, box-car integrators, digital electronics methods and micro-computer data acquisition.

507 Contemporary Optics (3) Topics in geometrical, physical, Fourier, and nonlinear optics and introductory laser physics. Extensive use of computer calculations and design of practical and sophisticated optical systems.

508 Laser Physics (3) Mode analysis, stable and unstable resonators; rate equations and population inversion, saturation, relaxation oscillations, fluctuations and noise, laser stability; quantum theory of laser, photon coherence; mode-locking, Q-switching and frequency stabilization; specific laser types: semiconductor and solid-state, excimer, copper vapor and dye lasers.

511-512 Theoretical Physics (3,3) Concepts and applications in applied physics. Topics: one-body, two-body and rigid body dynamics, ideal fluid, small oscillations and waves, elements of special relativity, electrostatic and magneto-static problems, EM waves, duality and quantization, absorption and emission, statistical ensemble and thermal equilibrium, and other modern applications of current interest, in areas of quantum chemistry, biophysics, optics, spectroscopy, and astrophysics. Recommended background: Familiarity with computational methods.

513 Problems in Theoretical Physics I (3) Fundamentals of physics: classical mechanics (Newtonian mechanics, Lagrangian and Hamiltonian dynamics) and electrostatics and magnetostatics.

514 Problems in Theoretical Physics II (3) Fundamentals of physics: electrodynamics, relativity, and quantum mechanics.

521-522 Quantum Mechanics (3,3) Fundamental principles of quantum mechanics, angular momentum, electron spin, particles in electric and magnetic fields, perturbation theory, variational methods, scattering theory, second quantization, quantization of electromagnetic field, absorption, absorption, and scattering of light, bremsstrahlung, pair creation and annihilation. Application of quantum mechanics to problems of atomic, molecular, nuclear, and solid state physics. Prereq for 522: 521

531 Classical Mechanics (3) Variational formulation, Lagrange’s and Hamilton’s equations, constraints, canonical transformations, Hamilton-Jacobi theory and action-angle variables.

532 Advanced Classical Mechanics (3) Advanced topics in classical mechanics, KAM theorem and Hamiltonian chaos, dissipative chaos. Topics may vary according to interest of students and instructor. Prereq: 531.

541-542 Electromagnetic Theory (3,3) 541—Review of electrostatics, magnetostatics, and quasi-static problems; Maxwell’s field equations and their solutions in dielectric and conducting media; electrodynamics and relativity, retarded potentials and gauge transformations, radiation produced by accelerating charges. 542—Advanced treatment of Electrodynamics, collisions between charged particles, bremsstrahlung, multiple fields. Topics may vary according to interest of students and instructor. Prereq or coreq for 541: 571. Prereq for 542: 541.


561 The Theory of Relativity (3) Geometry of space-time, relativistic electrodynamics, particle mechanics and continuum mechanics, Einstein’s field equations, Schwarzschild solutions, the classical test of general relativity. Prereq/Coreq: 531 and 541.


591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

594 Special Problems (3) Especially assigned theoretical or experimental work on problems not covered in other courses. May be repeated. Maximum 9 hours.


600 Doctoral Research and Dissertation (3-15) P/NP only.

601-602 Atomic Physics (3,3) 601—Survey of research problems and methods. Topics of current interest. Intended for all graduate students. 602—Advanced problems for students specializing in field.

605 Laser Spectroscopy (3) Applications of lasers to spectroscopy of atomic and molecular systems; absorption, laser-induced fluorescence, and Raman spectroscopy: molecular and atomic coherence; quantum beats, resonance fluorescence, photon echoes, self-induced transparency; saturation and Doppler-free spectroscopy; laser cooling and trapping. Prereq: 521, 541.

606 Nonlinear Optics (3) Nonlinear optical susceptibilities, wave propagation in nonlinear media, sum-frequency and difference frequency generation, harmonic generation, parametric amplification and oscillation, stimulated Raman processes, two- and multi-photon processes, four-wave mixing and phase conjugation, transient coherent optical effects and free induction decay, optical breakdown and nonlinear effects in plasmas. Prereq: 522.

610 Quantum Optics (3) Quantum theory of emission and absorption of radiation; frequency-dependent susceptibility; coherence theory; field quantization and coherent photon states; interaction of radiation with atoms; photon optics, counting and higher-order coherence; atomic scattering phenomena. Prereq: 521.

611 Advanced Quantum Mechanics and Field Theory (3) Survey of problems and methods. Topics of current interest. Intended for all graduate students.

612 Advanced Topics in Quantum Field Theory (3) Renormalization, Lamb shift, anomalous magnetic moments, gauge theories, electroweak theory, quantum chromodynamics, grand unified theories, and advanced topics in laser physics and quantum optics. Topics vary according to interest of students, instructor and present state of physics. Prereq: 611 or consent of instructor.

615-616 Astrophysics and Cosmology (3,3) 615—Stellar evolution: hydrostatic equilibrium, energy production and transport, star birth, main sequence, red giants, variable stars, and stellar explosions. General relativity and gravitation, white dwarfs, neutron stars, pulsars, and black holes. 616—Galaxies and the interstellar medium. Active galaxies, quasars, and supermassive black holes. Large-scale structure, the expanding Universe, cosmologies, big bang, cosmic background radiation, inflation, dark matter, formation of structure, and fate of the Universe. The Planck scale and quantum gravity.

621-622 Nuclear Physics (3,3) 621—Survey of research problems and methods. Topics of current interest. Intended for all graduate students. 622—Advanced problems intended for students specializing in the field.

626-627 Elementary Particle Physics (3,3) 626—Survey of elementary particle physics: experimental methods, conservation laws, invariance principles, and models of interactions. Intended for all graduate students. 627—Advanced topics intended for students specializing in field: quark models, electroweak interactions and unification of elementary forces.

642 Advanced Topics in Modern Physics (3) Advanced theoretical or experimental topics not covered in other courses. May be repeated with consent of department. Maximum 9 hours.

643 Computational Physics (3) Developing computer algorithms for solving representative problems in various fields of physics, celestial dynamics in astrophysics, boundary value problems in electromagnetism, atomic and nuclear structures, band structure in solid state physics, transport problems in statistical mechanics, Monte Carlo simulation of liquids, fitting and interpolation of data, correlation analysis, or optimization strategy. Prereq: 521, 531, 571.

671-672 Advanced Solid State Physics (3,3) 671—Survey of research problems and methods. Topics of current interest. Intended for all graduate students. 672—Advanced problems intended for students specializing in field.

PLANT SCIENCES (791)

410 Nursery Management and Production (2) Modern management methods as applied to retail and wholesale nurseries and landscape contracting firms. Methods of producing liners, container and field-grown woody ornamental plants. 2 hours and 1 lab. Prereq: 220, 330, and Environmental and Soil Sciences 210, or consent of instructor.

427 Management and Administration of Public Horticulture Institutions (2) Management of resources in non-profit institutions, support organizations and communities. Theoretical framework and institutional mission; strategic planning and programming; financial accounting and budgeting; development and fund raising; personnel policies; volunteer development; marketing and publicity; legal issues; relationships between staff and governing boards; the use of information technology in management and governance systems; and conservation/preservation roles in community development. Prereq: 226.

429 Field Study of Public Horticulture Institutions (2) Extended 10 -12 day field study of various public horticulture institutions: botanical gardens, arboreta, historical grounds, zoos, conservatories, cemeteries, and nature preserves. Travel journal and course portfolio required. Application and travel fee required. Prereq: 226.

432 Weed Management (3) Principles of weed interference, integrated management, herbicide selectivity and behavior, specific recommendations for various crop and non-crop situations. 2 hours and 1 lab. Prereq: Environmental and Soil Sciences 210. Students who have received credit for 334 may not receive credit for this course.

434 Fruit and Vegetable Crops (3) Botanical description, geographical distribution, general cultural practices of warm and cool season vegetables, small fruits, and deciduous tree fruits. A Saturday day and overnight trip is required. 2 hours lecture and one 2-hour lab. Prereq: 120, Biology 110-120.

435 Field and Forage Crops (2) Agronomic principles of crop production and management. Crop improvement, cropping systems, tillage, fertigation, pest management, harvest and utilization of major field and forage crops. 2 hours and 1 lab. Prereq: 335.

436 Plant and Garden Photography (2) Principles and techniques of photography related to plants and gardens. Equipment options and field shooting under various weather conditions and in different seasons. Prereq: Senior standing and consent of instructor.

437 Public Garden Operations and Management (2) Analysis of year-round operations and management of public gardens. Case studies: time and labor management, budget development and management, implementation of volunteer programs, information dissemination methods for public outreach, management of grounds and facilities using the University of Tennessee Institute of Agriculture Gardens as model. Prereq: 226.

441 Advanced Turfgrass Management (2) Principles and scientific basis of turfgrass culture; adaptation, ecology, physiology, climatic influences on grass culture; clipping and water management; design. 1-hour lecture and one 1-hour lab. Prereq: 240.

446 Horticultural Therapy (2) Application of horticulture as therapy for treatment, rehabilitation and/or training of individuals with disabilities. Prereq: Senior standing.

448 Horticultural Internet Technology (3) Creation and management of information resources for the internet, with a focus on development of visual and oral communications skills through a series of individual and team exercises in writing, graphics and public speaking. Prereq: Communication Studies 210 or 240.

450 Specialty Landscape Construction (3) Methods of design, materials, and construction techniques for specialized components of landscape industry. Irrigation systems, outdoor lighting, garden ponds and water features.

451 Plant Tissue Culture (3) (See Entomology and Plant Pathology 451.)

454 Plant Biotechniques (3) Lectures will discuss recombinant DNA technology, molecular assisted breeding of economically important crops, gene cloning and transformation technologies. Examples will be given of food and ornamental crops, pharmaceuticals, and renewable energy sources produced using biotechnology as well as potential risks of this technology. Labs will include electrophoresis, tissue culture, plasmid prep, genomic DNA preps, PCR, plant transformation, genomic techniques. 1-hour lecture and one 3-hour lab. Prereq: 353 or Biology 240.

457 Weed Management (2) Principles of weed interference, integrated management, herbicide selectivity and behavior, specific recommendations for various crop and non-crop situations. Prereq: Environmental and Soil Sciences 210.


459 Agronomy Weed Management Lab (1) Laboratory addressing the principles and practices presented in 457, from the standpoint of agronomy. Prereq or coreq: 457. Prereq: Environmental and Soil Sciences 210.

460 Advanced Landscape Design (3) Comprehensive application of landscape design skills to variety of project experiences: landscape planning and analysis, planting design, and materials estimating. Two 3-hour labs. Prereq: 280 and 380.

485 Computer Aided Landscape Design (3) Computer Aided Design (CAD) related to landscape design and construction. Site planning and construction of related landscape plan view and 3-D drawings. Operating system, use of AutoCAD and LANDCADD software. Two 3-hour labs. Prereq: 280, 380, Agriculture and Natural Resources 290 or Computer Sciences 100 or equivalent.

494 Professional Horticultural Communications (3) Communication for public horticulturists through written, oral and visual media. Communication skills using proper writing techniques and grammar for print media, brochure design using desktop publishing, slide show development, oral presentations, and video use for educational and informational presentations in ornamental horticulture. Prereq: Agriculture and Natural Resources 290 or Computer Sciences 100 or equivalent and senior standing.

500 Thesis (1-15) P/NP only.

501 Special Topics in Plant Sciences (1-3) Topics to be assigned. May be repeated. Maximum 6 hours. Prereq: Consent of instructor.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Non-Thesis Project (1-2) Library, field, or laboratory project under supervision of faculty member. Not for thesis candidates. May be repeated. Maximum 4 hours.

504 Seminar (1) Presentations and discussion of topics. May be repeated. Maximum 2 hours.

505 Seminar Preparation (1) Application of speaking, writing, and organizational skills in preparation and presentation of scientific material to both scientific and general audiences. Preparation of abstracts for scientific presentations. Required of all entering graduate students during their first year of graduate study.

507 Professional Development Seminar (1) (See Agriculture and Natural Resources 507.)

513 Plant Pathogenic Fungi (2) (See Entomology and Plant Pathology 513.)

521 Flowering Physiology (1) General phenomenology, photoperiodism, thermoperiodism, interactions of external factors, juvenility, and hormonal regulation. 3 hours weekly for 5 weeks. Prereq: Introductory plant physiology or equivalent.

522 Drought Physiology (1) Biophysical and biochemical aspects of plant water relations and drought physiology. 3 hours weekly for five weeks. Prereq: Introductory plant physiology or equivalent.

530 Integrated Pest Management (3) (Same as Entomology and Plant Pathology 530.)

532 Environmental Crop Physiology and Ecology (3) General and specific relations among environmental factors, crop organisms, and agricultural systems. Interrelationships of atmospheric gases in photosynthesis, evapotranspiration and foliar injury. Relationships of temperature stress, vernalization and bud dormancy to crop production. Influences of maturation ripening and senescence on post-harvest quality of fruit, vegetable, grain and forage crops. 2 hours and 1 lab. Prereq: Plant physiology course.

536 Ecology of Grazing Land Systems (3) Multi-university, field-oriented course. Components and functions of grazing lands and how these vary in different ecoregions; research needs, objectives and techniques in soil-plant-animal research; forage-livestock ecology and systems in grazing lands (cropland, pastureland, rangeland and forestland); role of forages in conservation practices, wildlife habitats, and sustainable agriculture; and industries involved with forages and livestock. Two-week field trip, inclusive report and examination. Prereq: Consent of instructor.

544 Protein Gel Electrophoresis (1) (See Entomology and Plant Pathology 544.)

545 Plant Microtechnique (1) (See Entomology and Plant Pathology 545.)

551 Organismal Plant Genetics (3) Discovery of genetics, ploidy, extrachromosomal inheritance, apomixis, incompatibility systems, mutations, controlling elements, quantitative inheritance and heritability. Prereq: General genetics and 561 or equivalent.

561 Statistics for Biological Research (3) Application of statistics to interpretation of biological research. Notation, descriptive statistics, probability, distributions, confidence intervals, t- and chi-square tests, analysis of variance, mean separation procedures, linear regression and correlation. Prereq: Mathematics 125 or 152. Students may not receive credit for both 461 and 561.

571 Design and Analysis of Biological Research (3) (Same as Animal Science 571.)

592 Internship (1-2) Application of horticulture and design principles and practices in supervised, professional setting. approved by department. Satisfactory/No Credit or letter grade.

593 Problems in Plant Sciences (1-3) Independent study. Current topic related to technology, science or design. May be repeated. Maximum 6 hours.
600 Doctoral Research and Dissertation (3-15) P/NP only.

603 Special Topics in Crop Physiology and Ecology (1-3) Microclimatology of agroecosystems, crop dormancy and responses to stress, physiology of crop growth and reproduction. Interactions of physiology and germplasm in crop production, theory and application of quantitative methods in crop physiology and ecology research. May be repeated. Maximum 6 hours.

605 Special Topics in Plant Breeding and Genetics (1-3) Genotype by environment interactions, estimation of quantitative parameters, mutations, chromosome dynamics, polyploidy, genetic engineering, interspecific hybridization, linkage, screening methods, genome organization. May be repeated. Maximum 6 hours.

