Courses of Instruction

REGISTRATION NOTES

(RE) Prerequisite(s) and Corequisite(s) will be enforced by the Registration System in the future. They are currently enforced by the department.
(DE) Prerequisite(s) and Corequisite(s) are enforced by the department.
Registration Restrictions are enforced by the Registration System.

Accounting (009)

451 Operational Auditing and Consulting (3) Approaches auditors might use to evaluate an entity’s efficiency and effectiveness in variety of settings and techniques auditors might use 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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.
Comment(s): Master of Accountancy admission or consent of instructor required.

518 Professional Standards (3) Basic standards and contemporary issues relevant to assurance providers. Actual practice cases are used to illustrate application.
Comment(s): Master of Accountancy admission (or consent of instructor) required.

519 Seminar in Business Risk and Assurance Methodology (3) Business risk and emerging methodology used by assurance providers.

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.
(DE) Prerequisite(s): Management accounting course.
Comment(s): Admission to a graduate program or consent of instructor required.

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.
Comment(s): Master of Accountancy admission or consent of instructor required.

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.
(DE) Prerequisite or (DE) Corequisite: 531.
Comment(s): Master of Accountancy admission or consent of instructor required.

533 Taxation of Partnerships and S Corporations (3) Current issues in partnership and S corporation taxation including partnership 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.
(DE) Prerequisite or (DE) Corequisite: 531.
Comment(s): Master of Accountancy admission or consent of instructor required.

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.
(DE) Prerequisite or (DE) Corequisite: 531.
Comment(s): Master of Accountancy admission or consent of instructor required.

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.
(DE) Prerequisite: 531.
Comment(s): Master of Accountancy admission or consent of instructor required.

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.
Comment(s): Master of Accountancy admission or consent of Master of Accountancy advisor required.

593 Individual Research in Accounting (3) Directed research in topic of mutual interest.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Master of Accountancy admission or consent of Master of Accountancy advisor required.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

611 Doctoral Seminar in Accounting (3) Analysis of issues reflected in accounting literature.
Registration Permission: Consent of PhD program advisor.

612 Doctoral Seminar in Accounting (3) Analysis of issues reflected in accounting literature.
Registration Permission: Consent of PhD program advisor.

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

621 Accounting Colloquium (1) Research and discussion of contemporary issues in practice of accounting.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Registration Permission: Consent of PhD program advisor.
622 Accounting Colloquium (1) Research and discussion of contemporary issues in practice of accountancy.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Registration Permission: Consent of PhD program advisor.

693 Independent Study (3) Directed research in topic of mutual interest.
Repeatability: May be repeated.
Maximum 6 hours.
Comment(s): Admission to the PhD/business administration major/accounting concentration required.

Advertising (012)
490 Special Topics (3) Detailed study of a specialized area of advertising. Topics vary by semester and include advanced media strategy, advanced creative strategy, direct marketing, and multicultural advertising.

500 Thesis (1-15) Grading Restriction: P/ Nope only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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.
Comment(s): Admission to the program (or consent of the instructor) required.

530 Advertising and Public Relations Research (3) Nature, scope, and application of research function to advertising and public relations decisions.

540 Advertising Decision Making (3) Analysis of decision making in marketing, creative strategy, media strategy, research, evaluation, and agency-client relationships. Advertising response functions.
Comment(s): Admission to the program or consent of instructor required.

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

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

Aerospace Engineering (018)
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, and compressibility effects. Subsonic, transonic, and supersonic airfoils.
(See Mechanical Engineering 531 and 310.)

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.
(See Mechanical Engineering 331.)

(See Mechanical Engineering 351.)

426 Introduction to Aerospace Design (2) Design process, synthesis, design studies. Individual design reports required.
(See Mechanical Engineering 351, 370, and 363.)

429 Aerospace System Design (3) Synthesis and design of a complete aerospace system. Participation in team design effort including formal presentations and design report.
(See Mechanical Engineering 344.)

449 Aerospace Engineering Laboratory (3) Designing, conducting, and reporting results of experimental exercises. Test standards and specifications. Analysis of data and formation of conclusions.
(See Mechanical Engineering 345, 351, and 425.)

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

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

500 Thesis (1-15) Grading Restriction: P/No Credit only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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

511 Inviscid Flow (3) Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping.
(See Mechanical Engineering 423 or 541, and Mathematics 425.)

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.
Registration Permission: 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.
(See Mechanical Engineering 423 or 541.)

515 Air Vehicle Aerodynamics and Performance (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 altitude, propulsion systems, vehicle performance characteristics, and trajectory optimization.
(See Mechanical Engineering 422.)

516 Air Vehicle Aerodynamics and Performance (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 altitude, propulsion systems, vehicle performance characteristics, and trajectory optimization.
(See Mechanical Engineering 515.)

521 Aerodynamics of Compressible Fluids (3) One-dimensional internal and external flow; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics.
(See Mechanical Engineering 422.)

522 Aerodynamics of Compressible Fluids (3) One-dimensional internal and external flow; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics.
(See Mechanical Engineering 521.)

525 Hypersonic Flow (3) Slender body flow; similarity: Newtonian theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow.
(See Mechanical Engineering 512.)

527 Aerospace Ground Test Facilities (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.
(See Mechanical Engineering 521, 541, and Mechanical Engineering 522.)

528 Aerospace Ground Test Facilities (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.
(See Mechanical Engineering 521, 541, and Mechanical Engineering 522.)

529 Rarefied Gasesdynamics (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.
(See Mechanical Engineering 522 and Mechanical Engineering 522.)

531 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics; thermodynamic and thermophysical properties of gas plasmas; governing equations and applications.
(See Mechanical Engineering 541.)
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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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. (DE) Prerequisite(s): 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. (DE) Prerequisite(s): 211 and 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 changes agents influence the introduction, adoption, and diffusion of technological change. (DE) Prerequisite(s): 435 and 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. (DE) Prerequisite(s): 436 and 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. (DE) Prerequisite(s): 435 and 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. (DE) Prerequisite(s): 211 or consent of instructor.

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 (androgygy 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. (DE) Prerequisite(s): 211 and 511 or 346 or consent of instructor.

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

532 Managing Organizations, Programs and Personnel (3) Theory and principles of management for individual and organizational effectiveness of agricultural organizations. (DE) Prerequisite(s): 511 and 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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 3 hours. Registration Permission: Consent of instructor.

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

Agricultural Economics (047)

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

420 International Agricultural Trade and Marketing (3) Introduction to real and monetary aspects of international trade effect on agricultural commodity flows; partial equilibrium analysis of international trade in agricultural products; institutional aspects of international marketing of agricultural products.

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.

442 Agribusiness Management (3) Advanced concepts in developing business and marketing plans and in applied management principles such as inventory control and pricing techniques. Discussion of management issues including going international, employee supervision, management succession and guerrilla marketing. Teamwork emphasized in managing an agribusiness firm through game simulation. Written and oral presentation required.

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.

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.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated. Registration Restriction: Master of Science – agricultural economics major.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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. Recommended Background: Calculus and intermediate microeconomics courses.

512 Advanced Agribusiness Finance (3) Financial and investment analysis tools and concepts and their application to decisions faced by agribusiness. Emphasis on financial analysis and planning principles, capital budgeting, debt structure and financing, options, present value concepts, and risk analysis. Recommended Background: Senior-level finance course.

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.

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. Recommended Background: Calculus and statistics courses.

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. Recommended Background: Calculus and intermediate microeconomics courses.

530 Agricultural Policy Analysis (3) Evaluation of public policy as related to agricultural industry and rural areas.
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.

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.

552 Advanced Agribusiness Seminar (3) A capstone course for students in the Master of Science non-thesis agribusiness concentration. The course centers on discussion and analysis of real-world management case studies. Students are responsible for the development of a comprehensive written case study analyzing a real-world agribusiness management problem. Major writing and oral presentation emphasis.

Recommended Background: 2 completed semesters of the agricultural economics MS program.

570 Advanced Natural Resource Economics (3) Analysis of natural resource allocation issues; applied welfare economics, external effects and evaluation of public policy.

593 Special Topics in Agricultural Economics (1-3) Topics to be assigned.

Repeatability: May be repeated. Maximum 9 hours.

595 Professional Internship (3) 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 nonmarket considerations, regulation, uncertainty, property rights, equity considerations, and landscape pattern and change.

Recommended Background: Advanced microeconomics course.

Agriculture and Natural Resources (088)

491 International Experience in Agriculture and Natural Resources (1-12) 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.

Grading: Satisfactory/No Credit or letter grade.

Repeatability: May be repeated. Maximum 12 hours.

507 Professional Development Seminar (1) Planning and executing graduate research programs; ethics and professionalism; graduate program procedures and resources. (Same as Animal Science 507; Entomology and Plant Pathology 507; Food Science and Technology 507; Plant Sciences 507.)

Grading Restriction: Satisfactory/No Credit grading only.

512 Teaching Internship in Agriculture and Natural Resources (1) Supervised experience in teaching – test preparation and evaluation of agriculture students.

Repeatability: May be repeated. Maximum 2 hours for MS students and maximum 4 hours for PhD students.

American Studies (099)

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

442 American Humor (3) (See English 442.)

510 Special Topics (3) Repeatability: 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.

Contact Hour Distribution: 1 hour and 2 labs.

(DE) Prerequisite(s): 320 or equivalent.

430 Nutrient Evaluation and Ration Formulation (3) Ration nutrient analyses 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.

Contact Hour Distribution: 2 hours and 1 lab.

(DE) Prerequisite(s): 330 or equivalent and an 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.

Contact Hour Distribution: 2 hours and 1 lab.

(IE) Prerequisite(s): 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 herd improvement programs. Alternatives evaluated in terms of production responses and economic returns.

Contact Hour Distribution: 2 hours and 1 lab.

(IE) Prerequisite(s): Completion of 300-level courses 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.

Contact Hour Distribution: 2 hours and 1 lab.

(IE) Prerequisite(s): Completion of 300-level core courses 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.

Contact Hour Distribution: 2 hours and 1 lab.

(IE) Prerequisite(s): Completion of 300-level core courses or consent of instructor.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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

511 Special Problems in Animal Science (1-4)

Repeatability: May be repeated. Maximum 9 hours.

Registration Permission: Consent of instructor.


(IE) Prerequisite(s): General undergraduate coursework in anatomy/physiology and biochemistry or consent of instructor.

523 Advanced Mammalian Reproduction (3) Current topics and new frontiers in reproductive biology.

(IE) Prerequisite(s): 320.
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. (DE) Prerequisite(s): Animal nutrition, feeds, and ration formulation course or consent of instructor.

535 Ruminology (2) Anatomy, physiology, and microbiology of rumen ecosystem: microbial fermentation and metabolism of polysaccharides, lipids and nitrogen. (DE) Prerequisite(s): 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. (Same as Plant Sciences 571.) Recommended Background: 3 hours of statistics.

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. Contact Hour Distribution: 2 hours and 1 lab. Recommended Background: 6 hours of statistics.

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

600 Doctoral Research and Dissertation (3-15) P/NP only. Grading Restriction: P/NP only. Repeatability: May be repeated.

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

631 Advanced Topics in Animal Nutrition (1-4) Recent advances and concepts, research techniques, current problems. Repeatability: 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. (Same as Comparative and Experimental Medicine – Veterinary Medicine 651.) Repeatability: May be repeated. Maximum 6 hours.

652 Disorders of the Endocrine System (2) Pathological and physiological aspects of diseases; endocrine glands of various animal species. (Same as Comparative and Experimental Medicine – Veterinary Medicine 652.) Recommended Background: 3 hours of physiology.

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. Repeatability: May be repeated. Maximum 6 hours.

696 Seminar (1) Advanced topics in animal science. Required of all first- and second-year PhD students. Repeatability: 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. (DE) Prerequisite(s): 130.

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

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

413 Dynamics of Culture (3) Definition and in-depth study of major forms of culture change, ranging from evolution and diffusion to religious revitalization and political revolt. Continuity and change in diverse cultural settings examined through use of archaeological, ethnographic, and contemporary case studies. (DE) Prerequisite(s): 130 or consent of instructor.

414 Political Anthropology (3) Examination of the 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. The relationship between actors (individuals) and structures. The encapsulation of traditional political forms and systems within modern states. (DE) Prerequisite(s): 130 or consent of instructor.

415 Environmental Anthropology (3) Overview of theoretical and methodological approaches to the study of human / environmental interactions. Impacts of environmental change on society and culture; human impacts on environmental change. (DE) Prerequisite(s): 130. Registration Permission: 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. (DE) Prerequisite(s): 130 or consent of instructor.

431 Ethnographic Research (3) Conceptual and practical exploration of methods and techniques cultural anthropologists use in fieldwork. (DE) Prerequisite(s): 130 or consent of instructor.

432 Anthropology of Warfare and Violence (3) Origins and tactics of warfare; overview of cultural foundations of warfare and structural violence; and effects on communities, social institutions, environments, and social organization. (DE) Prerequisite(s): 130. Registration Permission: 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 Background: 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. Primary focus on Paleolithic/Mesolithic chronology and lifeways. (DE) Prerequisite(s): 120 or consent of instructor.

463 Rise of Complex Civilizations (3) Development of complex societies in Old World from origins of agricultural economics to rise of States. Focus on Mesolithic, Neolithic, and Metal Age lifeways in Africa, Europe, and Asia. (DE) Prerequisite(s): 120 or consent of instructor.

464 Principles of Zooarchaeology (3) Basic osteological studies of major vertebrate groups; with emphasis on the aboriginal's use of animals as subsistence and culture. Identification and interpretation of archaeological derived molluscan and vertebrate remains; with introduction to laboratory use of comparative collections. (DE) Prerequisite(s): 120 or consent of instructor.

465 Urban Archaeology (3) Field archaeology and interpretation of archaeological remains on historic urban sites in the United States. Course content will include lectures and field and laboratory research on urban sites in East Tennessee. Recommended Background: 361.

480 Human Osteology (4) Intensive examination of the human skeleton. Contact Hour Distribution: 3 hours and 1 lab. (DE) Prerequisite(s): 110 or consent of instructor.

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.)


490 Primate Evolution (3) Living and fossil primate taxonomy, ecology, and comparative anatomy. Survey of primate fossil record with emphasis on the origin or major primate lineages. (DE) Prerequisite(s): 110.
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.  
(DE) Prerequisite(s): Consent of instructor.

500 Thesis (1-15)  
Grading Restriction: P/NP grading only.  
Registration Permission: Consent of instructor.  
Repeatable: May be repeated.  

501 Graduate Research (1-9) Independent investigation of special problems in anthropology.  
Repeatable: May be repeated.  

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatable: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

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.  
Registration Permission: 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.  
Repeatable: May be repeated.  

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.  
Registration Permission: 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.  
Repeatable: May be repeated.  

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.  
Repeatable: May be repeated.  

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

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

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

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.

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.

(DE) Prerequisite(s): 480.

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

585 Laboratory Studies in Biological Anthropology (3) Topical coverage of laboratory methods in biological anthropology.  
Repeatable: May be repeated.  
Registration Permission: Consent of instructor.

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.  
Registration Permission: Consent of instructor.

591 Foreign Study (1-15)  
Repeatable: May be repeated.  
Maximum 15 hours.

592 Off-Campus Study (1-15)  
Repeatable: May be repeated.  
Maximum 15 hours.

593 Independent Study (1-15)  
Repeatable: May be repeated.  
Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatable: May be repeated.  

601 Advanced Graduate Research (1-6) Independent investigation of special problems in anthropology by advanced graduate students.  
Repeatable: May be repeated.  
Credit Restriction: Only 3 hours may be applied toward the 600-level requirement.

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

660 Advanced Seminar in Archaeology (3) Selected topics in prehistoric and historic archaeology.  
Repeatable: May be repeated.  

680 Selected Topics in Physical Anthropology (3)  
Repeatable: May be repeated.  
Comment(s): For doctoral students in biological anthropology concentration.

691 Selected Topics in Paleoanthropology (3)  
Repeatable: May be repeated.  

695 Gross Human Anatomy (9) Skeleton, muscles, and cardiovascular system. Dissection of cadavers.  
Contact Hour Distribution: 5 hours and 5 labs.  
(DE) Prerequisite(s): 480 or human biology course.

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.  
(DE) Prerequisite(s): 403.

406 Ideas in Architecture (3) Historical and critical review of major ideas of architecture through the ages.  
Comment(s): 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 examined through lectures, readings, essays, and sketch studies including 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. Examples from prehistoric times to present including the fertile crescent; the 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. (Same as Medieval Studies 415.)

417 The International Style (3) Survey of architecture of the early modern movement, primarily in Europe and America, covering the years 1900 to 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-20th century.