633 Plant Metabolism (3) Metabolism of chemical compounds of economic importance in crop production: plant growth regulators, naturally occurring plant metabolites, and herbicides. Prereq: Botany 521 or 522 and organic chemistry or biochemistry.

643 DNA Analysis (2) (See Entomology and Plant Pathology 643.)

653 Advanced Plant Breeding (3) Principles and methodologies targeting genetic gain for crop improvement. Concepts of qualitative and quantitative trait improvement. Parental germplasm, hybridization, population formation, inbreeding, genetic variance, heritability, selection methods, molecular genetic markers, genetically engineered crops. Prereq: Botany 521 or 522 and organic chemistry or biochemistry.

POLITICAL SCIENCE (801)

402 The City in the United States (3) Development and character of U.S. cities. Contemporary issues and selected case studies. (Same as Urban Studies 411.)

403 Survey of Planning (3) History of city development and of planning. U.S. experience in urban and other levels of planning. State of the art process, comprehensive plan, implementation devices. Planning issues in society. Not for credit for MSP degree. (Same as Urban Studies 412.)

425 Media and Politics (3) Examines the interrelationship between the political system and the media from a political science perspective.

430 United States Constitutional Law: Sources of Power and Restraint (3) Analysis of judicial review, constitutional powers of President and Congress, federalism, sources of regulatory authority, and constitutional protection of political and economic rights. (Same as Legal Studies 430.)

431 U.S. Constitutional Law: Civil Rights and Liberties (3) Analysis of current issues in civil rights and liberties including: first amendment freedoms, equal protection, privacy and rights of accused. (Same as Legal Studies 431.)

435 Criminal Law and Procedure (3) Substantive and procedural law in criminal justice field: constitutional questions and public policy issues. (Same as Legal Studies 435.)


442 Administrative Law (3) Legal dimensions of administrative power and procedures, and constitutional controls over administrators. (Same as Legal Studies 442.)

445 Administration of Justice (3) Administration and processes of justice system, including judicial administration and decision making in trial and appellate courts. (Same as Legal Studies 445.)

446 Housing (3) Nature and demand for housing in the U.S. and abroad. U.S. experience. Private market processes and public influences. Problems of change in housing supply, impact of new technology, and governmental programs to increase supply and quality of housing. (Same as Urban Studies 446.)

451 Ethnic Conflict in Foreign Countries (3) Examination of political and violent conflict among ethnic and national groups and challenges these conflicts pose for democratic and democratizing states.

452 Black African Politics (3) Recent evolution and current political environment of Black African nations. (Same as African and African-American Studies 452.)

454 Government and Politics of China and Japan (3) Examination of the political setting, structure and political processes in China and Japan.

456 Latin American Government and Politics (3) Political development of Latin America: contemporary politics. (Same as Latin American Studies 456.)

459 Government and Politics of Russia and Eastern Europe (3) System transformation, political processes and governmental structures in Russia and Eastern European countries.

461 Policy Making in Democracies (3) Comparative approach to theory and process of making public policies.

463 Contemporary Middle East Politics (3) Governments and movements in Middle East, their characteristics, bases, and interrelationships.

471 International Political Economy (3) The politics of international economics. Topics include globalization, development, trade, crime, the IMF, the WTO, the environment and challenges to the status quo.

473 Negotiation, Bargaining and Diplomacy (3) Diplomacy, negotiation, and foreign policy decision-making. Theories of diplomacy and negotiation are applied in a simulation focusing on issues from international crime and global economic stability to world health and the environment.

474 International Organization (3) Constitutional framework and key functions of the United Nations. Topics include collective security, peacekeeping, human rights, development, regional organizations, and the role of the Secretary-General.

475 Ancient and Medieval Political Thought (3) Survey of major western political thinkers from Socrates to Marsilio of Padua.

476 Modern Political Thought (3) Survey of major western political thinker from Machiavelli to Marx.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Scope and Methods in Political Science (3) Procedures of analysis in political science.

511 Research Design (3) Methods for planning and executing research, from case studies to experimental designs: development of research questions and hypotheses; measurement issues; and validity of inferences.

512 Quantitative Political Analysis (3) Methods and techniques in quantitative political analysis: univariate and bivariate statistics.

513 Quantitative Political Analysis (3) Methods and techniques in quantitative political analysis: multivariate model building.

514 Research and Methodology in Public Administration (3) Basic assumptions and techniques of research in public administration; measurement, analysis, and reporting of data.

520 Political Theory (3) Survey of major ideas, thinkers and works of Western political theory.

522 American Political Thought (3) Systematic examination of the normative and empirical theories of leading American political thinkers from the colonial period to the present.
530 American Government and Politics (3) Survey of literature, approaches to research and analysis, critical examination of major works, and overviews of research in various sub fields. May be repeated with consent of department. Maximum 9 hours.

531 Theory of Planning (3) Analysis of nature and objectives of planning process: role of planners and planning function in public decision-making.

532 Presidency (3) Systematic examination of the structure, functions and powers of the American presidency as they have evolved from the founding to the present.

533 Congress (3) Formal, empirical and theoretical approaches to and models of the institutional workings of Congress and the behavior of legislators.

535 Mass Political Behavior (3) Theoretical and empirical analyses of public opinion, political socialization, political attitudes and behavior, especially voting behavior.

537 Political Parties and Interest Groups (3) Theoretical and empirical examination of the structure, functions and operations of political parties and interest groups.

539 State and Local Government and Politics (3) Theoretical and empirical analysis of government, politics, policymaking and public administration at the state and local levels.

540 Public Law (3) Selective examination of published research and current approaches in sub fields of constitutional law, judicial process, and judicial behavior. May be repeated with consent of department. Maximum 9 hours.

544 Information Systems and Networks in Planning (3) Use and impact of computer-based information systems and global networks in planning and public management. Development of practical skills in design of planning-decision support systems, databases, Internet-based tools and geographic information systems (GIS).

545 Planning Research Methods (3) Overall structuring of social science research in planning practice: familiarity with structure of planning literature information sources, decision processes and tools, practice in posing research questions relevant to planning, evaluation methods.

547 Planning Technology (3) Relationships between information technology, society and planning. Overview of other advanced technologies, economic development, and associated social and planning issues.

548 Public Policy Process (3) Theoretical, formal and empirical analysis of the roles, functions and decision making processes of public policymakers, including legislative, executive and judicial actors.

549 Environmental Policy (3) Overview of contemporary environmental policy and its evolution. Examines the roles of values in the environmental arena. Provides a framework for policy analysis and analytical tools for selection and choosing among policy options.

550 Public Administration (3) Overview of public administration theory and function.

552 Organization Theory (3) Appraisal of major theories of organization and their applicability to public sector.

555 Planning and Transportation (3) (See Civil Engineering 558.)

556 Policy Analysis (3) Strategies and techniques for identification and analysis of public problems and policy solutions. May be repeated with consent of department. Maximum 9 hours.

558 The Politics of Administration (3) Examination of public administration in context of American political system, policy making and political roles of public administrators and agencies. May be repeated with consent of department. Maximum 9 hours.

560 Public Financial Administration (3) Principles and techniques of public finance at state and local levels: budget preparation, execution and audit, risk management, capital planning, major tax structures, economic forecasting, cash management, and debt administration.

562 Public Management (3) Interpersonal and leadership skills, techniques and methods for planning, decision making, and implementation of management strategies in public sector. May be repeated with consent of department. Maximum 9 hours.


566 Ethics, Values, and Morality in Public Administration (3) Moral-ethical-value dilemmas confronting administrators in American political system.

569 Internship in Public Administration (3-9) Open to students participating in approved internship programs. May be repeated with consent of department. Maximum 9 hours. Satisfactory/No Credit grading only.

570 Comparative Government and Politics (3) Selected topics in modern governments. May be repeated with consent of department. Maximum 9 hours.

572 The Politics of Development (3) Selected topics dealing with political problems of less developed countries. May be repeated with consent of department. Maximum 9 hours.

574 Area Seminar in Comparative Government and Politics (3) Selected topics in area studies: African, Asia, Latin America, Middle East, Soviet Union and Eastern Europe or Western Europe. May be repeated with consent of department. Maximum 9 hours.

580 International Politics (3) Survey of literature and major aspects of international politics. May be repeated with consent of department. Maximum 9 hours.

581 Fundamentals of Planning (3) History of planning, structure and development of urban areas, operations of contemporary planning, trends and issues.


583 Economic Analysis and Development (3) Basic methods of policy analysis and planning. Planning for economic change in cities and regions. Economic development and planning process.

584 Environmental Planning (3) Role of planners and planning in maintenance of balance between natural and built environment.

585 Planning Methods (4) Preparation of comprehensive plans for urban areas and regions. Development of baseline data and forecasts, formulation of alternative plans and strategies, and development of plan implementation programs.

586 Planning and Property Development (3) Process of urban physical growth and change: functioning of private sector real estate development and its relationship to planning. Partnership roles of public and private sectors in urban development and redevelopment.

587 Legal Aspects of Planning (3) Legal basis for planning and guiding community development. Legal tools of planning.

588 Sustainable Communities (3) Overview of sustainable communities. Project-based classwork in local community.

590 Practicum in Planning (3) Prereq: Consent of instructor.
591 Foreign Study (1-15) See College of Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
593 Independent Study (1-15) See College of Arts and Sciences.
594 College Teaching in Political Science (1) Instructional effectiveness, techniques, organization, materials for teaching political science at college level. Prereq: Consent of instructor. Satisfactory/No Credit grading only.
595 Readings and Special Problems in Political Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 15 hours.
596 Workshops in Computer Applications (1) Training in software applications to support research and decision making tasks in public service. Successful completion certifies proficiency of MPA students in use of software applications for personal computer. Satisfactory/No Credit grading only.
597 Special Topics in Planning (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.
598 Problems in Planning (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.
600 Doctoral Research and Dissertation (3-15) P/NP only.
610 Special Topics in Empirical Theory and Methodology (3) Advanced methods and procedures of analysis in political science. May be repeated with consent of department. Maximum 9 hours.
628 Topics in Political Theory (3) Selected issues and problems in normative political theory. Specific content determined by instructor. May be repeated with consent of instructor. Maximum 9 hours.
639 Special Topics in American Government and Politics (3) Advanced study of selected topics. May be repeated with consent of instructor. Maximum 9 hours.
640 Special Topics in U.S. Constitutional Law (3) Systematic analysis of published research and judicial decision: development of constitutional law as major component of public policy. May be repeated with consent of department. Maximum 9 hours.
654 Contemporary Public Policies (3) Problems in one or more public policy areas from political and administrative perspectives. Topics selected by instructor. May be repeated with consent of department. Maximum 9 hours.
660 Contemporary Perspectives on Public Administration (3) Development of theory in public administration: contemporary critiques and alternatives. May be repeated with consent of instructor. Maximum 9 hours.
668 Special Topics in Public Administration (3) Analysis of selected issues and problems in public administration. May be repeated. Maximum 9 hours.
670 Special Topics in Comparative Government and Politics (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hours.
682 Theory and Analysis of U.S. Foreign Policy Processes (3) Theoretical approaches to decision making in foreign policy area and analysis of policy-making process. May be repeated with consent of department. Maximum 9 hours.
684 International Law (3) Provides the analytical tools necessary to evaluate the legality of events under international law. Presents the law relevant to politics, such as the use of force, human rights, war crimes, international courts, principles of jurisdiction, and air, space and sea law.
688 Special Topics in International Politics (3) Selected issues and problems in international politics. Specific content determined by instructor. May be repeated with consent of instructor. Maximum 9 hours.

PORTUGUESE (811)
400 Portuguese for Speakers of Another Romance Language (3) Accelerated class for beginning students of Portuguese with strong background in another Romance language. Introduction to grammar, reading and culture of Portugal and Brazil. Prereq: 3 hours at the 300-level in another Romance language or equivalent.
431-432 Topics in the Literature and Language of Portuguese-speaking World (3,3) Outstanding works of literature and culture from Portuguese countries. Topics may vary. Prereq: At least one course at the 300-level or the equivalent. May be repeated. Maximum 12 hours.
591 Foreign Study (1-15) See College of Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
593 Independent Study (1-15) See College of Arts and Sciences.

PSYCHOLOGY (830)
409 Group Facilitation (3) Study of theory and technique through supervised experience in small groups. Prereq: General Psychology or consent of instructor. May be repeated. Maximum 6 hours.
410 Sensory Processes and Perception (3) Survey of physiological and psychological theories of perception. Audition and vision. Prereq: 385 or Mathematics 115 or Statistics 201 or graduate standing.
415 Psychology of Religion (3) History of psychology of religion: various philosophical and empirical orientations. Psychological function of religion for individuals and society. Prereq: 110 or consent of instructor.
420 History and Systems of Psychology (3) History of psychological thought. Classical approaches and recent developments. Prereq: 110 or consent of instructor or graduate standing.
424 Psychology and the Law (3) Psychological aspects of legal systems. Prereq: 110 or consent of instructor.
430 Health Psychology (3) Survey of psychological factors related to health and illness: stress, personality, and environment. Applications of psychological treatments to physical illness. Prereq: 110 or consent of instructor.
434 Psychology of Gender (3) Biological, psychological, and social factors in gender. Importance of gender roles and stereotypes for behavior and experience. Prereq: 110 and junior standing (60 semester hours) or consent of instructor. (Same as Women's Studies 434.)
440 Organizational Psychology (3) Social-psychological analysis of organizations, role-theory and systems theory. Prereq: 110 and 360 or consent of instructor.
450 Comparative Animal Behavior (3) (See Ecology and Evolutionary Biology 450.)
459 Comparative Animal Behavior Laboratory (3) (See Ecology and Evolutionary Biology 459.)

461 Physiological Psychology (3) Nervous system and physiological correlates of behavior. Biological basis of emotion, learning, memory and stress. Prereq: 110 or consent of instructor and one of the following sequences, Biology 101 and 102, Biology 130 and 140, Anthropology 110 and 210.

470 Theories of Personality (3) Survey of major theories of human personality and their development. Prereq: 110 or consent of instructor.

475 Adolescent Development (3) Theoretical perspectives and empirical research findings pertinent to adolescent development. Prereq: 110 or consent of instructor.

480 Theories of Learning (3) Classical and current approaches to learning and cognition. Prereq: 110 or consent of instructor.

482 Topics in Psychology (3) Intensive analysis of special topics: Afro-American psychology or evaluation of programs in community. Prereq: 110 or consent of instructor. May be repeated. Maximum 6 hours.

489 Supervised Research (1-9) Prereq: Consent of instructor. May be repeated. Maximum 12 hours in 399, 489, 491, 492, and 493 combined may apply toward undergraduate major.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 Research Design (3) Techniques for planning and conducting research in controlled and natural settings: experiments, quasi-experiments, observational studies, surveys, and program-evaluations. Development of questions and hypotheses for study. Design of studies to maximize validity. Prereq: Consent of instructor.

507 Foundations of Applied Psychology (3) Fundamental methods for application of psychology principles and techniques in community, organizational, and industrial settings, and related ethical and theoretical issues. Prereq: 505 and consent of instructor.

508 Readings and Special Issues in Psychology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

509 Research Practicum (1-3) Required of first-year graduate students in psychology. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

510 Topics in Psychology (3) Intensive examination of selected issues in psychology. Prereq: Consent of instructor. May be repeated. Maximum 9 hours.