425 Special Topics in Architecture (1-6) Faculty-initiated courses. Topics vary.

Repeatability: May be repeated. Maximum 12 hours.

Registration Permission: Consent of instructor.

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.

(DE) Prerequisite(s): 231 or consent of instructor.

433 Computer Applications in Design III (3) Advanced course that integrates three-dimensional modeling and technical analysis with computers to augment building design. Independent studies under faculty direction.

Registration Permission: Consent of instructor.

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

(DE) Prerequisite(s): 342.

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

Comment(s): Open to all students.

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

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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.

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.

Registration Permission: 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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 9 hours.

526 Directed Readings in Architecture (3) Readings on topics of interest: primary texts, history, theory, urban issues, technology and professional practice.

Repeatability: May be repeated. Maximum 9 hours.

Registration Permission: Consent of instructor.

528 Topics in Architectural History and Theory (3) Historic topics, ideas, and theories in architecture.

Registration Permission: Consent of instructor.

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

(DE) Prerequisite(s): 180.

Comment(s): Enrollment is limited to Master of Architecture students.

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.

Registration Permission: 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.

571 Architectural Design Studio: Building Groups/Complexes (6) Investigations analyzing cultural and contextual influences and precedents informing architectural form, space and structure in communal complex of buildings. Design of residential, recreational, educational, religious and communal facilities comprising distinctive/individual and modular/repetitive units.

(DE) Prerequisite(s): 282.


(DE) Prerequisite(s): 571.


(DE) Prerequisite(s): 572.


(DE) Prerequisite(s): 551.

589 Urban Site Planning Workshop (4) Explores ideas, vocabulary, conventions, and technical skills essential to a critical understanding of how design and planning operate within the various scales of urban and ecological context. Examines both underlying terrain elements (landform, vegetation, water, climate) and human site interventions (urban infrastructure, buildings, and landscape). Strategies and analysis techniques for reading, mapping, and analyzing urban sites are introduced, as are issues, language, and principles of site design in urbanized landscapes.

Comment(s): Open to all majors.

Registration Permission: Consent of instructor.

591 Foreign Study (1-9)

592 Off-Campus Study (1-9)

593 Independent Study (1-9)
Art (140)
481 Museum Studies I: Museums, Purpose and Function (3) Purposes, functions, and development of museums of art, history, natural 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. (Same as Anthropology 482.)
(D) Prerequisite(s): 481 or consent of instructor.
484 Museum Studies III: Field Projects (1-12) Special field projects including restoration, preservation, registration, and other related research on or off campus. (Same as Anthropology 484.)
Repeatability: May be repeated. Maximum 12 hours.
(D) Prerequisite(s): 481 and 482.
Registration Permission: Consent of instructor.
499 Special Topics (3) Student- or instructor-initiated course offered at convenience of department.
Repeatability: 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.
507 Professional Practices: Teaching Internship (1) Individual study in development of skills and methodology in teaching studio courses.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 4 hours.
Credit Restriction: May not be applied toward degree requirements.
Comment(s): Enrollment is limited to students who are not GTA's.
Registration Permission: Consent of instructor.
591 Foreign Study (1-6)
Repeatability: May be repeated. Maximum 15 hours.
592 Off-Campus Study (1-6)
Repeatability: May be repeated. Maximum 15 hours.
593 Independent Study (1-4)
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists.
Repeatability: May be repeated. Maximum 8 hours.
Credit Restriction: May not be applied toward the art history requirement.

Art Ceramics (135)
421 Ceramics: Advanced Handbuilding (6) Continued investigation of ceramic form: emphasis on the development of individual direction.
Repeatability: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 321 and 322.
422 Ceramics: Advanced Throwing (6) Continued, in-depth investigation of ceramic form: emphasis on the development of individual direction.
Repeatability: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 321 and 322.
424 Ceramics: Clays and Glazes (3) Clay chemistry, clay bodies, glaze theory, and calculation. Formulating, mixing and testing of clay bodies and glaze formulas.
(DE) Prerequisite(s): 320.
429 Ceramics: Special Topics (3) Student- or instructor-initiated course offered at convenience of department.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.
521 Graduate Ceramics I (2-5)
Repeatability: May be repeated. Maximum 10 hours.
525 Graduate Ceramics II (2-5)
Repeatability: May be repeated. Maximum 10 hours.
593 Independent Study (1-4)
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists.
Repeatability: May be repeated. Maximum 8 hours.
Credit Restriction: May not be applied toward the art history requirement.
599 Projects in Lieu of Thesis (10)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 20 hours.
Comment(s): Completion of all graduate coursework and successful second-year evaluation by graduate faculty required.

Art Design/Graphic (136)
400 Typography (3) Principles of typography as well as classical and contemporary type forms as vehicles for communication. An intensive introduction to the fundamentals of type, from individual letterforms to large bodies of textual information. Attention to formal, technological, rhetorical and historical issues.
(DE) Prerequisite(s): Art 295 and Art Design/Graphic 251.
405 Computer Enhanced Graphic Design (3) Exploration of new technologies and their significance to graphic design.
Repeatability: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 351 and 356 with a grade of C or better.
Registration Permission: Consent of instructor.
410 Advanced Typographic Investigation (3) Expands on principles introduced in Typography 400. Projects will include work in reflective as well as electronic environments with an emphasis on personal exploration.
(DE) Prerequisite(s): Art Design/Graphic 400.
425 Illustration (3) Develops skills and critical analysis for effective visual communication. Projects will explore the relationship between image and meaning. Students will explore a variety of media as they develop a personal visual vocabulary.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Art 295 and Art Design/Graphic 251.
451 Advanced Graphic Design (3) Theory and techniques of visual problem-solving as applied to advanced applications of graphic design.
(DE) Prerequisite(s): 352 with a grade of C or better.
452 Graphic Design Seminar (3) Discussion of design and professional issues including politics, economics, and ethics for the graphic designer. Culminates in a student-initiated project.
(DE) Prerequisite(s): 451 with a grade of C or better.
456 Graphic Design Practicum (1-12) Practical work experience in the graphic design field. Must be prearranged with department.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.
459 Special Topics in Graphic Design (3) Student- or instructor-initiated course offered at convenience of department.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.
550 Studies in Graphic Design/Illustration History (3) Design and illustration c. 1850 to present.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment is limited to MFA candidates.
551 Graphic Design I (2-6) Repeatability: May be repeated. Maximum 10 hours.
552 Graphic Design II (2-6) Repeatability: May be repeated. Maximum 10 hours.
553 Computer Enhanced Design (2-6) Repeatability: May be repeated. Maximum 10 hours.
Registration Permission: Consent of instructor.
593 Independent Study (1-4) Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists.
Repeatability: May be repeated. Maximum 8 hours.
Credit Restriction: May not be applied toward the art history requirement.
599 Projects in Lieu of Thesis (10)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 20 hours.
Comment(s): Completion of all graduate coursework and successful second-year evaluation by graduate faculty required.

Art Drawing (137)
419 Special Topics in Drawing and Painting (3) Student- or instructor-initiated course offered at convenience of department to enhance/expand the painting, drawing, and watercolor curriculum.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.
511 Graduate Drawing I (2-6) Repeatability: May be repeated. Maximum 10 hours.
512 Graduate Drawing II (2-6) Repeatability: May be repeated. Maximum 10 hours.
593 Independent Study (1-4) Repeatability: May be repeated. Maximum 15 hours.
(DE) Prerequisite(s): Consent of instructor.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists.
Repeatability: May be repeated. Maximum 8 hours.
Credit Restriction: May not be applied toward the art history requirement.

599 Projects in Lieu of Thesis (10)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 30 hours.
Comment(s): Completion of all graduate coursework and successful second-year evaluation by graduate faculty required.

Art Education (141)
510 History and Philosophy of Art Education (3) United States from 1860s to present.
Registration Permission: Consent of instructor.

520 Studies in Art Education (3) Issues and topics current to the field of art education.
Registration Permission: Consent of instructor.

530 Production and Critical Pedagogy in Art (3) Relationship of production to aesthetics and critical analysis of works of art.

540 Use and Construction of Instructional Materials for Teaching Art (3) Examination and construction of curriculum and instructional aids related to teaching strategies in art education.

Art History (139)
403 History of Photography (3) Survey of history of photography from introduction of daguerreotype and calotype to more recent trends. Emphasis will be placed on aesthetics and the use of photography as a medium for artistic expression.

411 Art of South and Southeast Asia (3) Survey of art and architecture of the Indian subcontinent and Southeast Asia from 2000 BC to the 20th century. The major achievements of each period are examined in relation to their religious, political, and social contexts.

415 Art of China (3) Survey of art and architecture of China from Neolithic period to the 20th century. The major achievements of each period are examined in relation to their religious, political, and social contexts.

416 Chinese Art of the 20th and 21st Centuries (3) Survey of Chinese art from the late 19th century through the present. Hong Kong, Taiwanese, and expatriate artists are also considered.

419 Art of Japan (3) Survey of the art and architecture of Japan from the Neolithic period to the 20th century. The major achievements of each period are examined in relation to their religious, political, and social contexts.

425 Early Christian and Byzantine Art to 1350 (3) Art in Italy and the Eastern Empire from the beginnings of Christian art to c. 1350. Mosaic and painting, sculpture and architecture. (Same as Judaic Studies 425.)

431 Medieval Art of the West, 800-1400 (3) Western European art of the Dark Ages, Romanesque, and Gothic periods. (Same as Judaic Studies 431; Medieval Studies 431.)

441 Northern European Painting, 1350-1600 (3) From courtly art of late Middle Ages to Northern Renaissance. Jan van Eyck, Roger van der Weyden, and Dürer; early printmakers. (Same as Medieval Studies 441.)

442 Art of Northern Europe, 1600-1675 (3) Concentrated study of Bruegel, Rubens, Rembrandt, Georges de La Tour, Vermeer, Poussin, and Hals.

451 Art of Italy, 1250-1450 (3) Development of exploration of naturalism. Revival of antiquity and development of theories of perspective in Early Renaissance. Including Duccio, Giotto, Masaccio, Donatello, Botticelli. (Same as Medieval Studies 451.)


453 Art of Southern Europe, 1575-1700 (3) Concentrated study of Caravaggio, Bernini, and Italian Baroque developments in all media. Spanish Baroque painting and sculpture with special attention to Velazquez.

454 Renaissance and Baroque Theory (3) Addresses the theory of Western art in the early modern period with emphasis on the development and evolution in European Art during the Renaissance and Baroque periods. (DE) Prerequisite(s): 172 and 173 or consent of instructor.

461 Art of Southern and Eastern Africa (3) Art traditions of the eastern and southern regions of Africa. Sculpture, painting, pottery, textiles, architecture and human adornment will be examined. Some ancient Stone and Iron Age traditions will be examined, but the main emphasis will be on the diverse ethnic and regional art traditions practiced in the area from 19th century to present. (Same as Africana Studies 461.)

462 Art and Archeology of Ancient Africa (3) Historical art traditions of sub-Sahara Africa. Topics to be covered include prehistoric rock paintings; art from archaeological sites and ancient kingdoms. The time period covered ranges from the first and second millennia BC for some of the early terracotta sculpture and rock paintings, the 11th through 19th centuries AD for the later ancient kingdoms. (Same as Africana Studies 462.)

463 Arts of the African Diaspora (3) Examines the aesthetic, philosophical, and religious patterns of the African descendants of Brazil, Surinam, Caribbean and United States. Emphasis will be placed on the full range of art forms, including the sculptural and performance traditions, as well as architecture, textile, basketry and pottery art forms. (Same as Africana 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.

471 History of North American Art (3) Survey of 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) Addresses the theoretical basis for the modern movement. Emphasis on analyzing and discussing individual works of art in light of contemporary writings by artists and theorists.


476 History of 20th-Century Painting and Sculpture in Europe (3) Development of the Modern and Post-Modern movements in Europe. Investigation of progression of abstraction through more recent conceptual trends. Analysis of the 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.
Repeatability: May be repeated. Maximum 12 hours.

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

489 Studies in Art History (3) Concentration in individually selected areas.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

571 Studies in Medieval Art (3) Art and architecture of the Middle Ages — major monuments from Byzantium or western Europe.
Repeatability: May be repeated with consent of department. Maximum 6 hours.
Comment(s): For MFA candidates.

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

573 Studies in Baroque Art (3) Seventeenth century art and architecture — major artists and works from southern or northern Europe.
Repeatability: May be repeated with consent of department. Maximum 6 hours.
Comment(s): For MFA candidates.

574 Studies in Modern Western Art (3) Selected topics in 19th- and 20th-century western art.
Repeatability: May be repeated with consent of department. Maximum 6 hours.
Comment(s): For MFA candidates.

575 Studies in Modern American Art (3) Selected topics in 19th- and 20th-century American art.
Repeatability: May be repeated with consent of department. Maximum 6 hours.
Comment(s): For MFA candidates.

576 Studies in Asian Art (3) Selected topics in Japanese or Chinese Art.
Repeatability: May be repeated with consent of department. Maximum 6 hours.
Comment(s): For MFA candidates.

579 Special Topics in Art History (3) Student- or instructor-initiated course offered at convenience of department.
Repeatability: May be repeated with consent of department. Maximum 9 hours.
Comment(s): For MFA candidates.
Art Media Arts (134)
431 Photography III (3-6) Individual development of photographic problems and techniques. 
Repeatability: May be repeated. Maximum 12 hours. 
(DE) Prerequisite(s): 231, 330, and 331.
433 History of Film and Modern Art (3) Study of the development and interaction between cinematic arts and visual arts within the context of modern art history. (Same as Cinema Studies 433.) 
Comment(s): Available for art history credit.
435 Cinematography as Art (4) Continued development of concepts and techniques for the creation of film as an art form with an emphasis on individual projects. (Same as Cinema Studies 435) 
Repeatability: May be repeated. Maximum 9 hours. 
(DE) Prerequisite(s): 235 and 330 or consent of instructor.
436 Video Art (4) Continued development of concepts and techniques for the creation of video works as an art form with emphasis on individual projects. (Same as Cinema Studies 436) 
Repeatability: May be repeated. Maximum 9 hours. 
(DE) Prerequisite(s): 236 and 330 or consent of instructor.
439 Special Topics in Media Arts (3) Student- or instructor-initiated course offered at convenience of department. 
Repeatability: May be repeated. Maximum 12 hours.
441 Digital Photography II (4) Continuation of exploration and implications of use of computer in photography. 
(DE) Prerequisite(s): 330 and 341. 
Registration Permission: Consent of instructor.
442 Large Format Photography II (4) Studio course that continues exploration of the use of the large format camera in photography. 
(DE) Prerequisite(s): 330 and 342. 
Registration Permission: Consent of instructor.
531 Photography I (2-6) 
Repeatability: May be repeated. Maximum 10 hours.
532 Photography II (2-6) 
Repeatability: May be repeated. Maximum 10 hours.
535 Media Arts I (2-6) 
Repeatability: May be repeated. Maximum 10 hours.
536 Media Arts II (2-6) 
Repeatability: May be repeated. Maximum 10 hours.
577 Studies in Media as Art (3) Selected topics in theory and history of media as art form. 
Repeatability: May be repeated. Maximum 9 hours.
593 Independent Study (1-4) 
Repeatability: May be repeated. Maximum 15 hours. 
Registration Permission: Consent of instructor.
595 Visiting Artist Seminar (3) Contemporary art issues by different visiting artists. 
Repeatability: May be repeated. Maximum 12 hours. 
Credit Restriction(s): May not be applied toward the art history requirement.
599 Projects in Lieu of Thesis (10) 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. Maximum 20 hours. 
Comment(s): Completion of all graduate coursework and successful second-year evaluation by graduate faculty required.

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. 
Repeatability: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 361 or consent of instructor.
469 Special Topics in Printmaking (3-6) Student- or instructor-initiated course offered at convenience of department. 
Repeatability: May be repeated. Maximum 12 hours. 
Comment(s): Prerequisites for topics determined by the department.
561 Printmaking I (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods, and monoprint. 
Repeatability: Not repeatable. May be taken once for 2-6 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. 
(DE) Prerequisite(s): 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. 
(DE) Prerequisite(s): 561 and 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. 
(DE) Prerequisite(s): 561, 562, and 563.
593 Independent Study (1-6) 
Repeatability: May be repeated. Maximum 15 hours. 
Registration Permission: Consent of instructor.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. 
Repeatability: May be repeated. Maximum 8 hours. 
Credit Restriction: May not be applied toward the art history requirement.
599 Projects in Lieu of Thesis (10) 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. Maximum 20 hours. 
Comment(s): Completion of all graduate coursework and successful second-year evaluation by graduate faculty required.

Art Sculpture (143)
441 Advanced Sculpture (3) Individual development of sculptural problems and techniques. Students work independently while participating in group projects, critique, and discussion. 
Repeatability: May be repeated. Maximum 12 hours. 
(DE) Prerequisite(s): 6 hours of 300-level sculpture.
449 Special Topics in Sculpture (3) Student- or instructor-initiated course offered at convenience of department. 
Repeatability: May be repeated. Maximum 12 hours. 
Prerequisite(s): Successful completion of any portfolio review.
541 Graduate Sculpture I (2-6) 
Repeatability: May be repeated. Maximum 10 hours.
542 Graduate Sculpture II (2-6) 
Repeatability: May be repeated. Maximum 10 hours.
593 Independent Study (1-4) 
Repeatability: May be repeated. Maximum 15 hours. 
Registration Permission: Consent of instructor.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. 
Repeatability: May be repeated. Maximum 8 hours. 
Credit Restriction: May not be applied toward the art history requirement.
Asian Languages (144)
431 Readings in Chinese Literature (3) (Same as Chinese 431.)
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Mastery of intermediate-level Chinese or consent of instructor.
451 Readings in Pre-Modern Japanese Literature (3) (Same as Japanese 451.)
(DE) Prerequisite(s): Mastery of intermediate-level Japanese or consent of instructor.
452 Readings in Modern Japanese Literature (3) (Same as Japanese 452.)
(DE) Prerequisite(s): Mastery of intermediate level Japanese or consent of instructor.

Asian Studies (145)
471 Selected Topics in Asian Studies (3) Content varies.
Repeatability: May be repeated. Maximum 6 hours.
510 Special Topics (3)
Repeatability: May be repeated. Maximum 6 hours.

Astronomy (150)
411 Astrophysics (3) Development of analytical physical models of galactic structure of the universe, stellar and interstellar matter, and planetary systems. Topical and interdisciplinary approach includes consideration of quasars, pulsars, black holes and current developments in the field. Acceptable for credit toward the physics major.
(DE) Prerequisite(s): Physics 136 or 138 or 222 or 232.
Registration Permission: 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.
Repeatability: May be repeated with consent of department. Maximum 9 hours.

Audiology and Speech Pathology (160)
(DE) Prerequisite(s): 300 or consent of instructor.
433 Observation of Clinical Practice (1)
(DE) Prerequisite(s): 320 or consent of instructor.
434 Clinical Practice in Speech-Language Pathology II (1-4)
Repeatability: May be repeated. Maximum 4 hours.
(DE) Prerequisite(s): 433.
Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval.
435 Introduction to Speech Sound Disorders (3) Etiology, diagnosis, and treatment of articulatory and phonological disorders.
(DE) Prerequisite(s): 300 and 305 or consent of instructor.
(DE) Prerequisite(s): 300 and 306 or consent of instructor.
455 Problems in Speech Pathology (1-3)
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.
461 Introduction to Language Pathology in Children (3) Etiology, diagnosis, and treatment of language impairments in children.
(DE) Prerequisite(s): 300 and 305 or consent of instructor.
473 Introduction to Audiologic Assessment (3) Basic principles of clinical audiology; pure tone, speech, masking and overview of special auditory tests.
(DE) Prerequisite(s): 300.
Registration Permission: 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.
(DE) Prerequisite(s): 300.
Registration Permission: Consent of instructor.

494 Introduction to Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Introduction to 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.
(DE) Prerequisite(s): 305 and 473 or consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role in speech and language.
(DE) Prerequisite(s): 300.

507 Anatomy and Physiology of Hearing (3) Structure and function of the peripheral and central auditory systems, and their roles in mediating auditory processes.
(DE) Prerequisite(s): 473 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)
Repeatability: May be repeated. Maximum 24 hours.
(DE) Corequisite(s): 546.
515 Practicum in Aural Rehabilitation (1-4)
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 473 and 494.
516 Language Sample Analysis (3) Methods of characterizing and describing language behaviors.
(DE) Prerequisite(s): 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 neurocognitive impairments.
(DE) Prerequisite(s): 506 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 neurocognitive-linguistic impairments.
(DE) Prerequisite(s): 506 and 518 or consent of instructor.

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

(DE) Prerequisite(s): 440 or consent of instructor.

525 Counseling and Communication Disorders (3) Issues related to the role of counseling in clinical practice in speech pathology and audiology. Includes discussion of counseling needs and approaches, including multicultural issues.

526 Dysphagia (3) Clinical diagnosis, evaluation, and treatment of adult swallowing disorders and critical interpretation of research literature on dysphagia.
(DE) Prerequisite(s): 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.
Comment(s): Graduate standing required.

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

533 Advanced Clinical Practice in Speech-Language Pathology (1-4)
Repeatability: May be repeated. Maximum 15 hours.
(DE) Prerequisite(s): 434 or equivalent.
Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval.
Registration Permission: Consent of instructor.

534 Advanced Clinical Practice in Speech-Language Pathology (1-4)
Repeatability: May be repeated. Maximum 15 hours.
(DE) Prerequisite(s): 434 or equivalent.
Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval.
Registration Permission: Consent of instructor.
<table>
<thead>
<tr>
<th>COURSES OF INSTRUCTION</th>
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<tbody>
<tr>
<td>535 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-4)</td>
<td>Repeatability: May be repeated. Maximum 15 hours. (DE) Prerequisite(s): 100 hours clinical experience. Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>538 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4)</td>
<td>Repeatability: May be repeated. Maximum 15 hours. Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval.</td>
</tr>
<tr>
<td>539 Motor Speech Disorders (3)</td>
<td>Neuromotor organization for speech production; types of motor speech disorders and associated neuromuscular symptomatology; diagnosis and management of motor speech disorders. (DE) Prerequisite(s): 506.</td>
</tr>
<tr>
<td>540 Structural Speech Disorders (3)</td>
<td>Etiology, diagnosis and clinical management of craniofacial and resonance disorders. (DE) Prerequisite(s): 306 and 435.</td>
</tr>
<tr>
<td>541 Pediatric Oromotor Disorders (3)</td>
<td>Evaluation, diagnosis, and treatment of pediatric oromotor disorders that affect normal acquisition of feeding and pre-speech skills. (DE) Prerequisite(s): 506 or consent of instructor.</td>
</tr>
<tr>
<td>542 Hearing Disorders (3)</td>
<td>Effects of heredity, development/aging, diseases, and physical agents on hearing. (DE) Prerequisite(s): 473 or consent of instructor.</td>
</tr>
<tr>
<td>543 Amplification Technology (3)</td>
<td>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. (DE) Prerequisite(s): 473 and 507 or consent of instructor.</td>
</tr>
<tr>
<td>545 Sound Measurement Techniques and Hearing Conservation (3)</td>
<td>Techniques of measurement and analysis of sound: hearing conservation in schools and industry. Registration Permission: Consent of instructor.</td>
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<tr>
<td>546 Audiologic Assessment (3)</td>
<td>Theoretical bases for behavioral audiology and acoustic immittance measurement.</td>
</tr>
<tr>
<td>547 Special Problems in Audiology (1-3)</td>
<td>Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 473 or equivalent. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>552 Seminar in Speech Pathology (2-3)</td>
<td>Current significant research in speech pathology. Topics vary. Repeatability: May be repeated with consent of department. Maximum 9 hours. (DE) Prerequisite(s): 9 hours in speech pathology.</td>
</tr>
<tr>
<td>555 Special Problems in Speech-Language Pathology (1-3)</td>
<td>Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>556 Independent Study in Speech-Language Pathology (1-3)</td>
<td>Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>558 Phonological Disorders (3)</td>
<td>Current theories and approaches to assessment and intervention for individuals with difficulty acquiring or using speech sound system of English. (DE) Prerequisite(s): 435 or consent of instructor.</td>
</tr>
<tr>
<td>561 Child Language Disorders (3)</td>
<td>Current literature on assessment and intervention techniques for young language learners. (DE) Prerequisite(s): 461 or consent of instructor.</td>
</tr>
<tr>
<td>563 Language Disorders: Birth to Three (3)</td>
<td>Overview of family-focused, transdisciplinary intervention process. Assessment/treatment of infants, toddlers, and preschoolers. Description of disabilities and resulting communication disorder. (DE) Prerequisite(s): 461 or consent of instructor.</td>
</tr>
<tr>
<td>574 Pediatric Audiology (3)</td>
<td>Theoretical and practical considerations in evaluation and treatment of hearing loss in infants and children. Audiol-ogical intervention in case management of hearing impaired child: amplification, educational alternatives, and state and federal guidelines.</td>
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</tbody>
</table>
613 Externship in Audiology (1-9) Off-campus clinical training experience. 
Repeatability: May be repeated. Maximum 36 hours. 
Registration Permission: Consent of academic advisor.

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

650 Advanced Seminar in Audiology (3-6) Topics vary. 
Repeatability: May be repeated. Maximum 9 hours. 
Registration Permission: Consent of instructor.

652 Advanced Seminar in Speech and Language (2) Topics vary: aberrations of voice, articulation, speaking time and rhythm, language development or use, and language symbolism. 
Repeatability: May be repeated. Maximum 8 hours. 
Registration Permission: Consent of instructor.

655 Practicum in College Teaching (1-3) Supervised experience in college teaching. 
Grading Restriction: Satisfactory/No Credit grading only. 
Registration Permission: Consent of instructor.

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

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

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

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

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

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

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

663 Advanced Seminar in Aural Habilitation/Rehabilitation (3) Synthesis of information on audiologic habilitation and rehabilitation cases. 
(DE) Prerequisite(s): 543, 544, 580, and 596 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. 
(DE) Prerequisite(s): 543, 544, 580, and 594 or consent of instructor.

Aviation Systems (169)

500 Thesis (1-15) 
Grading Restriction: P/NP only. 
Repeatability: May be repeated.

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. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. 
Credit Restriction: May not be used toward degree requirements.

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. 
(DE) Prerequisite(s): 501.

504 Airports and the Community (3) Structure of airports and their communities. Technology and economics of cargo, baggage, ticket, and passenger handling. Airport management, economics and logistics. Interfaces with community. Plans, programs and developments for collecting and distributing passengers and freight from various types of airports. Types of airport developments and their projections. 
(DE) Prerequisite(s): 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. 
(DE) Prerequisite(s): 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, height, 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; statistically 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, fuse- lages and frames, wings and ribs; laminated composite structures; elec- tronically aerelasticity.

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

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 air- borne 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.
521 Experimental Flight Mechanics (3) Performance. Experimental techniques for flight mechanics. Specially equipped airborne laboratory; student participation in series of experiments demonstrating acquisition of flight test data. Necessary theory supports class experiments. Tests cover broad range of aircraft performance, stability and control characteristics in addition to instrumentation and data reduction methods.

(DE) Prerequisite(s): 422.

522 Experimental Flight Mechanics (3) Stability and control. Experimental techniques for flight mechanics. Specialized equipped airborne laboratory; student participation in series of experiments demonstrating acquisition of flight test data. Necessary theory supports class experiments. Tests cover broad range of aircraft performance, stability and control characteristics in addition to instrumentation and data reduction methods.

(DE) Prerequisite(s): 422.


(DE) Prerequisite(s): 422.

550 Project in Aviation Systems (3)

Repeatability: May be repeated.
Credit Restriction: Maximum of 3 hours may be applied toward degree requirements.

Comment(s): Non-thesis aviation systems majors only.

Biochemistry and Cellular and Molecular Biology (188)

401 Biochemistry-Molecular Biology I (4) First semester of a two-course sequence providing in-depth coverage of biochemistry and molecular biology. Covers amino acid structure and chemistry, protein structure and chemistry, protein folding, enzyme behavior and function, reaction mechanisms, catalysis and energy transfer, synthetic metabolism including photosynthesis, and protein transport.

(DE) Prerequisite(s): Biology 240 and Chemistry 350, 360, and 369.

402 Biochemistry-Molecular Biology II (4) Second semester of a two-course sequence providing in-depth coverage of biochemistry and molecular biology. Covers 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.

(DE) Prerequisite(s): Biology 240 and Chemistry 350, 360, and 369.

403 Advanced Genetics Laboratory (3) Experiments illustrating methods in modern genetics: techniques in classical, cyto-molecular, and developmental genetics. Using model organisms, especially Drosophila and mouse.

(DE) Prerequisite(s): Biology 240 and Chemistry 350, 360, and 369.

404 Plant Molecular Biology (4) Introduction to current research approaches and methodologies in plant developmental biology and molecular genetics.

Contact Hour Distribution: Laboratory and lecture.

(DE) Prerequisite(s): Biology 140 and 240.

419 Cellular and Comparative Biochemistry Lab (2) Experiments with enzymes, nucleic acids, and membranes and organelles. Chromatography, kinetics, hybridization, sequencing, and immunochromatographic methods.

(DE) Prerequisite or (DE) Corequisite: 401 or 410.

421 Cell and Tissue Structure and Function (4) Study of animal cells and tissues at light and electron microscope levels.

Contact Hour Distribution: 2 hours and 2 labs.

(DE) Prerequisite(s): 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.

(DE) Prerequisite or (DE) Corequisite: 401 or 410.

440 General Physiology (3) Principles of cellular and organ-system animal physiology.

(DE) Prerequisite(s): Biology 140.

(DE) Corequisite(s): Chemistry 350 and 360. Recommended Background: Physics 221 and 222.

465 Human Genetics (3) Genetic and molecular principles and problems of human inheritance.

(DE) Prerequisite(s): Biology 240.

471 Biophysical Chemistry (3) Physicochemical principles with applications to biological systems. Thermodynamics; chemical equilibrium; solubility chemistry; transport; electrochemistry; kinetics; enzyme catalyzed reactions. (Same as Chemistry 471.)

(DE) Prerequisite(s): Chemistry 350 and 360, Mathematics 125, and general biology or consent of instructor.

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

481 Biophysical Chemistry (3) Physicochemical principles with applications to biological systems. Elementary quantum chemistry; interactions of light with biological molecules; optical and magnetic spectroscopy; light scattering; case studies of selected macromolecules. (Same as Chemistry 481.)

(DE) Prerequisite(s): Chemistry 350 and 360, Mathematics 125, and general biology or consent of instructor.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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.

(DE) Prerequisite(s): Prior knowledge of cell biology and biochemistry.

Registration Permission: 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

Repeatability: May be repeated. Maximum 6 hours.

Comment(s): Primarily for departmental graduate students.

516 Experimental Techniques II (2-4) Laboratory rotations. Students work in laboratory of faculty member on clearly defined project. Written proposal and oral report required.

Repeatability: May be repeated. Maximum 8 hours.

(DE) Prerequisite(s): 515.

Comment(s): Primarily for departmental graduate students.

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.

(DE) Prerequisite(s): 511 or consent of instructor.

520 Special Topics (1-3) Selected directed readings or special course in topics of current interest. Consult departmental listings for offerings.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated with consent of instructor. Maximum 6 hours.


(DE) Prerequisite(s): 401 and one semester of introductory plant physiology or cell biology.

523 Advanced Plant Physiology II (3) Growth and differentiation of plants at molecular, cellular and organismal levels. Regulation of development; macromolecular interpretation of differentiation, dormancy, germination, flowering, and senescence.

(DE) Prerequisite(s): 401 and one semester of introductory plant physiology or cell biology.

525 Graduate Research Participation (3-12) Tutorial laboratory experience.

Repeatability: 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.

Registration Permission: Consent of instructor.

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.

Registration Permission: Consent of instructor.

552 Physiology of Hormones (3) Cellular and organizational action of hormones in invertebrate and vertebrate animals. Contact Hour Distribution: 2 hours and 1 lab. Recommended Background: 410. Registration Permission: Consent of instructor.

559 Biophysical Crystallography (3) Theories and practices of X-ray diffraction, neutron diffraction and neutron scattering to elucidate the structure of nucleic acids, proteins, nucleosomes, ribosomes and viruses. Application of 3-D structures in designing drugs against AIDS, cancer, cardiac disease and neurodegenerative disorders. Recommended Background: 401 or two 300-level chemistry courses or Physics 240. Registration Permission: Consent of instructor.


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. Contact Hour Distribution: Two 3-hour labs. Comment(s): Approved graduate students in department only.

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. Contact Hour Distribution: 2 hours and 1 lab. Registration Permission: Consent of instructor.


591 Foreign Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

601 Departmental Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 15 hours.

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. Topics posted in advance. Required every semester in residence. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 15 hours.

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

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

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

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

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

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. Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 511 and 512 or consent of instructor.

Biomedical Engineering (192)

408 Cell and Tissue Engineering (3) Mammalian cell culture. Effects of mechanical forces on cells. Tissue engineering of cardiovascular and orthopedic tissues. (DE) Prerequisite(s): 310 and Biology 140.

430 Biomedical Engineering Laboratory (4) Experience with unique problems associated with making measurements and interpreting data in living systems. Experiments may include mechanical testing of biological materials, imaging and physiological measurements (EKG, EMG, ECG, etc.). (DE) Prerequisite(s): 310 and 346 or consent of instructor.