511 Developmental Psychology (3) Normal processes of human socialization; physical, cognitive, and emotional development from conception through infancy, childhood, and adolescence. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

512 Life-Span Development (3) Theories and research concerning normal human development throughout life, adulthood and old age. Prereq: Consent of instructor.

513 Foundations of Psychology: Biological Factors, Perception, Learning, Thinking, Motivation (3) Intensive survey. Prereq: Consent of instructor.

515 Colloquium in Experimental Psychology (1) Research and practical issues in experimental psychology. Prereq: Consent of instructor. May be repeated. Maximum 4 hours. Satisfactory/No Credit grading only.

517 Foundations of Counseling Psychology (3) History, theory, research and practice of counseling psychology. May be repeated. Maximum 6 hours.

521 Analysis of Variance for Social Sciences (3) Analysis of variance and statistical theory: application within social science framework. Contrasts among means, trend analysis, analysis of covariance, analysis of factorial designs, and multivariate approaches to analysis of within subjects data.

522 Multiple Regression for Social Sciences (3) Complexities of regression analyses and theory: application within social science framework. Bivariate correlation and regression, multiple regression, analysis of variable sets, interactions among continuous predictors, reducing collinearity between main effects and application of multiple regression to testing procedures of mediation and moderation.

526 General Vertebrate Neuroanatomy (3) Lecture and laboratory. Structure and functioning of central and peripheral nervous system. Prereq: 461 or equivalent and consent of instructor.

527 Behavioral Neurology (3) Disorders of nervous system, organic brain dysfunctions. Diagnosis and treatment. Prereq: Consent of instructor.

528 College Teaching in Psychology (3) Concepts, techniques, and materials for teaching psychology at college and/or university level. Supervised practice. Prereq: Consent of instructor. Satisfactory/No Credit grading only.

534 Cognitive Science (3) Theories and research. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

545 Advanced Animal Behavior (3) (See Ecology and Evolutionary Biology 545.)

546 Ethological Psychology (3) Basic ethology and comparative psychology. Implications for human behavior. Prereq: Consent of instructor. (Same as Ecology and Evolutionary Biology 546.)

547 Conceptual Foundations of Evolution and Behavior (3) Critical evaluation of seminal writings on theory and methods in comparative analysis of behavior. (Same as Ecology and Evolutionary Biology 547.)

550 Social Psychology (3) Survey of theory and research concerning interpersonal interaction and individual behavior in social context. Prereq: Consent of instructor.

554 Laboratory in Psychometrics (3) Further learning about psychometrics theories: item response theory (modern mental test theory), factor analysis, and applications of those methods using computer programs to simulated or empirical data. Prereq. 555. May be repeated. Maximum 6 hours.

555 Psychometrics (3) Basic concepts: factor analysis, scaling, test theories, probability models and their applications, computerized adaptive testing and other topics. Prereq: Statistics 537-538 or equivalent. May be repeated. Maximum 6 hours.

558 Interviewing and Observation (3) Sensitizing students to own feelings and beliefs and to feelings of interviewee, and analysis of language content, style, and body language. Exploration of various important aspects of interviewee’s life. Prereq: Admission to doctoral program in clinical psychology or consent of instructor. Coreq: 559.

559 Laboratory in Interviewing and Observation (1) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. Coreq: 558.

563 History and Systems of Psychology (3) History of philosophy concerning psychology. Major systems of psychology which emerged during 20th century. Prereq: Graduate standing.

567 Group Dynamics and Methods (3) (See Counselor Education 554.)
568 Prepracticum in Career Development (3) Didactic instruction and practice in counseling and career exploration. Prereq: Admission to doctoral program in counseling psychology.

569 Practicum in Counseling (3) (See Counselor Education 555.)

570 Personality: Theory and Research I (3) Advanced survey of psychodynamic and neo-Freudian approaches to personality; related research. Prereq: Admission to clinical program or consent of instructor.

571 Personality: Theory and Research II (3) Advanced survey of behavioral and humanistic approaches to personality; related research. Prereq: Admission to clinical program or consent of instructor.

572 Individual Cognitive Assessment in Counseling (3) Basic concepts and applications in individual assessment of intelligence; proficiency in administrative scoring, interpretation for Wechsler, adults and children, Stanford-Binet. Prereq: 445, Counselor Education 525 or equivalent. Satisfactory/No Credit grading only.

573 Descriptive and Theoretical Psychopathology (3) Current psychiatric taxonomic system. Theories of etiology for various diagnostic categories. Examples from written case vignettes and recorded interviews. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

574 Cross-Cultural Counseling: Theory and Research (3) (See Counselor Education 570.)

576 Object Relations (3) European and American conceptions of normal and psychopathological development of object relations. Significance for psychotherapy, psychoanalysis, and psychoanalytic theory. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

580 Research Questions and Designs (3) Question-asking process in research and strategies or designs through which answers might be derived. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

593 Independent, Off-campus, or Foreign Study (1-15) Prereq: Consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

594 Psychological Assessment I (3) Basic concepts and techniques of adult assessment: intelligence tests and personality tests. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

595 Psychological Assessment II (3) Basic concepts and techniques of adult assessment, intelligence tests and personality tests. Prereq: Admission to doctoral program in clinical psychology and 594 or consent of instructor.

596 Laboratory in Psychological Assessment (1) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. Coreq: 594 or 595. May be repeated. Maximum 4 hours. Satisfactory/No Credit grading only.

597 Developmental Psychopathology (3) Research and theory on pathways to psychological disorders and personal adjustment. Prereq: 571, or equivalent or consent of instructor.

598 Ethical Issues in Professional Psychology (3) Conceptual and practical applications in human services and research. Prereq: Consent of instructor.

599 Clinical Psychopathology (3) Formal use of descriptive categories used in the diagnosis of abnormal behavior. Prereq: 597, or equivalent or consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Seminar in Psychology (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hours.
695 Field Placement in Clinical Psychology (3) Prereq: Admission to doctoral program in clinical psychology and consent of instructor. May be repeated. Maximum 24 hours. Satisfactory/No Credit grading only.

696 Advanced Psychology Clinic Placement (1-3) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 24 hours. Satisfactory/No Credit grading only.

697 Supervised Field Work in Applied Psychology (1-6) Guided practice in applying psychological principles and techniques in industrial, organizational, and community settings. Prereq: 505, 507, 555, 557, and consent of instructor. May be repeated. Maximum 12 hours. Satisfactory/No Credit grading only.

PUBLIC HEALTH (839)

400 Consumer Health (3) (See Health 400.)

410 Worksite Health Promotion (3) Foundations of health promotion programs delivered in worksite that revolve around issues relative to employees and management: theory, program design, implementation and evaluation from perspective of health promotion specialist. Prereq: 300.

493 Directed Independent Study (1-3) Individual in-depth study of selected issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

509 Graduate Seminar in Public Health (1) In-depth discussion of timely topics reflecting scope of public health as discipline and its interrelation with many other academic and professional disciplines. Speakers both internal and external. May be repeated. Maximum 4 hours. Satisfactory/No Credit grading only. (Same as Exercise Science 509; Nursing 509; Nutrition 509; Social Work 509.)

510 Environmental and Occupational Health (2) Complexities of personal and ambient environment recognizing health as individual’s response to diverse and dynamic world. Principles of occupational safety and health. Survey of contemporary issues and their implications for healthful living today and in future. Prereq: Admission to MPH or public health nutrition (MS) programs or consent of instructor.

520 Public Health Policy and Administration (3) Administrative considerations of community-based health care programs and public health practice. Health policy formulation, political environment and governmental involvement in health, legal responsibilities, and managerial concepts/techniques/process.

521 Organization Theory and Health Care Delivery (3) Administrative and Organization theory related to health facilities; operation and management of community hospital. Case discussions and problem-solving exercises; managerial functions and skills.

523 Management in Extended Care Settings (3) Managerial concepts and theoretical foundations essential to supervision and administration of domiciliary health services programs. Management and operation of health services programs for patients and clients in settings which provide activities of daily living and special psychosocial environmental needs. Programs for home health services, comprehensive medical rehabilitation, nursing homes, congregate living centers and similar type health programs. Prereq: 521 or consent of instructor.

525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply techniques. Prereq: 520 or consent of instructor.

530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of vital statistics and introductory research methodology preparatory for first course in epidemiology. Prereq: Admission to MPH or public health nutrition (MS) programs or consent of instructor and introductory statistics.

540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of health problems. Historical origins of discipline, hypothesis formulation, research design, data and error sources, measures of frequency and association, etiologic reasoning, disease screening, and injury control. Prereq or coreq: 530.


550 Principles and Practices of Community Health Education (3) Theoretical foundations for community health education; opportunities for skill development in variety of educational processes; and introduction to community health analysis.

552 Community Health Problem Solving (4) Dynamics of community organization, community needs assessment, educational interventions, and application of program planning and evaluation techniques. Opportunity to practice skills in realistic setting. Prereq: 550 or consent of instructor.


560 Theories and Techniques in Health Planning (4) Overview of health planning concepts and methodologies; systems-oriented planning process. Major elements of planning: formulation and conceptualization of problem, plan design, evaluation and implementation. Health problems of institutions, communities and selected population groups, appropriate diagnoses, and programs for addressing needs.

580 Special Topics (3) Prereq: Consent of instructor. May be repeated under different topic. Maximum 6 hours.

585 Seminar in Gerontology (1) (See Health 585.)

587-588-589 Internship (3,3,3) Internship (community health education, gerontology, or health planning/administration) in either approved organization or research setting under supervision of designated preceptor. Prereq: MPH major, one semester advance notice and consent of major advisor. 589: available only for approved extended placements. Satisfactory/No Credit grading only.

590 Research Methods in Health (3) (See Health 590.)

635 Physical Activity and Positive Health (3) (See Exercise Science 635.)

650 Health Aspects of Gerontology (3) (See Health 650.)

655 Seminar in Nation’s Health (3) (See Health 655.)

660 International Health (3) (See Health 660.)
PUBLIC RELATIONS (841)

470 Public Relations Campaigns (3) Research, planning and communication, and evaluation of major public relations campaigns. Oral and written presentation of public relations project from inception to completion. Extensive out-of-class work. Prereq: 320, 370, or consent of instructor.

490 Special Topics (3) Topics vary. May be repeated. Maximum 6 hours.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when the student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

516 Seminar in Public Relations Issues (3) Topics vary. May be repeated. Maximum 6 hours.

525 Public Opinion (3) (See Journalism and Electronic Media 525.)

540 Public Relations Management (3) Theories of leadership and management and organizational structure and functions of public relations agencies and departments in public, private, and non-profit sectors. Analysis and management of problems in communication between organizations and their publics with emphasis on ethics and standards of the profession.

550 Public Relations Strategies (3) Strategic communication planning to achieve overall goals of organizations. Emphasis on decision-making, the budgeting process, including cost-benefit analysis of tactics, and managerial execution of public relations plans. Measurement and evaluation of effectiveness of communication programs.

561 Fund Raising and Proposal Writing (3) History, philosophy and practice of philanthropy in U.S. Sources of funds from foundations, corporations and public agencies. Research and preparation of fund-raising proposals.

590 Project (3) Capstone project under guidance of faculty. Application of principles from previous coursework. Satisfactory/No Credit grading only.

597 Independent Study (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

598 Internship (3) Professional work in public relations supervised by communications manager with faculty approval. No retroactive credit for previous work experience. Prereq: Completion of core curriculum.

READING EDUCATION (847)

434 Topics in Reading Education (1-6) Prereq: Admission to teacher education and course in reading education. May be repeated. Maximum 6 hours.

461 Developing Reading Skills in Content Fields (3) Techniques for teaching reading and study skills in content areas of school program. Extensive assessment of textbooks. Middle school and high school.

530 Teaching Reading in Elementary and Middle Schools (3) Trends in methods, materials, basic approaches, skill development and assessment procedures for teaching reading at elementary school level. Prereq: Course in teaching of reading or consent of instructor.

533 Reading in Community College: Research and Theory (3) Analysis of components of effective community college reading programs. Attention to research bases. Prereq: Course in reading education or consent of instructor.

534 Seminar in Reading Education (1-6) May be repeated. Maximum 6 hours.

536 Psychology of Reading (3) Reading act, relationship between learning theory and reading, role or reading in child's overall intellectual development. Affective and cultural factors. Prereq: 500-level course in reading education or consent of instructor.

537 Diagnosis and Correction of Classroom Reading Problems (3) Procedures, methodologies and materials for diagnosing and correcting classroom reading problems. Prereq: Course in reading education, or equivalent teaching experience, or consent of instructor.

538 Practicum in Diagnosis of Reading Problems (3) Theoretical and practical applications of specific reading diagnostic instruments; testing of elementary and/or secondary school students, preparing case study reports, and conducting parent conferences. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor.

539 Practicum in Remediation of Reading Problems (3) Application of learning and teaching methodology in working with elementary and/or secondary school students on one-to-one or small group basis. Prereq: Course in diagnosis and correction of reading problems or consent of instructor.

540 Teaching the Struggling Adolescent Reader (3) Methods of teaching middle and high school students who do not have sufficient reading skill to successfully engage in required reading. Prereq: Course in reading education, or equivalent teaching experience, or consent of instructor.

545 Developmental Reading Practicum (3) Diagnosing and teaching children having developmental and corrective reading needs in regular classroom. Prereq: Course in diagnosis and correction of reading problems or consent of instructor.

602 Seminar in Reading Education (1-6) May be repeated. Maximum 6 hours.

603 Advanced Studies and Theoretical Models of Reading (3) Research on reading processes. Current theoretical models related to how learners process print. Prereq: 500-level courses in reading education or consent of instructor.

605 Organizing and Administering Reading Programs (3) Diagnosing and teaching children having developmental and corrective reading needs in the regular classroom. Prereq: Course in diagnosis and correction of reading problems or consent of instructor.

RECREATION AND LEISURE STUDIES (853)

415 Development and Maintenance of Recreation and Athletic Facilities (3) Principles of designing, planning, equipping, operating and maintaining various facilities. Elements of risk management and safety in design process. Prereq: 310, Sport Management 350, or consent of instructor.

430 Organization and Administration of Leisure Services (3) Principles of administration applied to provision of leisure services offered by public, private and/or commercial enterprises. Organizational structures, personnel management, evaluation, legal authority, introduction to budgeting and fiscal procedures. Prereq: 310 or Sport Management 350.

440 Dimensions of Commercial Recreation and Leisure Enterprises (3) Prereq: 201, junior standing or consent of instructor.

450 Special Topics in Leisure Education (1-6) Development of special topics in recreation, therapeutic recreation and leisure. May be repeated. Maximum 6 hours.

470 Tourism and Leisure Industries (3) Symbiotic relationship between tourism and various sectors of leisure industry. Use of resources, both natural and developed, and economic impacts of ventures. Sociocultural impacts on venue as well as venues impact on local population.

500 Thesis (1-15) P/NP only.
and public or private rehabilitation facilities. Analysis of appropriate vocational rehabilitation agencies, private rehabilitation companies, procedures involved in management of caseloads in Federal-State programs and assistive devices; delivery systems, interdisciplinary planning and funding issues.

533 Job Analysis, Development, and Placement (3) Determining employment-readiness of people with disabilities, identifying appropriate jobs for selected clients, and assisting clients in seeking, obtaining, and retaining employment. Job analysis, job modification and re-engineering, marketing, and employer-servicing techniques; legislation impacting job placement; supported work; and use of occupational information.

537 Vocational Evaluation: Clinical Methods (3) Process, principles, and techniques used to assist individuals in determining and understanding their own work behavior and vocational potential. Selection and use of occupational exploration programs and work samples; application of situational tasks, job tryouts, and simulated work experiences in vocational evaluation. Clinical interpretation of data through formal staff conference, vocational counseling, and report writing.

538 Disability Management (3) Return-to-work issues in disability management programs: early intervention, quality services, and cost containment; standards and procedures for rehabilitation counselors/case managers in private sector rehabilitation.

541 Psychosocial Aspects of Disability (3) Psychosocial impact of disability on person and family. Reaction to loss, coping with disability, and societal rehabilitation.

543 Medical Aspects of Disability (3) Etiology and clinical symptoms related to disabling conditions served by special education and rehabilitation personnel. Restrictive measures to eliminate or minimize resulting handicaps. Skills necessary to communicate with lay and professional persons.

545 The Rehabilitation Interview (3) Interview as used in assessment and planning with people who have disabilities and vocational handicaps.

547 Practicum in Rehabilitation (3) Supervised experience in area of rehabilitation; application of concepts, principles, and skills. Prereq: Consent of instructor.

549 Internship in Rehabilitation Counseling (12) Supervised practice in rehabilitation counseling. Full time clinical experience for second-year students (600 clock hours required).

579 Special Topics (1-3) Prereq: Admission to graduate program. May be repeated. Maximum 9 hours. Satisfactory/No Credit or letter grade.

592 Assistive Technology in Rehabilitation (3) Technology as applied to needs of school age and post-secondary age students/clients. Delivery of assistive technology services; software programs and assistive devices; delivery systems, interdisciplinary evaluation/planning, and funding issues.

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

RELIGIOUS STUDIES (863)

401 Texts and the Study of Texts (3) Systematic introduction to the nature and function of (primarily, but not exclusively, oral and written) texts and textual traditions in the study of religion. How texts are made and used historically, how they are recovered and created by scholars, how they are interpreted by religious communities and scholars.

405 Modern Jewish Thought (3) History, culture, and geography of the now Israeli portion of Levant from 1850 to present. Founding of modern state of Israel in 1948 and political complexities of Middle East. Israeli culture and literature. Writing emphasis course. (Same as Judaic Studies 405.)

411 Modern Religious Philosophies (3) Religious implications of major Western thinkers and movements from Nicolas of Cusa to nineteenth-century German Idealists. (Same as Philosophy 411.)

425 Seminar in Western Religions (3) Selected figures, themes, movements, and problems. Content varies. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.
430 Seminar in American Religion (3) Selected figures, themes, movements, and problems. Content varies. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

440 Seminar in Comparative Religion (3) Selected figures, themes, movements, and problems. Content varies. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

490 Readings and Research in Religious Studies (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

499 Proseminar in Religious Studies (3) For advanced students in religious studies; required for majors. Selected specific topics: nature and function of myth in religion, problem of evil, transcendence, theories of religion, hermeneutics, integrating various disciplines involved in study of religion. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.


505 Religious Texts and Contexts (3) Critical study of texts and their interpretations: sacred texts, canons, commentaries, religious autobiographies, and religious themes in literature. May be repeated. Maximum 6 hours.

506 Historical Study of Religions (3) Description and analysis of religious traditions, phenomena, and themes. May be repeated. Maximum 6 hours.

507 Religion, Power and Society (3) Studies of religions in relation to social structure and political institutions: issues of gender, race, class, ethnicity, caste, slavery, religion and the state, globalization and human rights. May be repeated. Maximum 6 hours.

510 Introduction to Pedagogy of Religious Studies (3) Conceptualization, methodology, and practice of teaching about religion and religions in the public university context. Prereq: 503 and consent of instructor.

513 Religion, the Arts, and the Media (3) Material and expressive culture, religion and journalism, mass communication technologies, popular culture, issues of representation, cultural studies methodologies. May be repeated. Maximum 6 hours.

514 Religion and Healing (3) Ecology of religion, nature, shamanism, healing of body and mind, spirituality, religious dimensions of medical ethics. May be repeated. Maximum 6 hours.


520 Readings in the Study of Religion (1-6) May be repeated. Maximum 12 hours.

532 Topics in the History of Religions (3) Prereq: Consent of instructor.

533 Topics in Religious Thought (3) Prereq: Consent of instructor.


551 Comparative Historical Explorations in Religious Studies (3) Critical examination of parallel or contrasting historical phenomena from two or more religious traditions. Required for students in the MA concentration in religious studies. Prereq: 503. May be repeated. Maximum 6 hours.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

RETAIL AND CONSUMER SCIENCES (865)

412 Direct Retail Methods (3) Use of direct selling methods to sell goods and services. Analysis of consumers and product/service types for integrated direct retail methods. Direct mail, catalogs, telemarketing, infomercials, and electronic commerce (internet). Prereq: 210, 341, Marketing 300.

415 Retail Promotion (3) In-store promotional activities; development of retail promotion strategies; evaluation of retail promotions; supplementary focus on advertising and other methods to communicate in-store promotions. Prereq: 210, Marketing 300.

500 Thesis (1-15) P/NP only.

501 Professional Project (3-6) Application-oriented, capstone project to show competence in major academic area. Enrollment limited to retail and consumer sciences students in non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

510 Retail Strategy and Decision Making (3) Strategy, strategic management and strategic process in retail sector. Analytical decision-making skills in retailing. Retail industry structure. International differences in retail systems. Prereq: Retail Management or equivalent.


538 Consumer Product and Service Development (3) Critical analysis of consumer product and service development process in services industry. Strategies for developing consumer products, services, programs, and service processes from conception to implementation and evaluation.

541 Consumer Analysis in Services Management (3) Analysis of consumer behavior in consumer products and services industry. Development of knowledge to positively impact services marketing organizations through marketing, environmental and product/services strategies based upon consumer behavior knowledge. Investigations of qualitative and quantitative methodologies to conduct elementary consumer research.

562 Research Methods (3) Fundamentals of science method, advancement of science, methodology and method of research. Issues and concepts of basic and applied research. Prereq: Statistics 531 or equivalent.

590 Research Seminar (1) Research topics in retail and consumer sciences. May be repeated. Satisfactory/No Credit grading only.

593 Directed Study (1-3) Individual problems in retailing and consumer sciences. Prereq: 9 hours retail and consumer sciences graduate coursework. May be repeated. Maximum 9 hours.

595 Special Topics in Retail and Consumer Sciences (1-3) Lecture, group discussion on specialized topics: retail industry structure, international trade, international retailing, consumer affairs, entrepreneurship, small business management, issues in retail management, issues in retail strategy, quality perception by consumers, product and service value, retailing to children, retailing and special populations, special research methods. Prereq: 9 hours graduate coursework. May be repeated. Maximum 9 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.
614 Theory in Retail Environment (3) Analysis and evaluation of theory in retail environment and its application to research in retailing. Prereq: 562 or equivalent.

615 Retail and Consumer Sciences Literature and Thought (3) Evaluation of retail and consumer sciences literature with emphasis upon research literature, development of scholarly thought, and identification of potential areas of further study. Prereq: 562 or equivalent.

616 Research Methods, Models and Measurement in Retail and Consumer Sciences (3) Quantitative and qualitative methods and analytical concepts in the research process. Formulation of models and measurement of consumer sciences constructs. Prereq: 562, Statistics 538 or equivalent

625 Strategic Managerial Retailing (3) Decision-making orientation that integrates strategic framework components with preparation and analysis of specific retail case situations. Prereq: 510 or equivalent.

641 Retail Consumer Behavior (3) Theories and concepts from social science in relation to ultimate consumer’s behavior. Prereq: 541 or equivalent.

695 Advanced Topics in Retail and Consumer Sciences (3) Lecture, group discussion, individual research on advanced topics and research areas of current significance to retail and consumer sciences. Prereq: 9 graduate hours in consumer sciences. May be repeated. Maximum 9 hours.

RUSSIAN (886)

401-402 Advanced Grammar, Conversation, and Composition (3,3) Prereq: 312 or equivalent.

425 Introduction to Descriptive Linguistics (3) (See French 425.)

426 Methods of Historical Linguistics (3) (See German 426.)

430 Selected Topics in Russian Literature (3) Content varies. When content varies, may be repeated. Maximum 9 hours.

451-452 Senior Seminar (3,3) For majors in Russian; minors admitted at discretion of instructor. Intensive study of language, literary style, and literary criticism based on selected major novels.

510 Russian Phonetics and Advanced Grammar (3) Phonetics, pronunciation, stylistics, and selected topics in Russian grammar. For teachers and prospective teachers. Prereq: Consent of instructor.

550 Studies in Russian Literature (3) Content varies. May be repeated. Maximum 9 hours.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

SAFETY (890)

443 Sports and Recreational Safety (3) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and interrelationship in sports injury and control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hours and 2 labs.

452 Safety Principles and Practices (3) General principles, practices, and procedures in occupational and community safety. Historic and present safety issues, problems and practices addressing safety of individuals and groups in work-site, school, community, transportation, and industrial settings. Prereq: Junior or Senior standing or consent of instructor.

460 Fire Risk Management (3) Development, implementation, and management of comprehensive fire safety program. Basic fire risk management concepts, interpretation of codes and exposure to basic fire analysis techniques. Prereq: Senior standing or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

532 Behavioral Problems in Safety Education and Accident Prevention (3) Problems of behavior, causes of accidents, and application of principles of psychology in development of safe behavior in all segments of environment.

533 Problems and Research in Accident Prevention (3) Safety problems found in wide variety of accidents that occur in community; findings of current research in behavioral sciences as related to variation incidence of accidents.

534 Organization, Administration and Supervision of Safety Programs (3) National, state and local level programs; administrative, instructional, and supervisory aspects. Implementation of relevant programs.

535 Emergency Management (3) Civil and defense problems: tornadoes, floods, fires, mass civil disorders, and nuclear and personnel attack by alien countries.

536 Safety Instrumentation (3) Selection, calibration, maintenance, and use of sampling instruments available to safety practitioner for evaluating exposures of workers to physical stresses and airborne contaminants.

537 Advanced Emergency Management (3) Advanced study in emergency and hazard mitigation, planning, response and recovery. Theory and practice in identification of appropriate emergency warning systems, hazard assessment, facility inspection, plan development and implementation. Prereq: 535.

572 Graduate Workshop in Safety (3) Special safety education problems. For advanced graduate students, teachers, supervisors, and administrators. May be repeated. Maximum 12 hours.

590 Special Topics (1-3) Advanced study in selected disciplinary or professional area of safety education/management. May be repeated. Maximum 12 hours.

593 Directed Independent Study (1-3) Individual identification and study of problem/issue in safety. Extensive reading and critical analysis of safety literature. Specific proposal to instructor before registration. May be repeated. Maximum 12 hours.

601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, researched, and reported in acceptable form. May be repeated. Maximum 6 hours. (Same as Health 601.)

SCIENCE EDUCATION (899)

496 Teaching Science Grades 7-12 (3) Methods, materials, recent trends in science and environmental education programs for secondary schools. Prereq: Admission to teacher education.

509 Education for Sustainable Development: Making Connections (3) Holistic and interdisciplinary approach that encourages educators and learners to engage in dialogue in order to acquire through experiences and creativity skills and knowledge needed to maintain a balance between socio-economic, political and environmental goals.

510 Theoretical Foundations of Environmental Education (3) Study of history and philosophy of environmental education, pedagogical approaches, and current status, including model programs and standards for environmental education. Addresses implementation of environmental education in formal and non-formal educational settings. A technology-enhanced course with both online and fieldwork components.

531 Teaching Science to Young Children: K-4 (3) Recent trends in methods, materials and content in teaching science to students in grades K-4.

565 Instructional Trends and Issues in Science Education (3) Analysis of current trends in science instruction, instructional issues facing elementary, secondary, and community college science teachers, and application of learning theory to teaching biological, physical, and environmental sciences.

572 Nature of Mathematics and Science Education (3) Teaching and assessment of mathematics and science based upon student conceptions of nature of mathematics and science.


628 Advanced Studies in Science Education (3) Analysis of current research in science education and implications of research for classroom practice. May be repeated. Maximum 6 hours.

696 Research Trends in Science Education (3) Analysis of current research trends in science education and relationship of such trends within broader educational community.

SOCIAL SCIENCE EDUCATION (900)

454 Teaching Strategies and Issues in Social Studies Education (3) Goals, objectives, techniques, materials, and evaluation; direct observation in public schools, preparation of teaching plans and materials; simulated teaching experiences. Prereq: Admission to teacher education.

521 Teaching Social Studies in Elementary and Middle Schools (3) Planning and techniques. Trends in curriculum, development of concepts and generalizations, integration of social sciences. Prereq: Course in teaching of social studies or consent of instructor.

525 Strategies, Programs and Materials for Teaching Elementary Social Studies (3) Analysis of new and innovative social studies program materials and techniques. Exploration of current trends in social studies education. Prereq: Previous course in teaching of social studies or consent of instructor.


599 Seminar in Social Studies Education (3) Research, trends, and issues in secondary social studies.

621 Seminar in Social Studies Research and Theory (3) Status of research and theory. Needed research, related research from other fields, and application of research. Prereq: Recent course in teaching of social studies or consent of instructor.

SOCIAL WORK (905)

Graduate students majoring in fields other than social work are admitted to certain social work courses with the approval of the College of Social Work and the student’s major professor.

500 Thesis (1-15) P/NP only.

501 Foundations of Social Work Practice I (3) Survey of history, mission, and identity of profession. Basic theory, professional values and ethics, and methods generic to social work practice at various systems levels. Assessment, planning, communication, intervention, and evaluation skills.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Foundations of Social Work Practice II (3) Generalist practice with family and small group systems. Ecological theory to frame understanding of such systems and their adaptation to environments. Various social work roles and intervention strategies pertaining to client systems.

504 Foundations of Social Work Practice III (3) Basic theory, methods, problems, and strategies in implementing planned change within and among larger social systems: task groups, human service organizations, and community systems. Various practice roles: planner, program developer, supervisor, administrator, advocate and task group leader.

506 Social Work Research (3) Research methodologies with respect to evolution and application to social work theory and practice. History and philosophies of science; problem formulation; research design; ethics; instrument use and construction; data collection; analysis and reporting; and evaluation and utilization of research.

508 Practicum in Social Work Research (3-6) Supervised practice in application of research methods to social work. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

514-515 Human Behavior in the Social Environment I, II (3,3) Major social science theories that inform social work profession’s understanding of human behavior and social systems from ecological perspective. Interactions among biological, social, psychological, and cultural systems on development across life cycle. Effects of ethnic, racial, economic, gender, and sexual orientation variables. 514—Life cycle from infancy through adolescence. 515—From young adulthood through senescence.

516 Social Welfare Policy and Services (3) Development of contemporary social policy at local, state, national, and international levels. Contribution of social work professionals to formal policymaking process through which macrosocial change is effected and through which aggregate social welfare services are proposed, authorized, financed, and programmed. Theories of complex organizations applied to social welfare service delivery settings.