475 Design of Artificial Internal Organs (3) Design, development and evaluation of artificial internal organs; analysis of transport processes in therapeutic devices for design optimization; current research and development needs. Ethical considerations. (DE) Prerequisite(s): Aerospace Engineering 341 and Mathematics 231.

494 Special Project in Biomedical Engineering (1-3) Problems related to recent developments and practice. Repeatability: May be repeated. Maximum 6 hours.

495 Special Project in Biomedical Engineering (1-3) Problems related to recent developments and practice. Repeatability: May be repeated. Maximum 6 hours.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.
507 Application of Linear Algebra in Engineering Systems (3) (See Chemical Engineering 507.)
509 Multidisciplinary Project (1) (See Industrial Engineering 509.)
511 Biortransport 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.
(DES) Prerequisite(s): 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 Autolev. (Same as Mechanical Engineering 531.)
(DES) Prerequisite(s): Mechanical Engineering 231.
534 Mechanical Vibrations (3) (See Mechanical Engineering 534.)
539 Continuum Mechanics (3) (See Engineering Science 539.)
541 Fluid Mechanics I (3) (See Mechanical Engineering 541.)
552 Computational Biomechanics (3) Practical use of general-purpose commercial finite element packages for simulations related to orthopedic and sport biomechanics. Prediction of failure and performance of bone, joints and prosthetic devices.
(DES) Prerequisite(s): Mechanical Engineering 231 and 321.
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. (Same as Aerospace Engineering 555; Mechanical Engineering 552.)
(DES) Prerequisite(s): Mechanical Engineering 363 and 534.
Registration Permission: Consent of instructor.
559 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 559.)
561 Finite Elements for Engineering Applications (3) (See Engineering Science 551.)
562 Computational Fluid-Thermal Systems (3) (See Engineering Science 552.)
571 Biomechanics of Hard and Soft Tissue (3) (See Engineering Science 571.)
572 Biomedical Fluid Mechanics (3) (See Engineering Science 572.)
577 Neural Networks in Engineering (3) (See Nuclear Engineering 577.)
587 Dynamic Modeling and Simulation (3) (See Mechanical Engineering 587.)
590 Selected Biomedical Engineering Problems (2-6)
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment is limited to students in the non-thesis option. Registration Permission: Consent of instructor.
595 Seminar (1) All phases of biomedical engineering, reports on current research at UTK and UTSI. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated.
599 Special Topics in Biomedical Engineering (1-3)
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.
600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only. Repeatability: May be repeated.
610 Advanced Topics in BME (3) Current research topics of interest in biomedical engineering.
Registration Permission: Consent of instructor.
(DES) Prerequisite(s): 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 multibody 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. (Same as Mechanical Engineering 631.)
(DES) Prerequisite(s): 531.
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. Emphasis on off-road vehicles and bioprocessing systems.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: Rigid-body dynamics, mechanics of materials.
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. (Same as Civil Engineering 416.)
Recommended Background: Hydraulics or fluid mechanics.
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, and reaction kinetics, reactor design and systems; introduction to bioseparations; practical aspects of bioprocess engineers and process development.
Contact Hour Distribution: 2 hours and 1 lab.
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. Includes laboratory experiments and design projects.
Contact Hour Distribution: 3 hours and 1 lab.
Recommended background: Electrical circuits.
500 Thesis (1-15)
Grading Restriction: P/NP only. Repeatability: May be repeated. Registration Restriction(s): Master of Science – biosystems engineering major.
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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.
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.
Contact Hour Distribution: 2 hours and 1 lab.
Comment(s): Graduate standing in engineering required.
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.
Repeatability: 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. (Same as Biosystems Engineering Technology 532.)
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): Civil Engineering 395 or consent of instructor.

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.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): Coursework in thermodynamics and heat and mass transfer.

543 Instrumentation and Measurement (3) Modern instrumentation techniques. Static and dynamic response of instrumentation; signal conditioning; data acquisition and control. (Same as Environmental Engineering 543.)
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 451 or coursework in electronics and computer circuits.

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. (Same as Environmental Engineering 545.)
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 546.

550 Selected Topics (1-3) Lecture/group discussion on specialized topics.
Repeatability: 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. Specific topics: agriculture, environmental site assessment, natural resource management, and hydrology. (Same as Biosystems Engineering Technology 555.)
Contact Hour Distribution: 2 hours and 1 lab. 
Contact Hour Distribution: 2 hours and 1 lab.
Comment(s): Students with graduate standing in engineering, biological or physical sciences only.

575 Applied Microbiology and Bioengineering (3) (See Chemical Engineering 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. The student will learn how to implement spray drift reduction practices as well as make objective conclusions about spray drift test data.
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/No Credit grading only.
Repeatability: May be repeated.
Registration Restriction(s): Doctor of Philosophy – biosystems engineering major.

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

619 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.
(Re) Prerequisite(s): 519.

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, satellite imagery, precision geomatic techniques for the environmental scientist and engineer.
Contact Hour Distribution: 2 hours and 1 lab.
(Re) Prerequisite(s): 555.

650 Selected Topics (1-3) Lecture, group discussion, and individual study on specialized developments.
Repeatability: 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.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: General physics.

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.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: 2 semesters of calculus.

442 Agricultural Waste Management and Pollution Control (3) Waste renovation fundamentals; characteristics of animal manure; techniques for collection, transporting, storing, and utilizing livestock waste.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: 2 semesters of calculus.

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.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: 2 semesters of calculus.

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.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: 2 semesters of calculus.

500 Thesis (1-15)
Grading Restriction: P/No Credit only.
Repeatability: May be repeated.
Registration Restriction(s): Master of Science – biosystems engineering major.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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

506 Engineering Principles (3) Properties of materials, fundamentals of hydraulics, principles of electricity, thermal phenomena, applications in biological systems.
Contact Hour Distribution: 2 hours and 1 lab.

508 Special Problems in Biosystems Engineering Technology (1-3) Individual studies of current problems.
Repeatability: 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. 2-D applications with limited exposure to 3-D applications. Computer intensive course. Hands-on experience.
Contact Hour Distribution: 2 hours and 1 lab.
(Re) Prerequisite(s): 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.

Contact Hour Distribution: 2 hours and 1 lab.
Credit Restriction: Students cannot receive credit for both 434 and 534.
Registration Restriction(s): Minimum student level – graduate.

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.

Contact Hour Distribution: 2 hours and 1 lab.
(Re) Prerequisite(s): 506.

546 Automation Devices and Applications (3) Basic electronics as applied to simple automation systems, programmable controllers, data acquisition, digital logic and transducers.

Contact Hour Distribution: 2 hours and 1 lab.
(Re) Prerequisite(s): 506.

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.

Repeatability: May be repeated. Maximum 6 hours.

574 Environmental Instrumentation and Monitoring (3) Equipment and techniques commonly used to measure all aspects of hydrologic cycle: precipitation, runoff, streamflow, subsurface water movement. Sampling of all flows for contaminants. Design of monitoring systems. Analysis of data.

Contact Hour Distribution: 2 hours and 1 lab.
Credit Restriction: Students cannot receive credit for both 474 and 574.
(Re) Prerequisite(s): 506.
Recommended Background: Hydrology.
Registration Restriction(s): Minimum student level – graduate.

Business Administration (205)

501 MBA Career Development (1) Career opportunities available in each concentration.

Grading Restriction: Satisfactory/No Credit grading only.
Comment(s): Enrollment is limited to students admitted to the MBA program or by consent of the Assistant Dean of the MBA Program.


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.

Grading Restriction: Satisfactory/No Credit grading only.
Comment(s): Requires admission to the MBA program or consent MBA Program Director.


(De) Prerequisite(s): 511 or consent of Assistant Dean of MBA Program.
Comment(s): Requires admission to the MBA program or consent of MBA Program Director.

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.

(De) Prerequisite(s): 511 and 512 or consent of Assistant Dean of MBA Program.
Comment(s): Requires admission to MBA program or consent of MBA Program Director.


(De) Prerequisite(s): 511, 512, 513 or consent of Assistant Dean of MBA Program.
Comment(s): Requires admission to MBA program or consent of MBA Program Director.

520 Innovation and Entrepreneurship (3) Introduces students to innovation and entrepreneurship business logics and strategies. Topics include innovative problem solving, business consulting practices, business planning, continuous improvement, transformational change leadership, and project management.

(De) Prerequisite(s): 511, 512, and 513.


Comment(s): Master of Accountancy admission required.


Comment(s): Master of Accountancy admission required.


Comment(s): Master of Accountancy admission required.


Comment(s): Master of Accountancy admission required.


Comment(s): Executive MBA admission required.


(De) Prerequisite(s): 551.


(De) Prerequisite(s): 552.

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.

(De) Corequisite: 551.
Comment(s): Executive MBA admission and cooperation of sponsoring organization required.
562 Management Project II (3) Company project. Continuation of 561. Diagnosis and analysis of strategic issue. Work within firm under guidance of faculty member. 
(DE) Prerequisite(s): 561. 

563 Management Project III (3) Company project. Continuation of 562. Completion of analysis and presentation of report to senior management in sponsoring organization. Work within firm under guidance of faculty member. 
(DE) Prerequisite(s): 562. 

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. 
Comment(s): Requires admission to MBA program or consent of MBA Program Director. 

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

595 Entrepreneurial Strategy Implementation (3) Student teams of 2-4 individuals work with an entrepreneur to implement business strategies. Guided by a Statement of Work, students will conduct research, analyze company data, and interact weekly with the entrepreneur to understand goals of the strategy being implemented. One student per team will serve as the project manager, and a faculty member will serve as the Client Partner lead. 
(DE) Prerequisite(s): 511, 512, 513, and 520. 

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. 
(DE) Prerequisite(s): MBA core. 
Registration Permission: 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) 
Repeatability: May be repeated. Maximum 6 hours. 
Registration Permission: Consent of instructor. 

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

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. 
(DE) Prerequisite(s): 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 are used to design automation solutions: human-machine-interfaces. Workstations with modern industrial equipment, provide an interactive graphics, and visualization environment. 
(DE) Prerequisite(s): 360 and 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) 
Grading Restriction: P/NP only. 
Repeatability: May be repeated. 
Comment(s): Enrollment is limited to students admitted to the graduate program. 

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. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. 
Credit Restriction: May not be used toward degree requirements. 

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 decomposition 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. (Same as Biomedical Engineering 507; Electrical and Computer Engineering 507; Industrial Engineering 507; Materials Science and Engineering 507; Mechanical Engineering 507) 
Comment(s): Graduate standing or consent of instructor required. 

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. 

(DE) Prerequisite(s): 531. 

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 multicomponent 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. 

556 Data Mining in Engineering and Manufacturing (3) (See Industrial Engineering 556) 

561 Application of Multivariate Statistics to Process Monitoring and Data Analysis (3) Probability and distribution of single- and multi-variable systems. Estimation of population parameters. Factorial experimental design. Linear regression modeling in one and multi-variables and associated ANOVA. Application of multivariate statistical techniques in modeling and monitoring of engineering processes: fault detection and diagnostics. (Same as Industrial Engineering 561) 
Comment(s): Graduate standing or consent of the instructor required. 

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 Biosystems Engineering 575; Environmental Engineering 575; Microbiology 575) 

580 Technical Review and Assessment (3) Preparation of critical review literature in area related to chemical engineering 
Comment(s): Enrollment is limited to students in the non-thesis option. 
Registration Permission: Consent of advisor.
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. (Same as Engineering Science 585; Environmental Engineering 581.)

Comment(s): Graduate standing in engineering or consent of the instructor required.

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

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

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

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 505 and 547.

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

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

Chemistry (235)

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

(DE) Prerequisite(s): 230.

450 Advanced Organic Chemistry (3) Modern organic reactions of mechanistic, synthetic, and theoretical interest. Content reflects current trends in the area.

(DE) Prerequisite(s): 360.

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

473 Physical Chemistry I (3) Properties of gases; first, second and third laws of thermodynamics; chemical equilibrium; simple phase equilibria; properties of solutions.

Credit Restriction: Students may not receive credit for both 471 and 473.

(DE) Prerequisite(s): 130 or 138 and Physics 136 or 138 or 222 or 231 and Mathematics 241, 247.

479 Physical Chemistry Laboratory I (2) Experiments on topics discussed in 471 or 473.

Contact Hour Distribution: 1 lab.

(DE) Prerequisite(s) or (DE) Corequisite(s): 471 or 473.

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

483 Physical Chemistry II (3) Introduction to statistical thermodynamics: kinetics of chemical reactions; introduction to quantum mechanics and applications to electronic structure of atoms and molecules; molecular spectroscopy.

Credit Restriction: Students may not receive credit for both 481 and 483.

(DE) Prerequisite(s): 130 or 138 and Physics 136 or 138 or 222 or 231 and Mathematics 241, 247.

489 Physical Chemistry Laboratory II (2) Experiments on topics discussed in 481 or 483.

Contact Hour Distribution: 1 lab.

(DE) Prerequisite(s) or (DE) Corequisite(s): 481 or 483.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Chemistry Seminar (1) Lectures and discussion on current research. Continuous registration is required for resident graduate students.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

505 Special Problems (3) Specially assigned theoretical or experimental work on problems not covered in other courses.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of department.

510 Analytical Spectrometry (3) Principles and practice of optical and mass spectrometric techniques in quantitative chemical analysis.

(DE) Prerequisite(s): 2 semesters of physical chemistry.

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena.

(DE) Prerequisite(s): 2 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.

(DE) Prerequisite(s): 2 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.

(DE) Prerequisite(s): 1 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.

(DE) Prerequisite(s): 1 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.

(DE) Prerequisite(s): 1 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, isolobal theory, kinetics and mechanism of reactions of transition metals, and applications in organic synthesis.

(DE) Prerequisite(s): 1 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.

(DE) Prerequisite(s): 2 semesters of organic chemistry.

551 Organic Reactions (3) Organic transformations of use in synthesis; carbonyl chemistry and carbon-carbon bond formation; stereochemistry and regiochemistry of synthetic processes.

(DE) Prerequisite(s): 550.

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.

(DE) Prerequisite(s): 550.

553 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry.

(DE) Prerequisite(s): 2 semesters of organic chemistry.

554 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS and multinuclear FTNMR spectrometers. Development of problem-solving ability in area of spectroscopic characterization of organic molecules.

(DE) Prerequisite(s): 360 or equivalent.

(DE) Corequisite(s): 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.

(DE) Prerequisite(s): 2 semesters of physical chemistry.

571 Advanced Quantum Chemistry and Spectroscopy (3)
(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 2 semesters of physical chemistry.

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory.

(DE) Prerequisite(s): 2 semesters of physical chemistry.
590 Polymer Chemistry (3) Fundamentals of polymer synthesis and characterization through application of organic and physical chemical principles.

Recommended Background: 2 semesters of organic chemistry and 2 semesters of physical chemistry.


(DE) Prerequisite(s): 590 or equivalent.

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

(DE) Prerequisite(s): 590 or equivalent.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

601 Chemistry Research Proposal (2) Preparation and oral defense of original written research proposal based on thorough survey of chemical literature.

Grading Restriction: Satisfactory/No Credit grading only.

Registration Permission: Consent of department head.

610 Selected Topics in Analytical Chemistry (3) Topics of current significance.

Repeatability: May be repeated. Maximum 12 hours.

(DE) Prerequisite(s): 510, 511, and 512 or consent of instructor.

630 Selected Topics in Inorganic Chemistry (3) Topics of current significance.

Repeatability: May be repeated. Maximum 12 hours.

(DE) Prerequisite(s): 530, 531, and 532 or consent of instructor.

650 Selected Topics in Organic Chemistry (3) Topics of current significance.

Repeatability: May be repeated. Maximum 12 hours.

(DE) Prerequisite(s): Any two of 550, 551, 552 or consent of instructor.

670 Selected Topics in Physical Chemistry (3) Topics of current significance.

Repeatability: May be repeated. Maximum 12 hours.

(DE) Prerequisite(s): 570, 572, and 573 or consent of instructor.

690 Selected Topics in Polymer Chemistry (3) Topics of current significance.

Repeatability: May be repeated. Maximum 12 hours.

Registration Permission: Consent of instructor.

691 Selected Topics in Thermal Analysis of Polymeric Materials (3) Topics of current significance.

Repeatability: May be repeated. Maximum 9 hours.

Credit Restriction: Maximum 3 hours may be applied toward the chemistry major.

Registration Permission: Consent of instructor.

Child and Family Studies (245)

500 Thesis (1-15)

Grading Restriction: 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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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.


(DE) Prerequisite(s): 510 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) Comparison and contrast of theoretical frameworks 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.