518 Social Work and Oppression (3) Sources, dynamics, and impact of oppression in U.S. society as manifested in both social/ecological/economic systems and personal experience. Connections among various forms of oppression: racism, sexism, classism, and heterosexism, and forces that perpetuate such conditions.

521 Clinical Social Work Practice with Individuals (3) Theories, knowledge, and skills for clinical practice with individuals from ecological perspective. Therapeutic process and intervention strategies, incorporating content from psychodynamic and cognitive practice models, and specific client problems.
523 Clinical Social Work Practice with Families (3) Concepts related to understanding and analyzing family dynamics and inter-actional patterns from perspective of major family therapy models. Techniques of intervention in terms of application to families with varied system and individual problems and to families from varied social and cultural backgrounds.

524 Psychopathology and Social Deviance (3) Assessment of psycho social functioning of individuals. Examination of mental disorders: clinical presentation problems, causes, and processes. Ecological perspective. Prereq: Foundation or consent of instructor.

525 Clinical Social Work Practice with Groups (3) Theoretical and historical approaches to social work with groups and clinical principles supporting specific types of group work used in clinical practice and associated leader interventions.

526 Evaluating Clinical Practice (3) History and philosophies, conceptual approaches, techniques and methods in the practice and use of practice research as applied to implementation and evaluation of direct services to clients.

530 Seminar in Clinical Social Work (2-3) Topics in theory and practice of clinical social work with individuals, couples, families and groups. May be repeated. Maximum 6 hours.

532 Short-Term Interventions (3) Theory and practice of planned short term, emergency, and crisis interventions.

534 Social Work Interventions with Children and Adolescents (3) Various practice modalities for assessing and intervening with children and adolescents.

535 School Social Work (3) Place of school as community institution and resource. Methods, processes, and techniques employed in school social work.

540 General Topics in Social Work (3) Current topics in advanced social work. May be repeated. Maximum 6 hours.

541 Leadership and Management in Human Services (3) Management practices and leadership skills required in development and management of human services delivery systems. Issues regarding human resources management, resource allocation, strategic planning, and organizational dynamics.

543 Financial Management and Resource Development (3) Administrative decision-making related to financial planning and resource allocation in human service organizations. Knowledge and skills in budgeting, allocating, expenditure control, fundraising, grant writing, marketing, and evaluation.

547 Evaluation Research (3) History and philosophies, conceptual approaches, techniques and methods, and issues in practice and utilization of evaluation research as applied to development and evaluation of social work programs and policies. Issues pertaining to strengths and limitation of various evaluation methods, microcomputer application of data, and measurement of program goals and objectives.

550 Seminar in Management and Community Practice (2-3) Topics in theory and practice of management and community practice. May be repeated. Maximum 6 hours.


552 Community Organization (3) Locality development, social planning and social action as practice models for development of resources to meet human needs.

564 Substance Abuse (3) Survey and analysis of social, cultural, medical and psychological factors underlying alcoholism and drug abuse and addiction; recent research and practice innovations.

566 Social Gerontology (3) Physical, psychological and social aspects of aging, and major social policies and programs.

580 Field Practice (3) Instruction and supervision in social work practice. Satisfactory/No Credit grading only.

581 Field Practice (3) Instruction and supervision in social work practice. Satisfactory/No Credit grading only.

582 Field Practice (6) Instruction and supervision in clinical social work practice or management and community practice. Satisfactory/No Credit grading only.

583 Field Practice (6) Instruction and supervision in clinical social work practice or management and community practice. Satisfactory/No Credit grading only.

584 Field Practice (2-6) Instruction and supervision in social work practice. May be repeated. Satisfactory/No Credit grading only.

585 Seminar in Gerontology (1) (See Health 585.)

593 Independent Study (1-6) Individualized study, student selects, designs, and completes examination of special issue or problem. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Research for Social Work Practice I (3) Epistemological and methodological considerations for both quantitative and qualitative research for social work practice.

602 Research for Social Work Practice II (3) Epistemological and methodological considerations for both quantitative and qualitative research for social work practice.

604 Research in Social Service Settings (3) Advanced research, under faculty supervision, of practice issues in community agency. Prereq: First year required PhD courses or consent of instructor. May be repeated. Maximum 9 hours.

605-606 Analysis of Social Work Data I, II (3,3) Techniques for quantitative analysis of social work data; unique data analysis problems encountered in social work research.

608 Evaluative Research for Social Work Practice, Programs and Policy (3) Techniques and strategies for quantitative and qualitative analysis for social policy’s impact on individuals and groups and for evaluating processes and outcomes of social work practice.


640 History of American Social Work (3) Social, cultural, economic and political contexts for development of social work profession, development of education for profession, and modern welfare system.

650 Programs and Legislation for Children and Families (3) Background, purposes, and current issues surrounding major social welfare and health programs serving disadvantaged children and their families: Social Security Act (Title IV, Child Welfare and AFDC; Title V, the Maternal and Child Health Block Grant; Title XIX, Medicaid), Head Start, WIC and other nutrition programs, and Healthy Start. Current issues and controversy; legislative changes.

660 Issues in Social Work Knowledge Building (3) Advanced seminar in theory and model building in direct intervention, administration and planning. Prereq: First year required PhD courses or consent of instructor. May be repeated. Maximum 9 hours.

670 Critical Literature Reviews (3) Techniques and methods for conducting critical reviews of literature: conceptual and methodological critiques of existing research. Satisfactory/No Credit grading only.

693 Directed Study in Social Work Research (3) Advanced individual study, under faculty guidance, of social work practice issues. Prereq: First year required PhD courses or consent of instructor. May be repeated. Maximum 9 hours.
464 The Modern World System (3) Critical examination of capitalist world-system as social system, its coherence, boundaries, regions, member groups, cleavages, and patterns of conflict. Analysis of who gets what, why, and how in global political economy.


452 Minorities, Crime and Criminal Justice (3) Examines racial/ethnic disparities in criminal offending and victimization, as well as different experiences with law enforcement, judicial and correctional agencies. Emphasis on social justice.

453 Gender and Crime (3) Probes the gendered nature of offending, victimization and criminal justice. Examines the different experiences of males and females, and theories that attempt to explain these differences.

455 Society and Law (3) How laws and legal processes are affected by social change, social impact of legal sanctions, relations between law and social justice. (Same as Legal Studies 455.)

459 White-Collar Crime (3) Distinctive nature and dynamics of white-collar crime, victims and costs of white-collar crime, organizations as white-collar offenders, causal theories, and dynamics of responses to white-collar crime by private and public parties.

462 Population (3) Demographic factors and social structure; trends in fertility, mortality, population growth, migration, distribution, and composition; population policy.

464 Urban Ecology (3) Relation of humans to their urban environment: conservation and use of appropriate technology. (Same as Urban Studies 464.)

465 Social Values and the Environment (3) Human dimensions of ecosystem management and public policy. Applied focus on social values activated within specific biophysical and social settings. Prereq: 110 or 120 or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

504 Sociological Foundations of Political Economy (3) Survey of contemporary sociological theories of political economy, sources of political and economic power and conflict.

505 Foundations of Criminology (3) Critical overview of contemporary developments in criminology, theories of crime causation and theories of responses to crime.

506 Social Justice and Public Policy (3) Examines the formulation and consequences of public policy, analyzing: the general public policy process model; the model's specific applications to criminal justice policy, environmental policy, and economic and political policies; and techniques of policy evaluation research.

507 Foundations of Social Psychology (3) Current and classical theoretical perspectives in social psychology.

510 Professional Preparation (1) A variety of one-credit seminars that offer training in specific aspects of professional socialization. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

521 Sociological Theory I (3) Assessment of what sociological theory is; its major figures and their approaches to understanding society.

531 Research Methods in Sociology (3) Research design, measurement, sampling, quantitative and qualitative data collection techniques, data, reduction, and analysis.

534 Advanced Sociological Analysis (3) Underlying assumptions and logical procedures used by sociologists in formulating explanations; foundations of sociological research strategies and techniques.

541 Collective Behavior, Social Movements, Social Change (3) Basic theory and research on conditions of social unrest in human collectivities and efforts of collectives to change existing society.

543 Sociology of Development (3) Sociological theories and studies of development: modernization, colonialism, dependency; comparative impact of various development paths upon selected aspects of social structure and change.

551 Juvenile Delinquency and the Social Structure (3) This course examines how juvenile delinquency policies are shaped by social structures and changes in social perceptions of childhood, crime, and punishment.

560 Environmental Sociology (3) Systematic treatment of current research in environmental sociology. Social impact analysis and conflicts over environmental issues.

562 Sociology of Environmental Policy (3) Examines the history of environmental use and environmental protection; the policy process; the institutional and cultural barriers to improved environmental policies; and potential policies for sustainability.

575 Seminar in Gerontology (1) (See Health 585.)

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences.

599 Readings (3) Selected topics. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

622 Sociological Theory II (3) Distinct schools of sociological theory and contributions of their principal exponents. Prereq: 521 or consent of instructor.

629 Supplementary Readings in Sociological Theory (3) Individual guidance. Preparation for comprehensive examination. Prereq: Consent of instructor. Satisfactory/No Credit grading only.

633 Survey Design and Analysis (3) Systematic exploration of survey problems through student participation in design and analysis of survey. Prereq: 531 or consent of instructor. (Same as Child and Family Studies 633.)

636 Field Research (3) Research experience in selected field sites using techniques of interviewing, participant observation, and other methods of field research. Prereq: 531 or consent of instructor.

639 Supplementary Readings in Methodology (3) Individual guidance. Preparation for comprehensive examination. Prereq: Consent of department. Satisfactory/No Credit grading only.

644 Political Sociology (3) Critical examination of theories of state and political processes.

645 Advanced Studies in Political Economy (3) Topical seminar. Prereq: 504 or consent of instructor. May be repeated. Maximum 6 hours.

649 Supplementary Readings (3) Prereq: Consent of department. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

653 Sociology of Law (3) Intensive examination of selected topics in sociology of law. Prereq: 505 or consent of instructor.
655 Advanced Studies in Criminology (3) Intensive examination of selected topics in criminology. Recommended prereq: 505. May be repeated. Maximum 6 hours.

661 Environmental Theory (3) Historical and contemporary studies of interaction between humans and their environment. Prereq: Consent of instructor.

665 Advanced Studies in Environmental Sociology (3) Topical seminar covering particular lines of research and theory within area. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

675 Advanced Studies in Social Psychology (3) Selected contemporary research issues related to social psychological theories. Prereq: 541 or consent of instructor. May be repeated. Maximum 6 hours.

695 Advanced Special Topics (3) Topic of special interest or student-initiated courses that will not be regularly offered. Prereq: Consent of department. May be repeated. Maximum 6 hours.

699 Tutorials in Advanced Topics (3) Individual instruction. Prereq: Consent of department. May be repeated. Maximum 6 hours.

SPANISH (924)

421 Phonetics (3) Prereq: 323 or consent of instructor.

422 Advanced Grammar and Translation (3) Structure of grammatical system of Spanish. In-depth analysis of selected syntactic phenomena with practical illustration/application and exercise in Spanish-English and English-Spanish translation. Finer points of grammatical structures. Not available to native or bilingual students of Spanish without consent of department. Prereq: 323.

423 Advanced Composition and Conversation (3) Development of writing and speaking skills at advanced level, wide range of topics and situations. Variety of in-class and extra-class activities. Not available for credit for students whose level of proficiency in Spanish is superior as defined by the ACTFL Proficiency Guidelines or for graduate students in the Spanish MA or PhD programs. Prereq: 323 or consent of department.

425 Introduction to Descriptive Linguistics (3) (See French 425.)

426 Methods of Historical Linguistics (3) (See French 426.)

429 Romance Linguistics (3) (See French 429.)

430 Topics in Hispanic Linguistics (3) Spanish language through different areas of linguistics: phonology, morphology, syntax, semantics, sociolinguistics, dialectology and second language acquisition. Prereq: 323. May be repeated. Maximum 6 hours with consent of department. (Same as Linguistics 431.)

433 Images of Woman in Hispanic Literature (3) Major Hispanic texts (and/or women authors) in light of relation of female individuality to particular social context, role of women in society, patriarchal tradition, woman as cultural and as aesthetic value (the feminine symbolic), and feminist theoretical issues. Prereq: 323, 330 and completion of 9 additional hours of upper-division Spanish.

434 Hispanic Culture through Film (3) Analysis of selected films on subjects concerning life, culture, and artistic traditions in the Hispanic world; exploration of ideological, philosophical, social, and political implications of films and comparison of them with treatments of related subjects in other types of artistic production. Prereq: 323, 330, and completion of 9 additional hours of upper-division Spanish. Taught in Spanish. May be repeated. Maximum 6 hours with consent of department. (Same as Cinema Studies 434.)

461 Special Topics (3) Aspects of Hispanic literature, culture, linguistics, or foreign language pedagogy. Topics vary. May be repeated with consent of department. Maximum 6 hours.

465 Latin American Film and Culture (3) Latin American and Latino/a films and videos from 1900s to present as works of art and in light of political, cultural, and social contexts. Taught in English. Graduate credit available only for Latin American Studies and Cinema Studies majors. 1 hour lecture, 2 hours screening, and 1 hour discussion. (Same as Latin American Studies 465; Cinema Studies 463.)

479 Disenchanted Texts in Hispanic Literature (3) Texts representing trends and periods of renewal in Spain and Latin American countries. Selected topics on traditions in crisis. Content varies. Prereq: 323, 330, and completion of 9 additional hours of upper-division Spanish. May be repeated. Maximum 6 hours with consent of department. (Same as Latin American Studies 479.)

480 Social Forces in Hispanic Literary Expression (3) Analysis of major Hispanic texts that address factors and events that influenced and/or continue to influence social and cultural evolution of Hispanic world, including literature itself. Prereq: 323, 330 and completion of 9 additional hours of upper-division Spanish. May be repeated. Maximum 6 hours with consent of department.

481 Trends in Hispanic Thought (3) Intellectual/philosophical currents represented in literary works, selected thinkers, or movements from historical periods of Spain and Latin American countries. Prereq: 323, 330, and completion of 9 additional hours of upper-division Spanish. May be repeated. Maximum 6 hours with consent of department.

484 Race, Ethnicity, and Nation in Hispanic Literature (3) Close reading and analysis of literary texts that deal with issues of race and ethnicity in Hispanic world, with regard to identity and concepts of nationhood. Topics: mestizaje; conceptual distinctions between race and ethnicity in Latin America; indigenismo; afrocentrism; issues of monarchy and empire; relationship between Jews, Christians, and Moors in Spain. Prereq: 323, 330, and completion of 9 additional hours of upper-division Spanish. May be repeated. Maximum 6 hours with consent of department.

486 Literary and Artistic Movements in the Hispanic World (3) Relationships (themeatic, cultural, socio-political, aesthetic, philosophical, etc.) between specific trends in literature and other artistic media, in light of historical contexts in which those relationships emerged. Prereq: 323, 330, and completion of 9 additional hours of upper-division Spanish. May be repeated. Maximum 6 hours with consent of department.

498 Topics in Hispanic Civilization (3) Analysis of major trends, issues and/or movements in the civilizations of Spain and Spanish America. Political, literary, and cultural perspectives dealing with topics from Middle Ages to present day. Prereq: 323, 330, and completion of 9 additional hours of upper-division Spanish. May be repeated. Maximum 6 hours with consent of department.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

512 Teaching a Foreign Language (3) Practical application of methods for teaching and evaluating basic language skills and cultural aspects through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all MA and PhD students holding Graduate Teaching Assistantships, except those whose previous training or experience warrants their being excused by department.

531 Old Spanish (3) Evolution of Spanish language from its origins through 15th century.

532 Medieval Spanish Literature (3) Literary works of 11th through 15th century. Application of literary theories to understanding of literature, nature and evolution of major literary genres during Spanish Middle Ages, and socio-historical contexts of medieval works. May be repeated. Maximum 6 hours with consent of department.
353 Golden Age Prose (3) Wide range of prose fiction in Spain during 16th and 17th centuries: Moorish, picaroscopic, sentimental, pastoral and exemplary novels, and dialogues.

534 Don Quijote (3) Cervantes' masterpiece in socio-cultural and literary context of its times: study of thematic, structural, and stylistic issues: crisis of aristocracy, Quixotic madness, discrepant cognitive and ethical perspectives, satiric irony, culture of sentiment, and Cervantes' legacy to subsequent literary periods. Content varies. May be repeated. Maximum 6 hours with consent of department.

535 Golden Age Poetry (3) Garcilaso, Fray Luis de León, San Juan de la Cruz, Lope de Vega, Quevedo, and Góngora.

537 Golden Age Drama (3) Major dramatists of period: Lope de Vega, Tirso de Molina, Ruiz de Alarcón, Guillén de Castro, Calderón de la Barca, Moreto, and Rojas Zorrilla.


541 19th-Century Spanish Prose (3) Costumbrismo, realism, and naturalism in the novel, short story, and essay as represented in major authors: Larra, Mesonero Romanos, Fernán Caballero, Alarcón, Valera, Palacio Valdés, Pereda, Galdós, Pardo Bazán. Content varies. May be repeated. Maximum 6 hours with consent of department.

542 20th-Century Spanish Literature: Generation of '98 through Civil War (3) Principal achievements and representative directions in literature of Spain through Civil War years.

543 20th-Century Spanish Literature: Post-Civil War through Present (3) Principal achievements and representative directions in literature of Spain from Post-Civil War period to present.

550 Techniques of Literary Analysis and Research Methods (3) Theoretical and critical essays on various techniques of literary analysis. Exploration of bibliographical and research materials.

551 Special Topics in Hispanic Literature or Linguistics (3) May be repeated. Maximum 6 hours.

552 Directed Readings (3)

561 Spanish American Colonial Literature (3) From pre-Columbian era through 18th century. Reading and analysis of selected works from Colonial Spanish American period and their Continental sources. Indigenous texts and authors. Content varies. May be repeated. Maximum 6 hours with consent of department.


571 Spanish American Narrative: Criollismo to 1950 (3) Critical study of major trends and movements that shaped Spanish American narrative during first half of 20th century. Content varies. May be repeated. Maximum 6 hours with consent of department.

572 Spanish American Narrative: Boom to Present (3) Critical study of major trends and movements that established Spanish American narrative as influential force in world literature during second half of 20th century. Content varies. May be repeated. Maximum 6 hours with consent of department.

573 Regional Approaches to Interpreting Spanish American Literature (3) Interpretation of Spanish-American literature taking into consideration regional differences attributable to such factors as race, geography, immigration, and economic development. Key regions include Mexico and Central America, Caribbean, Andean countries, and the Southern Cone. Course readings vary between specific regional perspective and transregional one. Content varies. May be repeated. Maximum 6 hours with consent of department.

575 Spanish American Modernismo and Vanguardismo (3) Critical study of principal writers and literary works associated with Spanish American modernismo and vanguardismo published between 1880 and 1950. Concepts and expressions of modernity as reflected in literature of period. Content varies. May be repeated. Maximum 6 hours with consent of department.

576 Contemporary Spanish American Poetry (3) Critical study of major poets in Spanish America from 1950 to present. Content varies. May be repeated. Maximum 6 hours with consent of department.

577 Contemporary Spanish American Theater (3) Reading and analysis of Spanish America's major dramatic works published and performed since 1950. Content varies. May be repeated. Maximum 6 hours with consent of department.


579 Spanish American Literary Criticism (3) Major works in which Spanish Americans have developed strategies to define, organize, and catalog literature published throughout continent. Critical approaches that surpass European and other non-Spanish American critical perspectives. Content varies. May be repeated. Maximum 6 hours with consent of department.

591 Foreign Study (1-15) See College of Arts and Sciences.

592 Off-Campus Study (1-15) See College of Arts and Sciences.

593 Independent Study (1-15) See College of Arts and Sciences. Letter or Satisfactory/No Credit grading.

600 Doctoral Research and Dissertation (3-15) P/NP only.

621 Seminar in Spanish Literature (3) Topics vary in field of Peninsular literature. May be repeated with consent of department. Maximum 9 hours.

631 Seminar in Spanish American Literature (3) Topics vary. May be repeated with consent of department. Maximum 9 hours.

SPECIAL EDUCATION (932)

419 Psychology and Education of Students with Mild Disabilities (6) Nature and characteristics of persons with mild handicaps and educational strategies appropriate for these persons. Prereq: 402 and admission to Teacher Education Program. Coreq: 420.

420 Field Experience in Special Education Programs (3) Practicum in teaching special education programs: planning, developing, implementing and evaluating instruction. Prereq: 402, admission to Teacher Education Program: Coreq: 419 and/or 471. Satisfactory/No Credit grading only.

431 Field Experience in Comprehensive Programs (3) Prereq: 402 and admission to Teacher Education Program. Coreq: 432. Satisfactory/No Credit grading only.

454 Education of the Gifted and Talented Children (3) Orientation to psychometric and behavioral studies of giftedness. Analysis of past and present school practices in reference to curriculum and program implementation. Prereq: Admission to Teacher Education Program.

456 Speech and Language Basis of Learning Disabilities in the Classroom (3) Normal communication development; understanding of speech and language impairments in school-age students; integration of oral/written communication skills into existing curriculum, especially for high incidence special education students.

470 Psychology of the Exceptional Child (3) Varieties of exceptional children; general characteristics and educational needs. Implications of developmental variations for functioning as adults. Opportunity to expand study upon particular exceptionality. Enrollment limited to non-special education majors.

471 Early Childhood Special Education (3) Assessment, curriculum planning and development and teaching approaches used in early childhood special education. Prereq: Admission to teacher education.

504 Clinical Experience in Teaching and Supervision of Exceptional Children (3-9) (See Education of the Deaf and Hard of Hearing 504.)

506 Internships in Teaching in Special Education and Rehabilitation (3-15) Placement in professional settings in public schools or agencies under supervision of master practitioners. Enrollment limited to those in fifth-year program. Satisfactory/No Credit grading only.

553 Assessment of Exceptional Students (3) Current issues related to assessment; advanced study of evaluation models for special education; dynamic and other innovative assessment approaches; advanced study of application to educational programming; basic statistics and application in assessment.

554 Assessment in Early Childhood Special Education (3) Development of knowledge and skills in appropriate formal and informal assessments of handicapped infants and young children: screening, identification, diagnosis, placement and programming assessment issues. Prereq: 553 or consent of instructor.

555 Characteristics of Affective/Motivational Functioning in Children with Disabilities (3) Definition, methods, identification and symptoms of children with affective/motivational development in disabled youngsters. Comparison to normal development and that of children labeled disturbed or behavior disordered.

556 Instructional Systems for Affective/Motivational Education for Children with Disabilities (3) Educational strategies and models of instruction; simulation, demonstration, and media. Teaching techniques, materials, and teacher/pupil/family interactions. Therapeutic forms of education through art, music, role play, puppetry, bibliotherapy, and group interactions. Prereq or coreq: 555 or consent of instructor.

557 Positive Preventive Discipline (3) Instructional, classroom and preventive/proactive strategies for use in classroom which positively affects efficiency of classroom. Research on how curriculum can encourage appropriate interactions of children and youth. Prereq: Admission to graduate program.

558 Neuromuscular and Health Disorders: Educational Implications (3) Neurological impairments, physical disabilities and special health conditions, autism. Investigation of instructional techniques and adaptations.

564 Psychosocial Development of Gifted and Talented Children (3) Phenomena of talent development in context of home, school, and society. Implications of maladjustment. Practices for promoting social and emotional development. Prereq: 451 and 452 or equivalent or consent of instructor.

565 Instructional Systems for the Gifted and Talented (3) Instructional methods and systems evaluated in terms of effectiveness in various educational environments. Prereq or coreq: 564 or consent of instructor.

568 Early Childhood Special Education: Theories and Interventions (3) Theoretical perspectives of early childhood special education; exploration of programmatic models, family-focused concepts and curriculum development.

575 Creative Problem-Solving Strategies for Special Educators (3) Techniques for solving problems encountered by special educators in any setting.

586 Seminar in Research Techniques in Special Education (3) Evaluation of appropriate research methodologies with handicapped populations.


590 Application of Microcomputer Technology in Special Education and Vocational Rehabilitation (3) Application of microcomputer technology with all categories of exceptionalities and across all chronological and functioning age ranges. Microcomputer adaptive software, special switch access, authoring systems, telecommunication, and strategies for cognitive development.

620 Internship in Research in Special Education and Rehabilitation (3-9) Placement with professional engaged in theoretically-based research: public school, institutions, agencies or university settings. Prereq: 9 hours in statistical and research methods. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

630 Internship in Institutional Leadership in Special Education and Rehabilitation (3-9) Advanced level field experiences under supervision of practitioner. Prereq: Consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

**SPORT MANAGEMENT (957)**

440 Sport Marketing (3) Application of fundamental marketing concepts to sport industry. Marketing research, promotions, fund raising, advertising, and assessment of marketing programs specific to sport. Historical development of sport marketing. Prereq: Marketing 300 and progression to Sport Management.

460 Development and Revenue Generation in Sport (3) Designed to provide overview of theories, strategies, and techniques used in the production of revenue for sport organizations and through sport events. Emphasis on developing balanced, multifaceted programs that target a variety of constituencies in the sport industry.

500 Thesis (1-15) P/NP only.

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. Prereq: 532.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

511 Administration/Supervision In Sport (3) Development of knowledge and analytic skills desirable for managers/administrators in sport business/organization: organizational, administrative, and supervisory strategies related to sport in profit and non-profit settings.

512 Application of Legal Concepts to Sport Settings (3) Application of contract law, breach of contract, and monetary damages within sport settings: risk assessment and development of effective risk management strategies; development of contracts in sports; and analysis of cases involving discrimination based upon gender, race, and age as well as protection of rights at amateur and professional levels of sport.
530 Sport and Media Issues (3) Gender and race issues within context of media and sport. Development of sport media and media influence on sport.

532 Research Techniques in Sport (3) Evaluate, compare, and contrast research techniques in sport with consideration for and experiences in appropriate review, design, analysis procedures, and proposal development.

535 Ethics in Sport Management (3) Development of analytical skills and knowledge desirable of middle and upper level managers in sport business/organizations. Social issues and ethics in sport administration.

540 Sport Economics and Finance (3) Principles of economics and finance as applied to sport organizations. Market structures of sport finance and political economics that form those structures.

544 Theories of Leadership and Leader Behavior in Sport (3) Integration of various theoretical approaches to leadership styles in sport administration within cultural contexts, research, and field experiences.

553 Case Studies in Sport Management (3) Current issues and problems in sport administration at all levels of amateur and professional sport. May be repeated under different topic. Maximum 9 hours.

554 Readings in Sport Management (3) Survey of pertinent literature in refereed and applied journals and texts.

555 Evaluation Techniques for Sport Managers (3) Review and application of techniques of evaluation appropriate for sport programs, facilities, and personnel.

570 Event Management (3) Review of current research related to theory and practice in event management and involvement in management capacity with one or more special events.

575 Seminar in Sport Management (1) Selected topics in sport management. May be repeated with consent of instructor. Maximum 3 hours. Satisfactory/No Credit grading only.

580 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated.

590 Practicum (3) Practical experience in areas of major interest. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

593 Independent Study (1-3) May be repeated. Letter grade only.

595 Internship (3) Full-time application of previous theoretical and applied knowledge and skills in appropriate sport setting. Satisfactory/No Credit grading only.

SPORT STUDIES (959)

500 Thesis (1-15) P/NP only.

501 Special Project (3) Research study suitable for publication, or practicum requiring special written work.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

505 History of Olympics: Ancient and Modern (3) Examination of various aspects of ancient and modern Games. Ancient Olympics 776 BC to 393 AD: Panhellenic Games. Modern Olympics, 1896 to date: political, social class, gender, and economic issues that influence Games.


514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues.

515 Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport.

533 Psychology of Sport (3) Social psychological factors influencing human behavior in a sport context; discussion of contemporary theory, research, and methodology. Prereq: General psychology course or consent of instructor.

534 Motor Behavior and Skill Acquisition (3) Topical explanation and application of principles of human movement behavior to acquisition and performance of skills; discussion of current research and methodology.

535 Health and Exercise Psychology (3) Study and cultural critique of various aspects of health and exercise psychology.

536 Expert Performance in Sports (3) Examines expertise in athletic performance with a primary focus on the development and maintenance of expertise. Special emphasis is placed on theoretical and practical perspectives on the study of sport expertise as they intersect with issues regarding sport psychology, race, aging, gender, or other socio-cultural factors.

538 Professional Practice Issues in Sport Studies (3) Study and cultural critique of various aspects of professional practice in sport studies.

539 Research Development in Sport Psychology: Idea Formation to Data Collection (3) First of a two-semester sequence designed to familiarize students with research process in applied sport psychology. Includes idea formation, critical review of related literature, development of a research question and methodology, and data collection.

540 Research Development in Sport Psychology: Data Analysis to Manuscript Submission (3) Second of a two-semester sequence designed to familiarize students with research process in applied sport psychology. Includes data analysis, manuscript preparation and manuscript submission.

542 Sociological Aspects of Sport (3) Social and cultural factors influencing sport and physical education. Pertinent issues and research applications. Prereq: Consent of instructor.

543 Women, Sport, and Culture (3) Critical examination of experiences of girls/women in American sports from a socio-cultural perspective with particular emphasis on the constructs of gender, race, class, and sexuality. Explores theories from sport, feminist, race, and cultural studies. (Same as Women’s Studies 543.)

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

594 Supervised Readings (1-3) May be repeated. Satisfactory/No Credit or letter grade.

595 Special Topics (1-3) Advanced study in selected aspects of sport studies. May be repeated. Maximum 9 hours. Satisfactory/No Credit or letter grade.

600 Doctoral Research and Dissertation (3-15) P/NP only.

601 Research Seminar (1) (See Exercise Science 601.)

633 Advanced Sport Psychology (3) Analysis, synthesis, and discussion of contemporary theory and topics; research development and production in sport psychology. May be repeated. Maximum 9 hours.
681 Practicum (1-3) Intern experience in areas of major interest. May be repeated.

693 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

694 Supervised Reading (1-3) May be repeated. Satisfactory/No Credit or letter grade.

695 Special Topics (1-3) Study for doctoral students in selected aspects of sport studies. May be repeated. Maximum 9 hours. Satisfactory/No Credit or letter grade.