(DE) Prerequisite(s): 6 hours of graduate coursework in child and family studies.

545 Family Resource Management and Instruction (3) Design and implementation of family resource management curriculum for family life education audiences based on theory and application of managerial functioning in family settings; analysis of goals, resource use. Information systems, constraints within families. Observation and analysis of diverse family practices.

(DE) Prerequisite(s): 563.

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

552 Diversity in Children and Families (3) Diversity in family configurations in contemporary U.S. society. Variations of family patterns by race, ethnicity, religion, and social class; social dynamics of family formation, composition, and patterning.

(DE) Prerequisite(s): 550.

560 Human Sexuality (3) Theory, research, and family life education practice related to study of human sexuality: individual, relational, cognitive, emotional, biological, and developmental issues of human sexuality.

(DE) Prerequisite(s): 550 and 563.

562 Families and Children Coping with Stress (3) Processes used by children and families during times of stress. Theoretical contributions to study of impact of developmental stressors and catastrophes on children and families.

(DE) Prerequisite(s): 550.

563 Family Life Education Programs (3) Planning, implementing and evaluating programs in marital, parent-child, and family relationships, and parenthood education.

(DE) Prerequisite(s): 550.

564 Practicum in Human Development or Family Studies I (3) School and community programs. Education for human development and family living.

Grading Restriction: Satisfactory/No Credit grading only.

Registration Permission: Consent of instructor.

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.

Grading Restriction: 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. (Same as Counselor Education 566.)

(DE) Prerequisite(s): 562.

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.

(DE) Prerequisite(s): 550.

569 Action Research in Early Childhood Education (3) Principles and methodologies of action research for practitioners in early childhood and school settings.

Comment(s): Requires admission to the early childhood education graduate concentration in the College of Education, Health, and Human Sciences.


(DE) Prerequisite(s): 9 graduate hours in the major.
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 subjects 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.

Repeatable: Not repeatable. May be taken once for 1-2 hours.

(DE) Prerequisite(s): 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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatable: May be repeated. Maximum 12 hours.

Comment(s): Requires admission to the teacher education program.

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, symbolic interaction, work and family, Piaget, mainstreaming children, theory and research in human sexuality, cognition.

Repeatable: May be repeated if topic differs. Maximum 9 hours.

(DE) Prerequisite(s): 352.

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.

Repeatable: May be repeated if topic differs. Maximum 6 hours.

(DE) Prerequisite(s): 6 graduate hours or consent of instructor.

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.

Repeatable: Not repeatable. May be taken once for 1-4 hours.

(DE) Prerequisite(s): 575.

600 Doctoral Research and Dissertation (3-15) Applied seminar in second-language acquisition. Study and analysis of selected readings and research designs.

Grading Restriction: P/ NP only.

Repeatable: May be repeated.

610 Advanced Special Topics in Human Development or Family Studies (1-3) Study of research and theory related to current issues.

Repeatable: May be repeated if topic differs. Maximum 6 hours.

(DE) Prerequisite(s): 12 graduate hours in the major or consent of instructor.

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.

Repeatable: May be repeated if topic differs. Maximum 6 hours.

631 Adolescent Development in Families (3) Normative and non-normative adolescent development: physical, cognitive, moral, social, familial, sexual, and personality.

(DE) Prerequisite(s): 510, 511, and 550.

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.

(DE) Prerequisite(s): 570, master’s core, and 6 hours of 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.

(DE) Prerequisite(s): 550, 510, and 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.

(DE) Prerequisite(s): Communication 642 or Psychology 613.


(DE) Prerequisite(s): 9 hours of graduate family studies coursework.


(DE) Prerequisite(s): 9 hours of graduate family studies coursework.

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.

(DE) Prerequisite(s): 570.


SPSS analytic software.

(DE) Prerequisite(s): 570 and Statistics 532 and 537.

680 Knox Area Family and Child Study (KAFACS) Research Practica I (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.

(DE) Prerequisite(s): 570.

681 Knox Area Family and Child Study (KAFACS) Research Practica II (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.

(DE) Prerequisite(s): 570.

691 Analytic Reasoning (3) Analysis of quantitative methods and measures used in human development and family research: validity, reliability, causality, and generalizability.

(DE) Prerequisite(s): 570, 9 hours of graduate coursework in child and family studies, and 6 hours graduate-level statistics.

Chinese (249)

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

Cinema Studies (251)

400 Special Topics (3) Repeatable: 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.)

435 Cinematography as Art (4) (See Art Media Arts 435.)

436 Video Art (4) (See Art Media Arts 436.)

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

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

482 Special Topics in Global Cinema (3) (See Modern Foreign Languages and Literatures 482.)

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

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

582 Special Topics in Global Cinema (3) (See Modern Foreign Languages and Literatures 582.)

Civil Engineering (254)

416 Hydrologic and Water Quality Engineering (3) (See Biosystems Engineering 416.)

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

(DE) Prerequisite(s): 352.

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

(DE) Prerequisite(s): 352.

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

(DE) Prerequisite(s): 471.

474 Reinforced Concrete Design (3) Design of continuous beams, floor slabs, and columns with combined axial loads and bending, footings; and design for torsion.

(DE) Prerequisite(s): 471.

485 Principles of Hydrogeology (3) (See Geology 485)
540 Construction Management I (3) Management and organization of
    heavy and building construction projects.
    (DE) Prerequisite(s): 442.

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

543 Construction Estimating (3) Project costs, estimating and takeoff
    techniques, market cost conditions, and feasibility of design to cost.
    (DE) Prerequisite(s): 442.

550 Transportation Seminar (1) Seminar topics in transportation en-
    gineering. Research contributions and case histories by graduate students
    and engineers and scientists from the professional community.
    Grading Restriction: Satisfactory/No Credit grading only.
    Repeatability: May be repeated. Maximum 10 hours.
    Comment(s): Minimum student level – senior.
    Registration Permission: Consent of instructor.

551 Traffic Engineering: Characteristics (3) Characteristics of human,
    vehicle, and roadway in transportation system; microscopic and macro-
   scopic traffic models; elements of transportation/highway safety.
    (DE) Prerequisite(s): 352.

552 Traffic Engineering: Operations (3) Operation and management of
    the surface transportation system including freeways and arterials; traffic
    control systems including traffic signal design and operation; traffic con-
    trol devices including signing and markings.
    (DE) Prerequisite(s): 551.

553 Geometric Design and Layout of Roadways and Community Fa-
    cilities (3) Functional and geometric design and rural and urban roads of
    all classes; subdivision layout; configuration of urban roads of all class-
    es; techniques for access control; freeway interchanges and street inter-
    sections; and parking.
    (DE) Prerequisite(s): 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.
    (DE) Prerequisite(s): 452 or graduate standing.

557 Transportation Planning and Operations with Micro-Computer
    Applications (3) Hands-on laboratory and field experiences in computer
    and information technology for modeling and analysis of transportation
    problems.
    Contact Hour Distribution: Lecture and lab.
    (DE) Prerequisite(s): 551.

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
    community features. Use of planning process to establish existing
    travel patterns, modeling of demand, proposing alternatives and evalu-
    ation. (Same as Political Science 555.)
    Comment(s): Enrollment limited to students with graduate standing.

559 Intermodal Transportation (3) Technical and institutional aspects of
    intermodal transportation system for passengers and freight providing in-
    tercity and urban service; characteristics of individual modes and strate-
    gies for their coordination; functional design and operation of transporta-
    tion terminals including seaports and air cargo terminals; safety and se-
    curity issues.
    Comment(s): Minimum student level – senior.

561 Finite Element Applications in Structural Engineering (3) Appli-
    cation of finite element method to typical problems in structural engineer-
    ing. Truss, beam and plate elements; two-dimensional stress and strain;
    two-dimensional stress and strain; representation of nonlinear material behavior
    with elastic and elastic-plastic models. Taught concurrently with 538.
    Grading Restriction: Students may not receive credit for both 561 and 538.
    (DE) Prerequisite(s): Coursework in soil behavior and matrix computation.
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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 471.

576 Masonry Design (3) Clay and concrete masonry materials; unreinforced masonry design; reinforced masonry design; seismic behavior of masonry structures.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): Calculus II or consent of instructor.

590 Special Problems in Civil Engineering (3)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment limited to students in non-thesis option only.

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

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
(DE) Prerequisite(s): 435.

651 Analysis Techniques for Transportation Systems I (3) Topics on mathematical, statistical, operations research, or computer science techniques that may be applied to modeling and analysis of transportation systems.
Registration Permission: Consent of instructor.

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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 580 or consent of instructor.

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

Classics (257)

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

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

405 Selected Readings from Greek Literature (3) For advanced students in Greek, the study of plays, historical writings, the poetry of ancient Greece in the original Greek.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 401 and 402 or consent of instructor.

406 Selected Readings from Greek Literature (3) For advanced students in Greek, the study of plays, historical writings, the poetry of ancient Greece in the original Greek.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 401 and 402 or consent of instructor.

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

431 Selected Readings from Latin Literature (3) For advanced students in Latin. Oratory, historical writings, poetry of ancient Rome in the original Latin.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 351 and 352 or consent of instructor.

432 Selected Readings from Latin Literature (3) For advanced students in Latin. Oratory, historical writings, poetry of ancient Rome in the original Latin.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 351 and 352 or consent of instructor.

435 Medieval Latin (3) Selected readings from the Latin prose and poetry of medieval Europe.
Registration Permission: 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. (Same as Anthropology 436.)

441 Special Topics in Classical Civilization (3) Topics in art, literature, religion, and society of Greece and Rome.
Repeatability: 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 BC. 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. (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 BC). Developments in architecture, sculpture, and vase painting seen in the context of changes in society. Archaeological evidence for daily life, economy, and political institutions. (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 BC–AD 476). Highlights are the rise and decline of Etruscan culture, the development of Roman architecture, art, and urban planning, art and architecture used for political propaganda, and Roman cosmopolitan culture during the Empire. (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. (Same as Anthropology 562.)
Repeatability: May be repeated. Maximum 9 hours.

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. (Same as Anthropology 565.)
Repeatability: May be repeated. Maximum 15 hours.
591 Foreign Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Comment(s): Enrollment is limited to students admitted to the program.

540 Communication Theory (3)  
Overview of theory-building processes and theories in communication.  
Comment(s): Enrollment is limited to students admitted to the program or by consent of the instructor.

600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

610 Perspectives on Communication and Information Knowledge and Research I (6)  
Examination of the paradigmatic underpinnings that drive research in positivistic traditions. Integrative study of the role of theory, various theoretical traditions and methods within positivistic communication and information research. Themes on classic and contemporary literature and on conducting primary research across the various fields represented by the college.  
Comment(s): Requires admission to the program or consent of instructor.

615 Perspectives on Communication and Information Knowledge and Research II (6)  
Examination of the paradigmatic underpinnings that drive research in interpretivist traditions. Integrative study of the role of theory, various theoretical traditions and methods within interpretivist communication and information research. Themes on classic and contemporary literature and on conducting primary research across the various fields represented by the college.  
(DE) Prerequisite(s): 610.  
Registration Permission: Consent of instructor.

620 Seminar in Communication and Information Education (1-3)  
Topics examining the role and scope of communication and information teaching and professional development.  
Repeatability: May be repeated. Maximum 4 hours.  
Comment(s): Requires admission to the program or consent of instructor.

630 Theory and Literature in Communication and Information Disciplines (3)  
Topics covering specific areas in communication and information. Theory intensive.  
Repeatability: May be repeated. Maximum 12 hours.  
(DE) Prerequisite(s): 610 and 615.  
Registration Permission: Consent of instructor.

640 Advanced Communication and Information Research Methods (3)  
Topics in communication and information research design, methodology, analysis. Methods intensive.  
Repeatability: May be repeated. Maximum 12 hours.  
(DE) Prerequisite(s): 610 and 615.  
Registration Permission: Consent of instructor.

Communication Studies (250)

500 Thesis (1-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

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.  
Repeatability: May be repeated. Maximum 6 hours.  
Registration Permission: Consent of instructor.

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.  
Grading Restriction: 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.  
Repeatability: 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.  
Repeatability: May be repeated. Maximum 6 hours.

593 Independent Study (1-6)  
Independent study by individual under direction of faculty member.  
Comment(s): Approval of faculty member and department must be obtained prior to registration.

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)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 9 hours.  
Comment(s): Open to all graduate students.  
Registration Permission: Consent of instructor.

541 Cellular and Molecular Basis of Disease (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.  
(DE) Prerequisite(s): Biochemistry and Cellular and Molecular Biology 410 and 419.

600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

601 Journal Club in Comparative and Experimental Medicine (1)  
Readings and discussions based on current literature.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 12 hours.

610 Medical Biology Seminar (1)  
Invited speakers. Topics posted in advance.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 12 hours.

611 Advanced Topics in Medical Science (1-3)  
New developments in biological research applicable to clinical medicine.  
Repeatability: May be repeated. Maximum 12 hours.  
Comment(s): Primarily for doctoral candidates in comparative and experimental medicine.  
Registration Permission: Consent of instructor.
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)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Special Topics in Comparative and Experimental Medicine (1-6)
Specialized experience in comparative and experimental medicine.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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)
Contact Hour Distribution: 1 hour and 2 labs.
(DE) Prerequisite(s): Coursework in embryology, parasitology, and physiology and/or consent of instructor.

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.
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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

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

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

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

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.
Registration Permission: 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 technical training in virus diseases diagnosis.
Contact Hour Distribution: 2 hours and 1 lab.
Registration Permission: Consent of instructor.

608 Descriptive and Applied Epidemiology (3)
Principles of epidemiology as well as historic and modern applications to human and animal diseases. Host-agent relationships, measurement of diseases frequency, disease monitoring and control in human and animal populations, field investigations, animal health economics and production.
Registration Permission: Consent of instructor.

609 Mechanisms of Disease (4)
Advanced topics in pathobiology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, hemostasis. 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.
Registration Permission: 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.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

611 Journal Club in Emerging Infectious Diseases (1) Readings and discussions based on current literature.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

612 Journal Club in Pathobiology (1) Readings and discussions based on current literature.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

613 Journal Club in Large Animal Clinical Sciences (1) Readings and discussions based on current literature.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

614 Journal Club in Small Animal Clinical Sciences (1) Readings and discussions based on current literature.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: 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 Special Topics in Comparative Literature (3)
Repeatability: May be repeated. Maximum 9 hours.

402 Special Topics in Comparative Literature (3) Content varies.
Repeatability: 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)
Repeatability: May be repeated. Maximum 6 hours.

Computer Science (266)

420 Advanced Topics in Machine Intelligence (3)
Topics such as search, learning, expert systems, neural networks, pattern recognition, and natural language processing. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Completion of core curriculum or consent of instructor.

430 Advanced Topics in Hardware Systems (3)
Topics such as architecture, parallel processors, microprogramming, networks, and communications. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Completion of core curriculum or consent of instructor.

460 Advanced Topics in Software Systems (3)
Topics such as operating systems, compilers, parallel computation, software engineering, database systems, and programming languages. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Completion of core curriculum or consent of instructor.

470 Advanced Topics in Scientific Computation (3)
Topics such as numerical methods, supercomputers and computer modeling and simulation of physical systems. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Completion of core curriculum or consent of instructor.

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

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

480 Advanced Topics in Theoretical Computer Science (3)
Topics such as theory of computation, complexity theory, formal languages and graph theory and its applications. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Completion of core curriculum or consent of instructor.
494 Special Topics in Computer Science (1-3)  
Repeatability: May be repeated. Maximum 9 hours.

500 Thesis (1-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

522 Cybernetics (3) Various functions in living systems and their actual or potential realization in computers.  
(DE) Prerequisite(s): Coursework in 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.  
(DE) Prerequisite(s): Coursework in 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.  
Recommended Background: Coursework in discrete structures.

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.  
(DE) Prerequisite(s): Coursework in discrete structures and probability or statistics.

552 Image Analysis (3) Enhancement and restoration of digital images. 2-D transforms. Segmentation and description. Computational procedures for image reconstruction.  
(DE) Prerequisite(s): 1 year of calculus and coursework in 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.  
Recommended Background: Coursework in systems programming.

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

572 Numerical Mathematics (3) (See Mathematics 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.  
(DE) Prerequisite(s): Numerical linear algebra course.

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

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.  
(DE) Prerequisite(s): Fundamental algorithms course.

592 Off-campus Study (1-6)  
Repeatability: May be repeated. Maximum 6 hours.

593 Independent Study (1-15)  
Repeatability: May be repeated. Maximum 45 hours.

594 Special Topics in Computer Science (1-3)  
Repeatability: May be repeated. Maximum 45 hours.

600 Doctoral Research and Dissertation (3-15) P/NP only.  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

620 Advanced Topics in Intelligent Systems (1-6)  
Repeatability: May be repeated. Maximum 45 hours.  
Registration Permission: Consent of instructor.

650 Advanced Topics in Pattern/Image Analysis (1-6)  
Repeatability: May be repeated. Maximum 45 hours.  
Registration Permission: Consent of instructor.

660 Advanced Topics in Software Systems (1-6)  
Repeatability: May be repeated. Maximum 45 hours.  
Registration Permission: Consent of instructor.

670 Advanced Topics in Scientific Computing (1-6)  
Repeatability: May be repeated. Maximum 45 hours.  
Registration Permission: Consent of instructor.

680 Advanced Topics in Theory and Foundations (1-6)  
Repeatability: May be repeated. Maximum 45 hours.  
Registration Permission: Consent of instructor.

690 Advanced Topics in Computer Science (1-6)  
Repeatability: May be repeated. Maximum 45 hours.  
Registration Permission: Consent of instructor.

Counselor Education (255)

410 Sex Role Development: Implications for Education and Counseling (3) Theories and research concerning the development of sexual role and its relevance in educational and counseling settings. (Same as Women’s Studies 410.)

431 Personality and Mental Health (3) Perspectives of mental health with applications 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)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

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

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

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

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.  
Comment(s): Requires admission to the 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. Internet access account is required.  
(DE) Prerequisite(s): 552 or consent of instructor.

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. (Same as Psychology 569.)
   Repeatability: May be repeated. Maximum 9 hours.
   (DE) Prerequisite(s): 431, 525, and 551.
   Comment(s): Admission to program is required.
   Registration Permission: Consent of instructor.

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.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 12 hours.
   (DE) Prerequisite(s): 555.
   Registration Permission: Consent of instructor.

559 Internship in Mental Health Counseling (1-6) Supervised post-practicum employment at academic unit approved human services agency.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 12 hours.
   (DE) Prerequisite(s): 555.
   Comment(s): Admission to mental health counseling program required.
   Registration Permission: Consent of instructor.

560 Directed Research (1-3) Open to juniors, seniors, and graduate students.
   Grading Restriction: P/NP only.
   Repeatability: May be repeated. Maximum 15 hours.

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.
   (DE) Prerequisite(s): 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.
   (DE) Prerequisite(s): 551 and 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. (Same as 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) Grading Restriction: Satisfactory/No Credit or letter grade.
   Repeatability: May be repeated. Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only.
   Repeatability: May be repeated.

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.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 12 hours.

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

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.
   Comment(s): Admission to the doctoral program in counselor education required.

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

655 Practicum in Counselor Education (3) Supervised practice and application of counseling skills with clients.
   Repeatability: May be repeated. Maximum 6 hours.
   Comment(s): Admission to counselor education program required.
   Registration Permission: Consent of instructor.

659 Internship in Counselor Education (1-6) Supervised experience in departmentally approved counseling, teaching, supervision, or consultation internship sites.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 12 hours.
   Comment(s): Admission to doctoral program in counselor education required.
   Registration Permission: Consent of instructor.

   Comment(s): Requires admission to PhD program or consent 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.
   Comment(s): Requires admission to PhD program or consent 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.
   Comment(s): Requires admission to PhD program or consent 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.
   Comment(s): Requires admission to the PhD program or consent of instructor.

693 Independent Study (1-3) Grading Restriction: Satisfactory/No Credit or letter grade.
   Repeatability: May be repeated. Maximum 15 hours.

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. (Same as Women’s Studies 512.)

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 philosophical approach to lives and writings of influential educators: Plato, Quintillian, Comenius, Rosseau, Pestalozzi, Froebel, Dewey.

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 educational system and potential solutions offered by various programs.
   Comment(s): 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. (Same as Women’s Studies 548.)

549 Topics in International Education (3) Historical, philosophical, and sociological foundations; selected nations and their cultures.
   Repeatability: 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 projects. 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.
   (DE) Prerequisite(s): 560 or equivalent.

590 Cultural Studies Seminar (2) Two-semester sequence (fall and spring) covering discussion about cultural studies: popular culture, interdisciplinary work, social justice issues. Presentations, videos, readings.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 4 hours.
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 Social Justice and Education (3) Social justice issues: education practices. Social justice, moral commitments to others in educational settings, and equal opportunity to acquire social goods and benefits.

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

Comment(s): For doctoral students in education only.

608 Seminar in Philosophy of Education (3) Selected philosophical issues in education.

Repeatability: May be repeated with consent of instructor.

(DE) Prerequisite(s): 2 courses in the history or philosophy of education.

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. (Same as Women’s Studies 609.)

625 Seminar in History of Education (3) Selected historical issues in education.

Repeatability: May be repeated with consent of instructor.

(DE) Prerequisite(s): 2 courses in the history or philosophy of education.


(DE) Prerequisite(s): 560.

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. (Same as Educational Administration 534; Higher Education Administration 534.)

Registration Permission: Consent of instructor.

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.

560 Student Assessment (3) Processes for assessing and reporting 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 two consecutive semesters.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

623 Using Research for Curriculum Improvement (3) Research methodology; application to descriptive/survey curricular materials. Critical reading of research, methodological development in descriptive and survey areas.

630 Seminar in Assessment and Evaluation (3) Trends and issues in student/clinician assessment, personnel evaluation, and program evaluation; and examination of current state, regional, and national assessment and evaluation projects.

Registration Permission: 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.

(DE) Prerequisite(s): 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.

Registration Permission: 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.

676 Curriculum Theory (3) Influential curriculum theories and approaches, implications for structure and design of educational programs. Nature and function of theory, theory building activities.

(DE) Prerequisite(s): 558.

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. A mini-teaching experience is involved in this class.

480 Dance History through the 19th Century (3) Survey of the dance of various societies and cultures from pre-history through the 19th century.

490 Dance in the 20th Century (3) Survey of the history and philosophy of dance in the 20th century.

495 Dance Pedagogy (3) Principles and methods of teaching dance with practical application in a mini-teaching experience. Different level of performance is expected of those registered for graduate credit.

Comment(s): Upper-class or graduate standing required.

Registration Permission: Consent of instructor.

510 Ballet: Level IV (2) Instruction and practice in advanced classical ballet techniques.

Repeatability: May be repeated. Maximum 8 hours.

Registration Permission: Consent of instructor.

520 Jazz: Level IV (2) Instruction and practice in advanced jazz styles and techniques.

Repeatability: May be repeated. Maximum 8 hours.

Registration Permission: Consent of instructor.

530 Modern: Level IV (2) Instruction and practice in advanced modern dance techniques.

Repeatability: May be repeated. Maximum 8 hours.

Registration Permission: Consent of instructor.

550 Dance Composition IV (3) Independent study applying choreographic and production skills, culminating in presentation of two works.

(DE) Prerequisite(s): 440 and 445 or consent of instructor.

593 Independent Study (1-3)

Grading Restriction(s): Satisfactory/No Credit or letter grade.

Repeatability: May be repeated. Maximum 12 hours.

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).

(DE) Prerequisite(s): Biology 102 or 110 or 130.

411 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.

Repeatability: May be repeated. Maximum 4 hours.

Credit Restriction(s): Maximum 4 hours may be applied toward departmental major.

Comment(s): Prerequisites as announced.
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. Repeatability: May be repeated. Maximum 4 hours.

Credit Restriction(s): Maximum 4 hours may be applied toward departmental major.

Comment(s): Prerequisites as announced.

414 Plant Anatomy (3) Cells, tissues and organs, their development in vegetative and reproductive structures of vascular plants – emphasis on seed plants.

(DE) Prerequisite(s): Biology 111 and 112 or Biology 130 and 140.

419 Science as Method (3) The dynamic process of scientific discovery, as opposed to a static body of knowledge. Topics included will be comparisons of science, nonscience, pseudoscience, successful and unsuccessful science, the ethics of scientific research, and the philosophical aspects of the scientific enterprise. Implications for teaching and writing about science will be covered. (Same as Philosophy 419.)

(DE) Prerequisite(s): Introductory science or philosophy course or consent of instructor.

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. Includes periodic field trips or laboratories.

(DE) Prerequisite(s): Biology 250 or equivalent.

433 Plant Ecology (3) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in ecosystems. Includes weekly field trips or laboratory periods and at least two weekend field trips.

(DE) Prerequisite(s): 330 or equivalent.

446 Introduction to Oceanography (4) Basic oceanography: including physical, chemical, geological and biological processes and patterns. Emphasis on oceanic subsystems such as upwellings, polar oceans, hydrothermal vents, gyres, coral reefs, estuaries, and coastal regions. Field trip to coast required.

(DE) Prerequisite(s): General biology and Chemistry 120 and 130.

Recommended Background: Biology 250.

450 Comparative Animal Behavior (3) Principles and methods of ethology: emphasis on ecological, developmental, physiological, and evolutionary aspects. (Same as Psychology 450.)

459 Comparative Animal Behavior Laboratory (3) Introduction to observational and experimental research in ethology. (Same as Psychology 459.)

(DE) Corequisite(s): 450.


Contact Hour Distribution: 3 hours and 2 hours lab/discussion.

(DE) Prerequisite(s): 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. Repeatability: May be repeated if topic differs. Maximum 12 hours.

(DE) Prerequisite(s): Biology 250 or consent of instructor.

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.

Contact Hour Distribution: 2 hours and 2 labs.

(DE) Prerequisite(s): Biology 250 or consent of instructor.

Recommended Background: Physics 221.

470 Aquatic Ecology (3) Introduction to the physicochemical nature of inland waters with description of biotic communities and their interrelationships.

Contact Hour Distribution: 2 hours and 1 lab.

(DE) Prerequisite(s): Chemistry 120 and 130 and Biology 250.

474 Ichthyology (4) Evolution, classification, collection and identification, distribution and biology of fishes with emphasis on freshwater fauna of Eastern North America.

Contact Hour Distribution: 2 hours and 2 lab.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): Biology 240 and 250.

500 Thesis (1-15) Grading Restriction: P/RNP only. Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: Not be used toward degree requirements.

503 Ecology and Evolutionary Biology Seminar (1) Advanced topics in ecology, behavior, and evolutionary biology. Required of all first- and second-year graduate students. Senior departmental majors are encouraged to enroll.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 4 hours.

504 Special Topics (1-3) Selected directed readings or special course in topics of current interest. Consult departmental listing for offerings.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated with consent of instructor. Maximum 9 hours.

508 Introduction to Faculty Research (1) Orientation of new graduate students to current research of departmental graduate faculty. Required of all first-year students.

Grading Restriction: Satisfactory/No Credit grading only.

Comment(s): Admission to program in ecology and evolutionary biology required.

509 Foundations: Readings in Ecology (1-2) Readings and discussion of classic papers in field.

Repeatability: Not repeatable. May be taken once for 1-2 hours.

511 Foundations: Readings in Evolution (1-2) Readings and discussion of classic papers in field.

Repeatability: Not repeatable. May be taken once for 1-2 hours.

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.

Repeatability: Not repeatable. May be taken once for 1-2 hours.

530 Advanced Taxonomy of Flowering Plants (3) Evolution and classification of families of angiosperms, local flora.

Contact Hour Distribution: 2 hours lecture and 1 lab.

(DE) Prerequisite(s): 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 a field trip of 1-10 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.

Contact Hour Distribution: 4 hours combined lecture/lab.

Registration Permission: 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.

Contact Hour Distribution: 4 hours combined lecture/lab.

(DE) Prerequisite(s): 540 or consent of instructor.

543 Aquatic Insects (3) Taxonomy and biology of aquatic insects; immature forms.

Contact Hour Distribution: 2 hours and 1 lab.

(DE) Prerequisite(s): Consent of instructor.

545 Advanced Animal Behavior (3) Second-level course in ethology, stressing evolution, genetics, physiology, ecology, and human behavior. (Same as Psychology 545.)

(DE) Prerequisite(s): 450 or equivalent.

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. (Same as Geology 557.)

Registration Permission: Consent of instructor.
560 Biometry (3) Statistical applications in biological research.  
(DE Prerequisite(s): 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.  
(Same as Biochemistry and Cellular and Molecular Biology 561.)  
(DE Prerequisite(s): Biology 250 or consent of instructor.

575 Ecological Genetics (3) Genetics of natural populations, using both single-locus and quantitative genetical approaches.  
(DE Prerequisite(s): 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.  
(DE Prerequisite(s): Biology 250 or consent of instructor.

581 Mathematical Ecology (3) (See Mathematics 581.)

582 Mathematical Ecology (3) (See Mathematics 582.)

583 Zoogeography (3) Processes determining geographic distribution of animals and distribution and composition of animal communities.  
(DE Prerequisite(s): Ecology course or consent of instructor.

585 Mathematical Evolutionary Theory (3) (See Mathematics 583.)

591 Foreign Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

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.  
Credit Restriction: Students cannot receive credit for both 595 and 495.  
(DE Prerequisite(s): General biology course, general ecology course, coursework (1 or more courses) in organismal biology (ecology, evolution) at the upper-undergraduate level or consent of instructor.

600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Repeatability: 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.  
Repeatability: 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.  
Repeatability: May be repeated with consent of department. Maximum 9 hours.

607 Seminar in Ecology and Evolutionary Biology (1) Readings and discussion based on current literature.  
Repeatability: May be repeated. Maximum 12 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.  
Repeatability: May be repeated with consent of department. Maximum 9 hours.

610 Advanced Topics in Mathematical, Theoretical and Computational Biology (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.  
Repeatability: 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.  
Repeatability: 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.  
(Same as Biochemistry and Cellular and Molecular Biology 612.)  
Repeatability: May be repeated with consent of department. Maximum 9 hours.

662 Seminar in the History of Botany (2) History of botanical exploration and advances from early civilization to modern periods.  
Repeatability: May be repeated. Maximum 4 hours.

681 Advanced Mathematical Ecology (3) (See Mathematics 681.)

682 Advanced Mathematical Ecology (3) (See Mathematics 682.)

Economics (283)

400 Special Topics II (3) Variable topics for advanced students.  
(DE Prerequisite(s): 311 or 312 and 313.  
Registration Permission: Consent of instructor.

413 Macroeconomics: Business Cycles and Growth (3) Analysis of macroeconomic short-run fluctuations and long-term growth. Coverage will also include the role of monetary and fiscal policy on aggregate output, employment, and interest rates.  
(DE Prerequisite(s): 313.

421 International Economics (3) Balance of payments, exchange rate determination, monetary and fiscal policies, monetary arrangements, comparative advantage, tariff and non-tariff trade distortions, protection arguments, and regional integration, with analyses based upon intermediate-level economic theory.  
(DE Prerequisite(s): 311 or 312.

435 Industrial Organization (3) Monopoly and competition in United States economy; interrelationship of market structure, business behavior, and economic performance.  
(DE Prerequisite(s): 311 or 312.

436 Economics of Health and Health Care (3) Medical care and health status; demand for medical care and insurance; physician and hospital supplies; government provision of services and insurance; regulation of health care markets.  
(DE Prerequisite(s): 311 or 312.

441 Labor Economics (3) Extension of economic principles to labor markets, public policy questions, demand and supply, theory of wage differentials, unemployment, unions in the private sector, investment in individuals, education and training, mobility.  
(DE Prerequisite(s): 311 or 312.

463 Environmental Economics (3) Economic foundations for public decision making about environmental resources, utilizing tools from intermediate microeconomic theory. Emphasis on the welfare economic approach for the provision of public goods, with specific emphasis on market failure, externalities, benefit-cost analysis, and methods for valuing environmental resources and human health.  
(DE Prerequisite(s): 311 or 312.

472 Public Finance: Taxation and Fiscal Federalism (3) Analysis of federal, state, and local government revenue systems, to include individual and corporate income, sales, and property taxes and other tax and non-tax revenue sources. Consideration of current policy issues and relations among various levels of government.  
(DE Prerequisite(s): 311 or 312.

482 Introduction to Mathematical Economics (3) Application of basic mathematical tools (e.g., calculus, matrix algebra, etc.) to major topics of economic theory.  
(DE Prerequisite(s): 311 or 312.

500 Thesis (1-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

511 Microeconomic Theory (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.
512 Microeconomic Theory (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 Macroeconomic Theory (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.

514 Macroeconomic Theory (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.

579 Environmental Policy Research Workshop (1) Multidisciplinary analysis of advanced topics in environmental policy. Student participation. Major writing requirement.

Registration Permission: Consent of instructor.


582 Elements of Econometrics I (3) Elementary econometric concepts and techniques. Least squares and maximum likelihood estimation, specification and econometric problems, statistical inference, generalized least squares, simultaneous equation models, applications of concepts to economic problems.

(DE) Prerequisite(s): 311 and a calculus course.