STATISTICS (962)


500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

531 Survey of Statistical Methods I (3) Univariate and bivariate data collection and organization, statistical estimation and hypothesis testing; analysis of relationships for categorical and numerical data, including Chi-square tests and simple linear and quadratic regression. Use of computing facilities required. Credit not given for both 531 and 537. Prereq: 1 year college mathematics.

532 Survey of Statistical Methods II (3) Multiple linear regression, including use of dummy variables; single and multiple factor analysis of variance and covariance; issues in experimental design and analysis. Use of computing facilities required. Prereq: 531.

537 Statistics for Research I (3) Principles and application of statistical methodology, integrated with considerable use of major statistical computing system. Probability and probability distributions, forming and testing hypotheses using parametric and nonparametric inference methods. Matrix-based simple linear regression and correlation. Credit not given for both 531 and 537. Prereq: 1 year of undergraduate mathematics and 1 undergraduate statistics course.

538 Statistics for Research II (3) General linear model as applied to multiple regression and analysis of variance. Diagnostic and influence techniques. One-way, factorial, blocking, and nested designs, preplanned versus post-hoc contrasts. Random factors and repeated measures. Prereq: 537 or 532.

561 Introduction to Computing for Data Management and Analysis (1) The University of Tennessee, Knoxville, computing environment for beginning statistics graduate students. Use of operating system commands, system editor, utility programs and SAS statistical package for data entry and editing, file management and statistical analysis. Use of UTCC computing facilities required. Coreq: 531, 537 or 571, or consent of instructor.


564 Theory of Statistical Inference (3) Introductory theory underlying common statistical procedures of hypothesis testing and estimation. Prereq: 563.

566 Statistical Techniques in Industrial Processes (3) Applications of control charts and other statistical techniques in industrial setting. Attributes and variables control charts, process capability analysis, aspects of sampling, statistical tolerancing, estimation of variance components, problems of measurement, special industrial applications. Prereq: 571 or equivalent.


571 Statistical Methods (3) Data collection strategies. Descriptive statistics. Probability distributions, simulation of random variables, sampling distributions. Estimation and hypothesis testing, regression, Chi-Square test for categorical data, simple design of experiments, nonparametric methods. Use of statistical software. Prereq: one year of calculus and a statistics course.


573 Design of Experiments (3) One-way ANOVA, multiple range tests, equal and unequal variances, transformations; factorial experiments, completely randomized designs, analysis of covariance, split-plot and nested designs, fractional factorials, sequential designs. Prereq: 571.

574 Data Mining Methods and Applications (3) Understanding and application of data mining methods. Data preparation; exploratory data analysis and visualization; cluster analysis; logistic regression; decision trees; neural networks; association rules; model assessment; and other topics. Applications to real world data. Use of standard computer packages. Prereq: 532 or 538 or 571, or consent of instructor.

575 Applied Time Series (3) Fundamental concepts of time series analysis: Box-Jenkins approach, stationary and nonstationary models, forecasting model identification, seasonal models, transfer function models, and spectral theory. Prereq: 538 or 572 or consent of instructor.

578 Categorical Data Analysis (3) Log-linear analysis of multidimensional contingency tables. Logistic regression. Theory, applications, and use of statistical software. Prereq: 1 year of graduate-level statistics, regression analysis and analysis of variance, or consent of instructor.


583 Special Topics in Applied Statistics (1-3) May be repeated. Maximum 9 hours.

585 Principles of Statistical Process Management (1-3) Statistical and other techniques applied to management of organizational processes. Prereq: Consent of department head.

587 Graduate Seminar (1) Directed readings and active participation in colloquium program of Department of Statistics and of student’s minor program. Prereq: Consent of statistics department director of graduate studies. May be repeated. Maximum 2 hours. Satisfactory/No Credit grading only.
592 Internship (1-6) Supervised off-campus experience in application of statistical principles and methods in business, industry, or government. Written and oral report. Prereq: 4 courses in graduate-level statistics or consent of statistics department director of graduate studies. May be repeated. Maximum 6 hours. Satisfactory/No Credit grading only.

593 Independent Study (2-6) Faculty directed readings and investigation of specified topic in probability or statistics. Written report and oral presentation. Prereq: 2 courses in statistics and consent of the statistics department director of graduate studies. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

595 Statistical Consulting Practicum (1-6) Supervised experience helping on-campus researchers plan, manage data, and develop and perform analyses specific to designs and hypotheses. Discussion of activities in regular seminar meetings. Final written reports and/or detailed diaries. Prereq: 572 or 538. May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.

662 Computational Methods in Statistics (3) Up-to-date computational methods in statistics: open architecture interactive computational languages supplemented by other statistical packages with graphical capabilities. Statistical computing, numerical methods for linear models and generalized linear models, nonlinear statistical methods, matrix computations and special matrices, essentials of Monte Carlo simulation, and resampling techniques. Prereq: Knowledge of programming language and 572 or consent of instructor.


673 Advanced Topics in Design of Experiments and Linear Models (3) Experimentation for product and process improvement: response surface methodology and robust design methods; mixture experiments; optimal design topics; distribution theory and inference for linear models. Prereq: 573 or consent of instructor.


677 Statistical Modeling (3) Modern techniques of statistical modeling: predictive, likelihood, Bayesian, and information-based model selection and evaluation paradigms. Application of techniques in various types of models for both continuous and discrete data modeling problems. Interactive computational tools. Prereq: 564 and 572 or 538, or consent of instructor.

679 Multivariate Statistical Modeling (3) Modern information based techniques and model selection in multivariate analysis, informational tests of significance with multivariate data, multivariate analysis of variance, multivariate regression and variable selection, multivariate cluster analysis, common principal component model, factor analysis model, covariance structural models with latent variables, mixture-model cluster analysis. Prereq: Matrix algebra and 564, or matrix-based linear models with experience in interactive computing, or consent of instructor.

683 Special Topics in Statistics (1-3) Presentation of specialized topics in statistics. May be repeated. Maximum 6 hours.

691 Graduate Seminar in Applied Statistics (3) Reading of literature and discussion of open problems of importance to industry: design of experiments, modeling, process control, regression, and reliability. Prereq: Consent of instructor. Satisfactory/No Credit or letter grade.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and faculty member. May be repeated. Maximum 6 hours.

THEATRE (976)

420 Special Studies in Acting (3) Content varies. Exercises in selected concentrated areas such as styles, techniques, approaches, e.g., Shakespeare, movement, humor. Prereq: 320 and consent of instructor. May be repeated. Maximum 9 hours.

425 Selected Musical Theatre Techniques (3) Study and practice of musical theatre material: dance and vocal work. May be repeated. Maximum 6 hours.


446 Costume Patterning (3) Draping patterns for period costumes. Cosetry and study of historic patterns 1500-1900. Prereq: 345 or consent of instructor.

450 Special Studies in Entertainment Technology (1-3) Content varies. May be repeated. Maximum 9 hours. Prereq: consent of instructor.

452 Entertainment Technology II (3) Automation systems in live entertainment, including advanced rigging and flying for stage and film. Prereq: 352 or consent of instructor.

454 Scenery Painting (2) Introduction to materials, techniques, and principles of craft. Gaining skill and understanding through studio experience. Prereq: Consent of instructor.

456 Scenic Design II (3) Advanced studies in set design. Prereq: 355 or consent of instructor.

462 Lighting Design II (3) Advanced lighting design theory and practice. Lab and project intensive. Prereq: 362 or consent of instructor.

464 Computer Aided Drafting for the Theatre (3) Introduction to entertainment drafting. Emphasis on 2D graphical standards, drafting techniques, drawing layout and presentation.

470 Playwriting (3) Advanced instruction in writing of plays. Prereq: Consent of instructor.

491 Foreign Study (1-15) See College of Arts and Sciences.

492 Off-Campus Study (1-15) See College of Arts and Sciences.

493 Independent Study (1-15) See College of Arts and Sciences.

501 Introduction to Graduate Research in Theatre (3) Research tools and methods for theatre artist and scholar.
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Elements of Design for the Theatre (3) Analysis of the principles of design through visual, structural, and emotional relationships.

510 Studies in Theatre History (3) Intensive study of selected topics in theatre history. May be repeated. Maximum 9 hours.

512 Dramatic Literature Analysis (3) Dramaturgical strategies of major playwrights, using variety of analytical approaches from Aristotelian to deconstruction.

520 Master Class in Performance: Acting (3) Master class in acting techniques. Theatre MFA students only. May be repeated. Maximum 18 hours.

523 Master Class in Performance: Movement (3) Master class in movement techniques. Theatre MFA students only. May be repeated. Maximum 18 hours.

525 Master Class in Performance: Voice (3) Master class in voice and speech techniques. Theatre MFA students only. May be repeated. Maximum 18 hours.

536 Projects in Play Directing (3) Practical work in play direction involving various lengths and kinds of scripts. May be repeated. Maximum 9 hours.

542 The Social History of Costume (3) Study and analysis of costume as related to society’s manners and mores, architecture and furniture.


545 Millinery for the Stage (2) Pattern making and construction techniques for hats from antiquity to present. Prereq: Consent of instructor.

546 Advanced Costume Patterning (3) Advanced studies in patterning period costume. Development of historic patterns through flat pattern method. Prereq: 446.

547 Painting and Dyeing for the Theatre (3) Fibers, dyes and dye processes; color matching and distressing.

549 Projects in Costume Technology (1-3) Individualized studies in costume technology in theatre production. Prereq: Consent of instructor. May be repeated. Maximum 6 hours.

550 Special Studies in Entertainment Technology (1-3) Content varies. Prereq: consent of instructor. May be repeated. Maximum 9 hours.

551-552 Structural Design for Stage (3,3) Application of advanced theatre technology and analysis of common building materials to design of safe stage scenery. Must be taken in sequence.

553 Projects in Scenic Design (1-3) Conception and completion of major projects, both hypothetical and actual, in scene design. May be repeated. Maximum 9 hours.

555 Model Building (3) Techniques of model building for scenic designer. Theatre MFA students only. Prereq: 401 and one semester of 580.

556 Drafting (3) Drafting techniques for scenic designer. Theatre MFA students only.

560 Lab Analysis of Realized Lighting Design (3) Realized lighting design projects from concept meeting through opening night. Prereq: Consent of instructor. May be repeated. Maximum 18 hours.

562 Special Problems in Lighting Design (3) Advanced problems in lighting design and theory, problems in Broadway production and touring. Prereq: 462 or consent of instructor.

564 Advanced Computer Aided Drafting for the Theatre (3) Advanced drafting techniques. Emphasis on 3D solid modeling, rendering, and publication. Prereq: 464 or consent of instructor.

580 Design Seminar (1-6) Analysis, research, interpretation, and design of plays in a cross-disciplinary environment. May be repeated. Maximum 18 hours.

584 Photography for the Theatre (3) Photographic techniques for shooting live performance events under challenging lighting environments. Prereq: Consent of instructor.

585 Production Workshops (1-6) Directed experience in production collaborations. Prereq: Consent of instructor. May be repeated. Maximum 12 hours.

587 Computer Aided Rendering for the Theatre (3) Computer rendering programs and their use by theatrical designers. Prereq: Consent of instructor.

593 Independent Study (1-3) Individual or group projects. Available to Theatre MFA students only. Prereq: Consent of instructor. May be repeated. Maximum 15 hours.

599 Project in Lieu of Thesis (1-6) Available to theatre MFA students only. Prereq: Minimum of 30 hrs toward MFA degree and consent of advisor. May be repeated. Maximum 9 hours.

THEORY AND PRACTICE IN TEACHER EDUCATION (978)

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.

517 Trends and Issues in Education (3) Examination of contemporary trends and issues in education.

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only.

526 Drama and Story Telling in Teaching (3) Use of techniques of drama and storytelling to improve impact of teaching and to teach more effectively. Prereq: Classroom experience or admission to teacher education program.

535 Inquiry Teaching and Learning (3) Use of children’s and adolescent literature. Exploration of ways to create setting that invite learners to engage in inquiry learning and teaching.

540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and inservice programs. May be repeated. Maximum 6 hours. Satisfactory/No Credit or letter grade.

550 Action Research and Practical Inquiry in Education (3) Principles of action research and practical inquiry for practitioners in early childhood and school settings and methods for conducting such inquiries in professional role. Prereq: Admission to graduate program.

593 Independent Study (1-3) May be repeated. Satisfactory/No Credit or letter grade.

594 Supervised Readings (1-3) May be repeated. Satisfactory/No Credit or letter grade.

595 Special Topics (1-3) May be repeated. Satisfactory/No Credit or letter grade.

596 Clinical Experience in Assessment and Instruction (3) Academic remediation applied in lab/field setting; tasks related to teaching: assessment, preparation of lessons, and delivery of instruction. Coreq: 553. Satisfactory/No Credit or letter grade.
### Courses of Instruction