583 Elements of Econometrics II (3) Elementary econometric concepts and techniques. Least squares and maximum likelihood estimation, specification and econometric problems, statistical inference, generalized least squares, simultaneous equation models, applications of concepts to economic problems.

(DE) Prerequisite(s): Introductory statistics course.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.

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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

Registration Permission: 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.

Registration Permission: Consent of instructor.

651 Monetary Theory (3) Study of money, credit, and liquidity as related to real output determination, interest rates, employment, and prices.

(DE) Prerequisite(s): 513.

652 Topics in Monetary Theory (3) Advanced monetary models, issues in monetary policy, open economy monetary theory and policy. Student participation.

(DE) Prerequisite(s): 651.

661 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 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 federalism and intergovernmental relations.

677 Environmental and Natural Resource Economics (3) Models 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.

(DE) Prerequisite(s): 582 and 583.

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.

(DE) Prerequisite(s): 582 and 583.

690 Workshop (3) Advanced topics in economics. Student participation.

Repeatability: May be repeated. Maximum 9 hours. Registration Permission: Consent of instructor.

693 Independent Study (1-3) Directed research on topic of mutual interest to faculty and student. Variable title for transcript purposes.

Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.

Education (289)

540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and in-service programs.

Grading: Satisfactory/No credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

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.

(DE) Corequisite(s): 575.

575 Professional Internship in Teaching (1-8) Intensive teaching and teaching-related experiences in professional settings in public schools.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 hours.

Comment(s): Admission to teacher education program required. Enrollment limited to post-baccalaureate students in professional year program.

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.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 hours. Credit Restriction: May not be used for probationary licensure year. May not be used toward degree requirements.

589 Field Experience (1-3) Application of curricular and instructional principles, methods, and materials in schools.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 9 hours.

(DE) Prerequisite(s): Program prerequisites. Registration Permission: Consent of instructor.
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.
(De) Prerequisite(s): 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) Anatomy and physiology of hearing; nature and causes of hearing loss; methods and instrumentation for assessment of hearing level; interpretation of audiologic 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 the hearing impaired. 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. (Same as Special Education 504.)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 9 hours.
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.
(De) Prerequisite(s): 425, 523, and Educational Interpreting 223.
529 Teaching Reading to Deaf/Hard of Hearing (3) Specific methods necessary to 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)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 9 hours.
Comment(s): Admission to the graduate program is required.
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 513.)
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 backgrounds to read and understand technical professional literature. Introduction to inferential statistics, needs assessments, and evaluation procedures. (Same as Higher Education Administration 516.)
518 Educational Specialist Research and Thesis (3)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
522 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, spreadsheets, 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.
Repeatability: 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)
Repeatability: May be repeated. Maximum 6 hours.
596 Seminar in School Leadership, K-12 (3) On-site study of quality school processes throughout region.
Repeatability: 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 on-campus enrollment for 2 years. (Same as Higher Education Administration 606.)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated at discretion of student’s committee. Maximum 12 hours.
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. (Same as Higher Education Administration 616.)

(DE) Prerequisite(s): 614.

617 Case Study Methods in Educational Research (3) Methods, techniques and strategies consistent with case study approaches to inquiry in educational and related settings. (Same as Higher Education Administration 617.)

(DE) Prerequisite(s): 615.

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 American Sign Language III (3) Sequence (431-432) stresses fluency of expressive and receptive sign communication skills. Using language in context is emphasized. Grammatical structures of ASL and cultural implications of the deaf community.

(DE) Prerequisite(s): 431 and 432 must be taken in sequence.

432 American Sign Language IV (3) Sequence (431-432) stresses fluency of expressive and receptive sign communication skills. Using language in context is emphasized. Grammatical structures of ASL and cultural implications of the deaf community.

(DE) Prerequisite(s): 432 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. Conducted in ASL.

Grading: Satisfactory/No Credit or letter grade.

(DE) Prerequisite(s): 431 or consent of instructor.

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.

Grading: Satisfactory/No Credit or letter grade.

(DE) Prerequisite(s): Introductory course in psychology or consent of instructor.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

503 Problems in Lieu of Thesis (2-3)

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 9 hours.

504 Special Topics (1-3) Instructor-initiated course offered at convenience of unit on topics of current interest.

Grading: Satisfactory/No Credit or letter grade.

Repeatability: May be repeated. Maximum 15 hours.

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.

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

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) Approval form must be completed in office of unit head.

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of supervising instructor.

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) Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

Registration Permission: 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.

Registration Permission: 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.

Registration Permission: Consent of instructor.

524 Continuing Professional Education (3) Theories and concepts supporting design and management of educational programs for adults in professions.

525 Adult Learning (3) Key characteristics of adult learners, current theory and research on adult learning, and implications for teaching and learning concepts.

526 Informal Methods of Assessment (3) Development and use of rating scales, check-lists, observation, test scores and case reports in assessment and counseling of children and adults.

(DE) Prerequisite(s): Counselor Education 525.

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 Action Research (3) Models of action research and applications in professional practice.

550 Statistics and Research Design: Conceptual (3) Consumer-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.

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 student's 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. (Same as Educational Administration 577.)

585 Seminar in Gerontology (1) (Same as Health 585.)

593 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

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. (Same as Counselor Education 601.)

605 Research in Psychoeducational Studies (1) Data analyses, collection, and interpretation.

618 Practicum in Instructional Planning (3) Development and management of course or program of instruction in educational psychology. (DE) Prerequisite(s): 665 or consent of instructor.

619 Internship in Educational Psychology (1-6) Supervised employment in unit approved educational psychology internship sites.

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

621 Advanced Seminar in Program Planning (3) Concepts, principles, and theories related to program planning in adult education. (DE) Prerequisite(s): 521 or equivalent. Registration Permission: Consent of instructor.

622 Advanced Seminar in Adult Development and Learning (3) Adult development and adult learning theory and research. (DE) Prerequisite(s): 522 and 525. Registration Permission: Consent of instructor.

630 Doctoral Seminar in Collaborative Learning (3) Issues, theories, concepts and research in collaborative learning. Grading: Satisfactory/No Credit or letter grade.

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

640 Seminar in Applied Educational Psychology (2) Issues, theories, concepts and research in applied educational psychology.

655 Research in Psychoeducational Studies (1) Data analyses, collection, and interpretation.

662 Applied Research Design (3) Planning of empirical investigations, collection of data, and drawing of inferences from evidence gathered. (DE) Prerequisite(s): 2-course sequence in statistics.

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. (DE) Prerequisite(s): Counselor Education 525 and a 2-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. (DE) Prerequisite(s): 665 or consent of instructor.

669 Internship in Educational Psychology (1-6) Supervised employment in unit approved educational psychology internship sites.

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.

673 Collaborative Learning (3) Theories of collaborative learning and research related to facilitating collaborative learning in professional practice settings.

675 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. (DE) Prerequisite(s): 577. Registration Permission: Consent of instructor.

693 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.

698 Practicum in Instructional Planning (3) Development and management of course or program of instruction in educational psychology. (DE) Prerequisite(s): 665 or consent of instructor.

699 Internship in Educational Psychology (1-6) Supervised employment in unit approved educational psychology internship sites.

700 Senior Design (5) 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.

701 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.

Electrical and Computer Engineering (319)

Courses required in the electrical engineering undergraduate curriculum cannot be used in 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. (DE) Prerequisite(s): 316, 335, 342, and 355.

415 Automatic Control Systems (3) Automatic control systems for physical systems with linear models. The methods presented include steady-state error analysis, stability, root locus, Nyquist theory, and Bode plots.

416 Computer Control Systems (3) Computer controlled systems using state variables and z-transform model representations with sampling theory and its effect of digital control design. Design of digital controllers in both the state space and frequency domains. Includes Level 1 design projects.

(DE) Prerequisite(s): 316.
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. Includes Level 1 design projects.
(DE) Prerequisite(s): 316.

422 Power System Operations and Planning (3) Dynamic phenomena in power systems; transient stability assessment and enhancement; direct and indirect methods for stability determination in nonlinear systems. Operations planning, unit commitment, economic dispatch, frequency regulation and automatic generation control. Volt-var control, load management, cogeneration and other topics of contemporary concern. Includes Level 1 design projects.
(DE) Prerequisite(s): 421.

423 Electric Machines (3) Principles of electromechanical energy conversion. Design procedures for AC and DC machine windings; construction and performance constraints. Effects of machine parameters on steady state and dynamic performances; the d-q model; reference frames. Includes Level 1 design projects.
(DE) Prerequisite(s): 316 and 325.

431 Operational Amplifier Circuits (3) Linear and non-linear active circuits using commercial operational amplifiers. Includes operational, instrumentation, isolation, bridge, rms and logarithmic converters, multipliers and function generators, rectifiers, references, active filters, modulation and demodulation, sinusoidal generators. Noise fundamentals and calculations in op-amp circuits. Design for specified pole-zero functions. Emphasis on applications including transducer interfacing. Includes Level 1 design projects which require laboratory work.
(DE) Prerequisite(s): 316, 332, and 342.

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.
(DE) Prerequisite(s): 431.

441 Digital Communication (3) Quantization and pulse code modulation. Binary and Mary signaling, spectra of line codes, link budget analysis, binary communication in the presence of noise, matched filtering and equalization, bandwidth digital transmission, introduction to multiple access techniques. Includes Level 1 design projects.
(DE) Prerequisite(s): 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.

443 Antennas and Propagation (3) Introduction to antenna theory including fundamental antenna concepts and parameters (directivity, gain, patterns, etc.) and signal propagation. Theory and design of linear and loop antennas, arrays, and other simple antennas. Includes Level 1 design projects.
(DE) Prerequisite(s): 316, 341, and 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. Includes Level 1 design projects which require laboratory work.
(DE) Prerequisite(s): 316, 341, and 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. Includes Level 1 design projects which require laboratory work.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 206.

471 Introduction to Pattern Recognition (3) Introduction to statistical decision theory, adaptive classifiers, and supervised and unsupervised learning. Students will explore the application of these techniques in areas of current interest such as face recognition, speech processing, remote sensing, data mining and bioinformatics. Includes Level 1 design projects.
(DE) Prerequisite(s): 316. Comment(s): Non-majors must obtain consent of instructor.

472 Introduction to Digital Image Processing (3) Basic methods for digitizing, storing, processing, and displaying images. Computational procedures for image enhancement, restoration, coding, and segmentation. Includes Level 1 design projects.
(DE) Prerequisite(s): 316. Comment(s): Non-majors must obtain 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. Includes Level 1 design projects and laboratory work.
(DE) Prerequisite(s): 316, 325, and 336.

482 Power Electronic Circuits (3) Voltage-fed inverters, PWM principles, control of inverters, dc-dc converters, dc machine drives, resonance converters, step motor drives, brushless dc machine principles. Includes Level 1 design projects.
(DE) Prerequisite(s): 481.

491 Special Topics (3) Relating to basic design and current practice. Includes Level 1 or Level 2 design projects which may require laboratory work.
(DE) Prerequisite(s): Completion of all junior electrical and computer engineering courses or consent of instructor.

495 Senior Seminar (1) Current topics in electrical engineering. Grading: Satisfactory/No Credit or letter grade. (DE) Prerequisite(s): Completion of all junior electrical and computer engineering courses or consent of instructor.

500 Thesis (1-15) Graduation Restriction: P/NP only. Repeatability: May be repeated.

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.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of graduate committee.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.


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 matrix, matrix exponential, controllability, observability, realization theory, and stability theory.
(DE) Corequisite(s): 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.
(DE) Prerequisite(s): 511.

521 Power Systems Analysis I (3) Matrix-vector representations of power networks, sequence modeling of power system components, unbalanced shunt and series faults. Formulating and solving problems in matrix-vector form with application to large scale power systems.
(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.


(DE) Prerequisite(s): 431 and 432 or consent of instructor.


(DE) Prerequisite(s): 531.

541 Electromagnetic Fields (3) Maxwell’s equations, special relativity, wave reflection and transmission, generalized media, guided waves, radiation from current elements.

(DE) Prerequisite(s): 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.


(DE) Prerequisite(s): 504.


(DE) Prerequisite(s): 543.

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 swept 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.

(DE) Prerequisite(s): 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 from 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.

557 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.

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.

(DE) Prerequisite(s): 461 or 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): Requires 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.

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.

(DE) Prerequisite(s): 471 or consent of instructor.


(DE) Prerequisite(s): 472 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 from current literature.

(DE) Prerequisite(s): 573 or consent of instructor.

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

598 Graduate Seminar (1) Topics of interest discussed in weekly seminar.

Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.

599 Special Topics (1-3) Repeatability: May be repeated. Maximum 9 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

613 Nonlinear Systems Theory (3) Introduction to nonlinear systems theory with applications to control systems. Specific emphasis is given to Lyapunov Theory, Adaptive Control, Feedback Linearization and Sliding Mode Control.

(DE) Prerequisite(s): 511 or equivalent.

614 Optimal Control (3) Deterministic and stochastic dynamic programming in continuous and discrete time, minimum principle and matrix minimum principle, computational methods in optimal control.

(DE) Prerequisite(s): 611.

615 Control of Electric Machines (3) Models in the form of nonlinear differential equations are developed for the induction, synchronous, brushless DC and switched reluctance motors. High performance methods of control based on state space techniques are developed including field-oriented and input-output linearization control.
617 Special Topics in Systems Theory I (3) Topics of current interest to students and faculty: large-scale systems, model-order reduction, algebraic- and geometric-system theories, and advanced-design methods. 
(De) Prerequisite(s): 511. 
Registration Permission: Consent of instructor.

618 Special Topics in Systems Theory II (3) Topics of current interest to students and faculty: large-scale systems, model-order reduction, algebraic- and geometric-system theories, and advanced-design methods. 
(De) Prerequisite(s): 511. 
Registration Permission: Consent of instructor.

623 Advanced Power Electronics and Drives (3) Phase-controlled cycloconverters, cycloconverter-fed ac drives, resonant converters, vector and scalar control of synchronous machines, static Kramer drives, static Scherbius drives, VSC generation, modern control theory in ac drives.

625 Utility Applications of Power Electronics (3) Electric power quality, harmonics, voltage sag, reactive power compensation, transient stability, Structure and control of power converters, multilevel converters, active power filters, static series and shunt compensators, FACTS, HVDC.
(De) Prerequisite(s): 521 and 523 or consent of instructor.

(De) Prerequisite(s): 523 or consent of instructor.

629 Traction Drives (3) Operating principles of traction drives for electric and hybrid electric vehicles. Low speed constant torque control mode and high speed constant power control mode. Ideal performance of the doubly fed, separately excited dc machine and the wound rotor synchronous machine. High CPSR drives based on singly-fed machines including the induction, permanent magnet synchronous, brushless dc and switched reluctance motors. Other contemporary topics in traction drive applications. 
(De) Prerequisite(s): 523 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, electro-mechanical and quantum-mechanical devices.
(De) Prerequisite(s): 531 and 532. 
Registration Permission: Consent of instructor.

632 Advanced Topics in Electronic Instrumentation II (3) Physical operation of modern discrete, monolithic, and hybrid electronic structures and their application in signal processors. Resolution, sensitivity, response time, and noise considerations in signal processors used in modern electronic instrumentation.
(De) Prerequisite(s): 631.

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.
(De) Prerequisite(s): 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.
(De) Prerequisite(s): 644 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.
(De) Prerequisite(s): 643.

651 Computer-Aided Design of VLSI Systems I (3) Fabrication of microelectronic devices; computer architecture design; algorithmic state machines; partitioning; structured design methodology.
(De) Prerequisite(s): 551 and 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.
(De) Prerequisite(s): 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.
(De) Prerequisite(s): 553. 
Registration Permission: Consent of instructor.

654 Advanced Computer Architecture and Design (3) Advanced computer architecture issues including topics such as superscalar architectures, parallel algorithms, principles of parallelization and vectorizing compilers, interconnection networks, SIMD/MIMD machines, processor synchronization, shared and distributed memory, data coherence, multiprocessors, multicomputers, dataflow machines, special purpose processors.
(De) Prerequisite(s): 557.

655 Computer and Telecommunications Systems Performance Evaluation (3) Introduction to the basic tools of computer and communications systems analysis and evaluation. Deterministic and stochastic models; 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.
(De) Prerequisite(s): 504.

658 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 issues in 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.
(De) Prerequisite(s): 551 and 552.

663 Advanced Plasma Physics I (3) Basic concepts of high temperature plasma physics. Magnetohydrodynamics and kinetic description of plasma, plasma transport, plasma waves, equilibrium, and stability.
(De) Prerequisite(s): 541, 542 and 461, 462 or 563, 564, or consent of instructor.
Comment(s): 663 and 664 must be taken in sequence.

664 Advanced Plasma Physics II (3) Plasma heating and radiation phenomena. Advanced topics of current interest. 
(De) Prerequisite(s): 663. 
Comment(s): 663 and 664 must be taken in sequence.