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<tr>
<td>600</td>
<td>Doctoral Research and Dissertation (3-15)</td>
<td>Prereq: Admission to Candidacy. P/NP only.</td>
<td></td>
</tr>
<tr>
<td>604</td>
<td>Trans-Departmental Seminar I (1)</td>
<td>Introduction to doctoral programs in education: research requirements, academic integrity, the meaning of scholarship in academe and issues/problems in education. Prereq: Admission to a doctoral program or consent of doctoral program coordinator. May not be used to meet 600-level requirement. Satisfactory/No Credit grading only.</td>
<td></td>
</tr>
<tr>
<td>605</td>
<td>Trans-Departmental Seminar II (1)</td>
<td>Seminar to prepare doctoral students for the final steps in completing a terminal degree including preparing for and completing qualifying exams, preparing a prospectus, and completing a dissertation. Prereq: 604. May not be used to meet 600-level requirement.</td>
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</tr>
<tr>
<td>610</td>
<td>Internship in College Teaching and Supervision (3-9)</td>
<td>Supervised practice in college teaching and supervision. Prereq: Admission to doctoral program or consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.</td>
<td></td>
</tr>
<tr>
<td>617</td>
<td>Trends and Issues in Teacher Education—An Interdisciplinary Perspective (3)</td>
<td>Current trends and issues in field of teacher education: elementary education, mathematics education, science education and social science education. Prereq: Admission to doctoral program or consent of instructor.</td>
<td></td>
</tr>
<tr>
<td>620</td>
<td>Research in Literacy, Language, and ESL Education (3)</td>
<td>Recent trends and historical traditions in language and literacy research: analysis of nature of research methods used, questions asked and topics studied. Prereq: Admission to doctoral program or consent of instructor.</td>
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<tr>
<td>689</td>
<td>Internship (1-3)</td>
<td>Experiences in application of principles and practices of curriculum development and instructional improvement. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hours. Satisfactory/No Credit grading only.</td>
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<tr>
<td>693</td>
<td>Independent Study (1-3)</td>
<td>May be repeated. Satisfactory/No Credit or letter grade.</td>
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<tr>
<td>694</td>
<td>Supervised Reading (1-3)</td>
<td>May be repeated. Satisfactory/No Credit or letter grade.</td>
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<tr>
<td>695</td>
<td>Special Topics (1-3)</td>
<td>May be repeated. Satisfactory/No Credit or letter grade.</td>
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**URBAN STUDIES (985)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>411</td>
<td>The City in the United States (3)</td>
<td>(See Political Science 402.)</td>
<td></td>
</tr>
<tr>
<td>412</td>
<td>Survey of Planning (3)</td>
<td>(See Political Science 403.)</td>
<td></td>
</tr>
<tr>
<td>441</td>
<td>Urban Geography of the United States (3)</td>
<td>(See Geography 441.)</td>
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<tr>
<td>442</td>
<td>Urban Social Geography (3)</td>
<td>(See Geography 442.)</td>
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<tr>
<td>446</td>
<td>Housing (3)</td>
<td>(See Political Science 446.)</td>
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<tr>
<td>464</td>
<td>Urban Ecology (3)</td>
<td>(See Sociology 464.)</td>
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**VETERINARY MEDICINE (987)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>801-802</td>
<td>Application Based Learning Exercise (ABLE) I, II (1,2)</td>
<td>Small group, student-centered learning sessions with faculty facilitator for self discovery of new information. Week-long sessions based on specific clinical case or problem, and integration of basic science and clinical material. Satisfactory/No Credit grading only.</td>
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</tr>
<tr>
<td>804-805</td>
<td>Application Based Learning Exercise (ABLE) and Clinical Exposure I, II, III (2,2,2)</td>
<td>Week-long small group, student-centered learning sessions with faculty facilitator for self discovery of new information; based on specific clinical case or problem; integration of basic science and clinical material. One week of clinical experience through participation in specific clinical rotations in Veterinary Teaching Hospital. Satisfactory/No Credit grading only.</td>
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</tr>
<tr>
<td>811</td>
<td>Infection and Immunity II—Bacteriology and Mycology (3)</td>
<td>Fundamental aspects of microbiology and cell biology relative to pathogenesis of bacterial and fungal diseases of animals: antimicrobial actions and mechanisms of bacterial resistance. General approaches to diagnosis, treatment and prevention.</td>
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<tr>
<td>813</td>
<td>Infection and Immunity I—Immunology (2)</td>
<td>Basic biology and practical aspects of immunology: cells of immune system, immune function and dysfunction, immunoprophylaxis, diagnostic testing and specific diseases involving immune system.</td>
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<tr>
<td>814-816</td>
<td>Clinical Correlations and Ethics I, II (1,2)</td>
<td>Correlations between basic science material from concurrent courses and practice of veterinary medicine. Thoughts on wide spectrum of current veterinary ethical issues. 816—Student-led discussions follow faculty presentations.</td>
<td></td>
</tr>
<tr>
<td>821-822</td>
<td>Veterinary Anatomy I, II (4,4)</td>
<td>Lectures, laboratories, and demonstrations are used in an integrated approach to the study of macroscopic (gross) clinically relevant anatomy, including neu-roanatomy, and embryology of common domestic animals. Dissections of embalmed specimens, prosections, plastinated specimens, and radiographs of common domestic species are examined for comparative purposes.</td>
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<tr>
<td>823-824</td>
<td>Physiology I,II (4,4)</td>
<td>Introduction to concepts and problems in physiology which form basis for clinical applications and for formal training in pharmacology, medicine, pathology, and surgery: Cellular, neural, cardiovascular, renal, respiratory, digestive, endocrine, and reproductive physiology.</td>
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<tr>
<td>825-826</td>
<td>Veterinary Microscopic Anatomy I, II (2,2)</td>
<td>Lectures, laboratories, and demonstrations are used in the study of the cell, embryology, and microscopic anatomy of organ systems in common domestic animals to relate structure with function.</td>
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<tr>
<td>827</td>
<td>Special Problems in Animal Science (1-8)</td>
<td>Extramural and specially designed study for students interested in select topics in anatomy, histology, and physiology.</td>
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<tr>
<td>831</td>
<td>Physical Diagnosis (1)</td>
<td>Basic care, feeding, restraint, and handling domestic animals. Introduction to physical examination and diagnostic techniques used by veterinarian.</td>
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<tr>
<td>832</td>
<td>Anesthesiology (2)</td>
<td>Principles of anesthesiology: pharmacology of anesthetic agents, and introduction to anesthetic techniques in veterinary medicine.</td>
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<tr>
<td>833</td>
<td>Epidemiology and Evidence Based Medicine (2)</td>
<td>Study of distribution and detriments of disease in animal populations. Use of knowledge (evidence) gained from management of clinical patients in past to improve future clinical decision making processes.</td>
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<tr>
<td>834</td>
<td>Hematopoietic System (2)</td>
<td>Pathophysiology and diagnosis of disorders involving bone marrow and blood cells, platelets, and blood coagulation in domestic animals; interpretation of laboratory test results using illustrative clinical cases.</td>
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</tbody>
</table>
836 Toxicology (2) Principles of toxicology, molecular mechanisms, pathologic processes and clinical features of animal diseases caused by common toxic agents.

837 Food Hygiene and Zoonoses (2) Host-agent relationships, public health aspects of veterinary medicine and role of veterinarians in ecology and food hygiene.

840 Integumentary System (3) Pathophysiology, special pathology, medicine and surgery of diseases of integumentary system. Laboratory examination, pathology, diagnosis and treatment.

841 Reproductive System (3) Pathophysiology, special pathology, medicine and surgery of diseases of male and female reproductive systems and mammary glands.

842 Alimentary System (4) Pathophysiology, special pathology, medicine and surgery of diseases of alimentary systems.

843 Musculoskeletal System I (3) Pathophysiology, clinical description and basic treatment modalities of common diseases and conditions of skeletal system of small animals: development of basic diagnostic and treatment skills.

844 Musculoskeletal System II (3) Pathophysiology, special pathology, medicine and surgery of diseases of muscular and skeletal systems. Advanced principles, radiographic interpretation and surgical procedures.

845 Veterinary Nutrition (2) Principles of nutrition, and nutrition of animals in health and disease. Applied nutrition relating to individual small or large animal patient or to herd situations.

846 Multispecies Medicine (3) Anatomy, pathophysiology, medicine, and surgery of avian species, laboratory and zoo animals and reptiles. Species and diseases seen by practicing veterinarian. Current topics on foreign animal diseases.

851 Urinary System (3) Pathophysiology, special pathology, medicine and surgery of diseases of urinary system. Urinary system in health and disease.

852 Cardiovascular System (2) Pathophysiology, special pathology, medicine and surgery of diseases of cardiovascular system. Anatomic, physiologic and pharmacologic principles which provide basis for treatment.


854 Respiratory System (3) Pathophysiology, special pathology, medicine and surgery of diseases of respiratory system. Upper and lower respiratory systems: infectious and noninfectious diseases.

855 Radiology (3) Basic, advanced and special techniques in radiology with interpretation and use of radiologic and related techniques in diagnosis and treatment of animal diseases.

856 Special Senses (2) Pathophysiology, special pathology, medicine and surgery of diseases of visual and auditory systems.

857 Nervous System (3) Pathophysiology, special pathology, medicine and surgery of diseases of nervous system: clinical neurology and neuropathology.

858 Neurology/Ophthalmology (4) Clinical training in specialty services: ophthalmology and neurology. Direct responsibility for diagnosis, patient care, and treatment of patients in both Large Animal and Small Animal Clinical Sciences.

861 Pharmacology I (2) Principles of pharmacokinetics and pharmacodynamic properties of veterinary drugs; mode of action and pharmacologic effects including important metabolic aspects, chemical and physical properties, side effects (toxicities) and clinical application.

862 Pharmacology II (2) Continuation of 861: modes of action, pharmacologic effects, and clinical application of drugs to control specific disease conditions.

863 Infectious Diseases (2) Pathogenesis and clinical findings of major viral, bacterial, and fungal infectious diseases of domestic animals: cattle, horses, swine, sheep, goats, dogs and cats; relevant case-based presentations.

865 Clinical Rotation in Comparative Medicine (2) Clinical training in avian medicine, laboratory animal and zoo animal medicine, epidemiology, public health, and other related disciplines.

867 Special Problems in Comparative Medicine (1-8) Extramural and specially designed study for students interested in select topics in avian medicine, laboratory animal medicine, zoo animal medicine, epidemiology, public health, pharmacology or toxicology.

868 Introduction to Animal Behavior (2) Basic principles of normal and abnormal animal behavior in domestic animals; clinical case discussions to illustrate common behavioral problems and current approaches to therapy.

870 Anesthesiology (4) Clinical training in sedation and anesthesia of companion animals, food animals and horses. Direct responsibility for diagnosis, care and treatment of clinical patients.

871 General Pathology (3) Principles of pathology: causes of disease, disturbances of cell growth and inflammation.

873 Infection and Immunity IV—Parasitology (3) Principles of parasitology: protozoology, helminthology, and entomology and relationship to diseases in animals.

874 Oncology (2) Fundamental aspects of cell biology and pathology relative to etiology and natural behavior of various neoplasms of animals; general approaches to diagnosis, treatment and prevention of neoplasia.

877 Special Problems in Pathology (1-8) Extramural and specially designed study for students interested in select topics in morphologic pathology, clinical pathology, clinical microbiology and parasitology.

878-879 Elective Clinical Rotation I, II (2,2) Special rotations in applied clinical education in Small Animal Clinical Sciences, Large Animal Clinical Sciences, Comparative Medicine and Pathology. Novel experience not associated with required clinical rotations may be arranged.

881 Clinical Rotations in Small Animal Clinical Sciences I (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, care, and treatment of clinical patients.

882 Clinical Rotations in Small Animal Clinical Sciences II (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, care, and treatment of clinical patients.

883 Clinical Rotations in Small Animal Clinical Sciences III (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, care, and treatment of clinical patients.

886-889 Clinical Rotation in Radiology and Pathology I, II (4,4) Two weeks in each discipline. Clinical training in radiographic techniques and interpretation, including ultrasonography. Post-mortem examination and laboratory diagnostics: clinical pathology and introductory histopathology of biopsy specimens.

887 Special Problems in Small Animal Clinical Sciences (1-8) Extramural and specially designed study for students interested in select topics in medicine, surgery, anesthesiology, radiology and medical specialties of small (companion) animals.
WILDLIFE AND FISHERIES SCIENCE (993)

440 Wildlife Techniques (3) Methods of wildlife damage control, forest, farmland, wetland wildlife habitat management, identification of wildlife field sign, wildlife capturing techniques and management plan preparation. Weekend field trips. 1 hour and 1 lab or field. Prereq: Forestry, Wildlife and Fisheries 317 or consent of instructor.

442 Fisheries Techniques (3) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques; age determination and incremental growth analysis; stream assessment; equipment and instrumentation usage and maintenance; safety in sampling methods. Weekend field trip. 1 hour and 1 lab or field. Prereq: Forestry, Wildlife and Fisheries 317 or consent of instructor.

443 Fisheries Science (3) Quantification and management of freshwater fisheries: population estimation, age and growth, biological assessment, and stocking. 2 hours and 1 lab. Prereq: Forestry, Wildlife and Fisheries 317 or consent of instructor.

444 Ecology and Management of Wild Mammals (3) Biological and ecological characteristics of game mammals and endangered mammals. Current principles and practices of wild mammal management. 2 hours and 1 lab. One weekend field trip required. Prereq: Forestry, Wildlife and Fisheries 317 or consent of instructor.

445 Ecology and Management of Wild Birds (3) Biological and ecological characteristics of game birds, endangered birds, and bird pests. Current principles and practices of wild bird management. 2 hours and 1 lab. Prereq: Forestry, Wildlife and Fisheries 317 or consent of instructor.

500 Thesis (1-15) P/NP only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Satisfactory/No Credit grading only.

512 Seminar in Wildlife and Fisheries Science (1) Current developments in wildlife and fisheries science. Required of all graduate students in residence in fall. May be repeated. Maximum 2 hours. Satisfactory/No Credit grading only.

515 Seminar in Avian Ecology and Management (1-2) Readings and discussion based on current literature on contemporary topics in avian ecology and management. Additional credit awarded for writing review paper on contemporary topic of interest to student. Prereq: Consent of instructor.

525 Endangered Species Management and Conservation of Biodiversity (2) Status, ecology and management of endangered wildlife and plant species. Historic aspects, policy implications and philosophical issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor.

530 Wildlife Diseases (2) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr biology, 444 or 445, or consent of instructor. (Same as Comparative and Experimental Medicine–Veterinary Medicine 530)

531 Wildlife Physiology and Nutrition (2) Introduction and overview of endocrine and physiological mechanisms regulating wild animal populations (primarily wild birds and mammals); the importance of wildlife physiology and nutrition in monitoring and managing wildlife. Prereq: Senior or graduate standing in life sciences.

535 Floodplain Ecosystems (3) Ecology, restoration and management of floodplain ecosystems: biotic and abiotic processes, social considerations, and wildlife and forest management; Lower Mississippi River Alluvial Valley. Prereq: Consent of instructor.

540 Predator Ecology (2) Dynamics of terrestrial vertebrate predator populations in human-altered and relatively unaltered environments. Prereq: 444 or 445 or consent of instructor.

545 Advanced Population Analysis (2) Detail characteristics, assumptions, goals, methods, and current technologies for fish and wildlife population analysis. Use of computers. Prereq: Animal Science 571 or Statistics 538 or consent of instructor.

546 Advanced Habitat Analysis (2) Habitat analysis as tool to evaluate habitat use and predict occurrences of animal and plant species: principles and goals of modeling, habitat analysis theory, GIS and statistical techniques. Use of computer programs. Prereq: Forestry, Wildlife and Fisheries 410 or Geography 411 or consent of instructor.

550 Fish Physiology (3) Mechanisms of gas transfer, circulation, excretion, osmoregulation, locomotion, and neural/hormonal control of these systems in fishes. Comparisons and contrasts with physiology of terrestrial animals. Practical applications of fish physiology to aquaculture, pollution assessment, and fisheries management. Prereq: Senior or graduate standing in life sciences.

555 Fish Culture (3) Principles, concepts and techniques of culturing economically important fish and shellfish species. 2 hours and 1 lab. Prereq: 443 or consent of instructor.

556 Recirculating Aquaculture (3) Growing fish in intensive, indoor systems with reconditioned water. Techniques of solids removal, nitrification, and gas balance. Practical experience with operating system. Prereq: 443 or consent of instructor.

560 Advanced Topics in Wildlife and Fisheries Science (1-3) Recent advances and concepts, research techniques and analysis of current problems. Prereq: 443, 444, 445, or consent of instructor. May be repeated. Maximum 6 hours.

593 Independent Study in Wildlife and Fisheries Science (1-4) May be repeated. Maximum 6 hours.
WOMEN’S STUDIES (994)

400 Topics in Women’s Studies (3) Content varies. May be repeated.

410 Sex Role Development: Implications for Education and Counseling (3) (See Counselor Education 410.)

422 Women Writers in Britain (3) (See as English 422.)

425 Women’s Health (3) (See Health 425.)

434 Psychology of Gender (3) (See Psychology 434.)

469 Sexuality and Cinema (4) Explores issues surrounding sexuality, gender and cinema from points of view of feminist film criticism. Writing-emphasis course. (Same as Cinema Studies 469.)

483 African-American Women in American Society (3) (See African and African-American Studies 483.)

510 Special Topics (3) May be repeated. Maximum 6 hours.

543 Women, Sport, and Culture (3) (See Sport Studies 543.)

593 Independent Study (1-6) Prereq: Consent of Chair of Women’s Studies