671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, multi-sensor systems. 
(De) Prerequisite(s): 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereovision, shape theory.
(De) Prerequisite(s): 672.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning and navigation. 
(De) Prerequisite(s): 672.

681 Advanced Graduate Seminar (1) Research in department. 
Grading: Satisfactory/No Credit or letter grade. 
Repeatability: May be repeated.

691 Introduction to the theory of language development in children. 
(De) Prerequisite(s): An elementary school language arts course or consent of instructor.

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 individual entities of the two fields. 
Comment(s): Admission to teacher education required. Not open to students with recent course or background in teaching science and/or social studies.

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). 
Comment(s): Admission to teacher education required. Not open to students with recent course in language arts methods.

445 Early Childhood Education: Program Development and Teaching in Kindergarten (3) Curriculum planning, classroom organization and management practices for teaching young children; relationship of kindergarten to total elementary school. 
Comment(s): Admission to teacher education required.

504 Studies and Theory in Language Development (3) Studies and theory of language development in children. 
(De) Prerequisite(s): An 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. (DE) Prerequisite(s): Course in elementary and middle school teaching methods. (DE) Corequisite(s): 575.

515 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students’ programs.
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.


527 Elementary School Curriculum (3) Examination, evaluation and application of curriculum designs in elementary school. Trends and issues which affect elementary education.
Registration Permission: 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).
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

567 Application of Theory in Early Childhood Education (K-3) (3) Principles and practices from selected theoretical orientations.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Course in early childhood education or consent of instructor.

584 Seminar in Early Childhood Education (3) Analysis of research and theory in early childhood education; educative process of young children.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Course in early childhood education.

606 Research in Elementary Education (3) Analysis of research in elementary education with application to classroom teaching.
(DE) Prerequisite(s): Research course.

650 Advanced Studies in Early Childhood Education (3) Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 2 graduate courses in early childhood education.
Registration Permission: Consent of instructor.

651 Advanced Studies in Elementary School Language Arts (3) Selected issues in elementary school language arts.
(DE) Prerequisite(s): 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.
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Requires enrollment in engineering management.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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.
(DE) Prerequisite(s): 538 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.
(DE) Prerequisite(s): Consent of instructor.

537 Analytical Methods for Engineering Managers (3) Survey of management analysis and control systems through industrial engineering 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.
Credit Restriction(s): No credit for student 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 553 and Industrial Engineering 518 or consent of instructor.


(DE) Prerequisite(s): 516.

(DE) Prerequisite(s): Industrial Engineering 516.

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.
557 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 557.)


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

560 Optical Engineering I (4) Wave optics; scalar diffraction theory; introduction to Fourier optics; ray or geometric optics; lenses, mirror, gratings; paraxial design methods; introduction to aberrations.

561 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.

(DE) Prerequisite(s): 566.

562 Neural Networks in Engineering (3) Introduction to terminology, physiology, and analytical methods for mechanisms of living tissue. Continuum mechanics analysis of hard and soft issues, 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.)

563 Biomechanics of Hard and Soft Tissue (3) Introduction to terminology, physiology, and analytical methods for mechanisms of living tissue. Continuum mechanics analysis of hard and soft issues, 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.)

564 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 557.)


566 Optical Engineering I (4) Wave optics; scalar diffraction theory; introduction to Fourier optics; ray or geometric optics; lenses, mirror, gratings; paraxial design methods; introduction to aberrations.

567 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.

(DE) Prerequisite(s): 566.

568 Neural Networks in Engineering (3) Introduction to terminology, physiology, and analytical methods for mechanisms of living tissue. Continuum mechanics analysis of hard and soft issues, 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.)

569 Biomechanics of Hard and Soft Tissue (3) Introduction to terminology, physiology, and analytical methods for mechanisms of living tissue. Continuum mechanics analysis of hard and soft issues, 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.)

570 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 557.)

571 Biomechanics of Hard and Soft Tissue (3) Introduction to terminology, physiology, and analytical methods for mechanisms of living tissue. Continuum mechanics analysis of hard and soft issues, 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 fluid properties of blood and other biological fluids. Analysis of physiological flows, blood flow through arterial stenoses. Study of flow through artificial heart valves and in extracorporeal devices. (Same as Biomedical Engineering 572.)

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

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

575 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; Materials Engineering 539.)

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

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

578 Advanced Mechanics of Materials I (3) (See Mechanical Engineering 557.)

579 Advanced Mechanics of Materials II (3) (See Mechanical Engineering 558.)

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

581 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Repeatability: May be repeated with consent of department.

(Registration Permission: Consent of instructor.)

582 Advanced Mechanics of Materials IV (3) (See Mechanical Engineering 560.)

583 Fuzzy Systems in Engineering (3) (See Nuclear Engineering 578.)

584 Advanced Mechanics of Materials V (3) (See Mechanical Engineering 561.)

585 Green Engineering (3) (See Chemical Engineering 581.)

586 Advanced Mechanics of Materials VI (3) (See Mechanical Engineering 562.)

587 Neural Networks in Engineering (3) (See Nuclear Engineering 577.)

588 Advanced Mechanics of Materials VII (3) (See Mechanical Engineering 563.)

589 Advanced Mechanics of Materials VIII (3) (See Mechanical Engineering 564.)

590 Selected Engineering Problems (2-6) Grading Restriction: Satisfactory/No Credit grading only.

(Repeatability: May be repeated. Maximum 6 hours. Comment(s): Enrollment limited to students in problems option. Registration Permission: Consent of advisor.)

591 Seminar (1) All phases of engineering science, reports on current research at UTK and UTSM. Grading Restriction: Satisfactory/No Credit grading only.

(Repeatability: May be repeated.)

600 Doctoral Research and Dissertation (3-15) Registration Permission: Consent of advisor.


(Registration Restriction: May not be used toward degree requirements. Grading Restriction: Satisfactory/No Credit grading only.)


(DE) Prerequisite(s): 557.

651 Advanced Topics in Computational Fluid Dynamics (3) Modern approximation theory for Euler and Navier-Stokes conservation systems, compressible flow, hyperbolic forms, boundary conditions. Weak forms, extremization, finite element/volume/flux vector discrete implementations, a priori error estimates, accuracy, convergence, stability. Numerical linear algebra, approximate factorization, sparse matrix methods. Dissipation, Fourier spectral analysis, smooth and non-smooth solutions. (Same as Aerospace Engineering 651; Mechanical Engineering 651.)

(Repeatability: May be repeated with consent of department.)

652 Advanced Topics in Computational Fluid Dynamics II (3) Modern approximation theory for Euler and Navier-Stokes conservation systems, compressible flow, hyperbolic forms, boundary conditions. Weak forms, extremization, finite element/volume/flux vector discrete implementations, a priori error estimates, accuracy, convergence, stability. Numerical linear algebra, approximate factorization, sparse matrix methods. Dissipation, Fourier spectral analysis, smooth and non-smooth solutions. (Same as Aerospace Engineering 651; Mechanical Engineering 651.)

(Repeatability: May be repeated with consent of department.)
652 Advanced Topics in Computational Fluid Dynamics (3) Applications of modern CFD theory and code practice for Euler and Navier-Stokes conservation systems. Computer projects in incompressible/compressible flow, viscous, turbulent, reacting and/or inviscid/potential subsonic to hypersonic flows. (Same as Aerospace Engineering 662; Mechanical Engineering 652.) (DE) Prerequisite(s): 645 and 651.

653 Advanced Topics in Computational Solid Mechanics (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. (Same as Aerospace Engineering 663; Mechanical Engineering 653.) (DE) Prerequisite(s): 553.

654 Advanced Topics in Computational Solid Mechanics (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. (Same as Aerospace Engineering 664; Mechanical Engineering 654.) (DE) Prerequisite(s): 553.


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. Repeatability: May be repeated with consent of department. Registration Permission: Consent of instructor.

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. (Same as Medieval Studies 405.)

402 Chaucer (3) Reading and analysis of the Canterbury Tales and Troilus and Criseyde in Middle English. (Same as Medieval Studies 406.)

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. 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.


411 Literature of the Restoration and Early 18th Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1745. Repeatability: May be repeated.

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) Study of one major genre or literary mode such as drama, novel, poetry, nonfiction, prose, satire, romance, or epic written between 1660 and 1800. Repeatability: May be repeated.

414 Romantic Poetry and Prose I (3) Emphasis on Wordsworth, Coleridge, and Blake; with readings from Lamb, De Quincey, and other prose writers.

415 Romantic Poetry and Prose II (3) Emphasis on Keats, Shelley and Byron; with readings from Hazlitt, Peacock, and other prose writers.

416 Early Victorian Literature (3) May include poetry by Tennyson and the Browning’s; 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 19th-Century British Novel (3) Major novelists from Scott to Hardy.

421 Modern British Novel (3) Authors such as Joyce and Woolf through contemporary British fiction writers.

422 Women Writers in Britain (3) Emphasis on the literary consciousness and works of women writers in Britain. Course content will vary. Authors covered may include Marie de France, Margery Kempe, Aemilia Lanzer, Elizabeth Cary, Aphra Behn, Frances Burney, Mary Wollstonecraft, Mary Shelley, George Eliot, Virginia Woolf, and Doris Lessing. (Same as Women’s Studies 442.) Repeatability: May be repeated. Maximum 6 hours.

423 Colonial and Post-Colonial Literature (3) Emphasis on historical and theoretical methodologies for reading colonial and post-colonial literature. Repeatability: May be repeated with instructor’s consent. Maximum 6 hours.

431 Early American Literature (3) From the earliest texts to 1830, including exploration and discovery, Native American, colonial, revolution-ary, and early national works.

432 American Romanticism and Transcendentalism (3) Prose and poetry of the American Renaissance, from c. 1830 to the end of the Civil War. Includes writers such as Cooper, Poe, Hawthorne, Melville, Emerson, Thoreau, Stowe, Douglass, Whitman, Dickinson.

433 American Realism and Naturalism (3) Literature from the time of the Civil War to World War I, including such writers as Twain, Howells, James, Jewett, Freeman, Crane, and Norris.

434 Modern American Literature (3) World War I to the present.

435 Modern American Novel before 1900 (3) From earliest sentimental novels through Brown and Cooper, and major figures to 1900, including Hawthorne, Melville, Stowe, Clemens, and James.

436 Modern American Novel (3) Authors such as Faulkner, Steinbeck, Welty.

441 Southern Literature (3) Southern writing from colonial period into the 20th century, including frontier humorists, local color writers, and southern literary renaissance.

442 American Humor (3) Development of American humor from the early 19th century into the 20th century, with particular emphasis on Mark Twain. (Same as American Studies 442.)

443 Topics in Black Literature (3) Content varies according to particular genres, authors, or theories from 1845 to present, including Langston Hughes and the Harlem Renaissance, Richard Wright and Gwendolyn Brooks, writing by black women, international black literature in English, and black American autobiography. (Same as Africana 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.

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) Focuses on writing and analyzing persuasive texts in public, private, and academic contexts. (DE) Prerequisite(s): 355 or consent of instructor.

456 Contemporary/Postmodern Literature (3) Studies in literature written after World War II. Content will vary. Repeatability: 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. (DE) Prerequisite(s): 360 or consent of instructor.

462 Writing for Publication (3) Principles and practices of writing for publication. Dissertations, theses, articles, and reports in science and technology. (DE) Prerequisite(s): 360 or consent of instructor.

463 Advanced Poetry Writing (3) Development of skills acquired in basic poetry-writing course. (DE) Prerequisite(s): 363 or consent of instructor.
Advanced Fiction Writing (3) Development of skills acquired in basic fiction-writing course. (DE) Prerequisite(s): 365 or consent of instructor.

Writing, Layout, and Production of Technical Documents (3) Principles of design for desktop publishing. Production of various documents to be incorporated into a professional portfolio. (DE) Prerequisite(s): 360 or consent of instructor.

Special Topics in Rhetoric (3) Topics vary. Repeatability: May be repeated with consent of department. Maximum 6 hours. (DE) Prerequisite(s): 355 or consent of instructor.

Sociolinguistics (3) Language in relation to society. Empirical and theoretical focus. Emphasis on large-scale units - tribes, nations, social groups. (Same as Linguistics 471.) (DE) Prerequisite(s): 371 or 372 or Linguistics 200 or consent of instructor.

American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English, with attention to their origins, functions, and implications for cultural pluralism. (Same as Linguistics 472.) (DE) Prerequisite(s): 371 or 372 or Linguistics 200 or consent of instructor.

Teaching English as a Second or Foreign Language I (3) Introduces major issues surrounding teaching ESL/EFL, including 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. (Same as Linguistics 474.) (DE) Prerequisite(s): Second year of foreign language or consent of instructor.

Second Language Acquisition (3) How humans learn second languages. Examines theoretical models and research on such issues as differences between first and second language acquisition; the effect of age; cognitive factors in second language acquisition; learner variables; socio-cultural factors; and implications for second/foreign language instruction. (Same as Linguistics 476.)

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.)

Critical Literature (3) Historical survey of major works of literary criticism.


Studies in Folklore (3) Topics vary. Repeatability: May be repeated if topic differs. Maximum 6 hours.

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).

Special Topics in Literature (3) Topics vary. Repeatability: May be repeated. Maximum 6 hours.

Special Topics in Writing (3) Original writing integrated with reading, usually taught by professional author. Repeatability: May be repeated. Maximum 6 hours.

Special Topics in Language (3) (Same as Linguistics 485.) Repeatability: May be repeated with consent of department. Maximum 6 hours.

Special Topics in Criticism (3) Content varies. Special topics in theoretical and practical approaches to British and American literature. Repeatability: May be repeated with consent of department. Maximum 6 hours.

Special Topics in Film (3) Content varies. Particular directors, film genres, national cinema movements, or other topics. (Same as Cinema Studies 489.) Repeatability: May be repeated with consent of department. Maximum 6 hours.

Language and Law (3) Language in the Anglo-American legal process: focus on differences between spoken and written language; lexical and syntactic pragmatic properties of language; applied linguistic analysis; and the language rights of linguistic minorities. (Same as Legal Studies 490; Linguistics 490.) (DE) Prerequisite(s): 371 or 372 or consent of instructor.

Introduction to Rhetoric and Composition (3) Introduction to the historical, theoretical, and empirical modes of inquiry in rhetoric and composition and their implications for the teaching of composition. (DE) Prerequisite(s): 355 or consent of instructor.

The Rhetoric of Legal Discourse (3) Applying basic principles of persuasive writing to legal materials. Writing position papers, briefs, and memoranda, students learn issue identification and argument. Critical reading and discussion of both professional and student writing. Introductory legal research techniques. No prior legal knowledge necessary. (Same as Legal Studies 496.) (DE) Prerequisite(s): 355 or consent of instructor.

Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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.

Introduction to Literary Research (3) Critical examination of aims of English studies, profession of English teacher, theory of literature, and methods of research: collection of information, evaluation of material, and transmission of results of scholarship.

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. Repeatability: May be repeated. Maximum 6 hours.

History of the English Language I (3) Phonological, morphological, and syntactic development of English language: Old and Middle English. (DE) Prerequisite(s): 360 or consent of instructor.

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.

Readings in Medieval Literature (3) Reading and analysis of selected masterpieces of Old and Middle English literature and their continental sources in modern English. Repeatability: May be repeated. Maximum 9 hours.

Readings in Medieval Literature (3) Reading and analysis of selected masterpieces of Old and Middle English literature and their continental sources in modern English. Repeatability: May be repeated. Maximum 9 hours.

Readings and Analysis in Selected Areas of 16th- and 17th-Century Prose, Poetry, and Drama (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.

Readings and Analysis in Selected Areas of 16th- and 17th-Century Prose, Poetry, and Drama (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.

Readings in English Literature of the Restoration and 18th Century (3) Topics vary. Genre: poetry, prose, fiction, drama; or period: Restoration, earlier 18th century, later 18th century. Repeatability: May be repeated. Maximum 9 hours.

Readings in English Literature of the Restoration and 18th Century (3) Topics vary. Genre: poetry, prose, fiction, drama; or period: Restoration, earlier 18th century, later 18th century. Repeatability: May be repeated. Maximum 9 hours.

Readings in English Literature of the 19th Century I (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.

Readings in English Literature of the 19th Century II (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.

Readings in American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.

Readings in American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.

Readings in 20th-Century Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis. Repeatability: May be repeated. Maximum 9 hours.
561 Readings in 20th-Century Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis. 
Repeatability: May be repeated. Maximum 9 hours.

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 20th-century literary criticism from New Criticism to present. 

580 Fiction Writing (3) Advanced fiction projects under supervision of instructor and time for independent study. 
Repeatability: May be repeated. Maximum 6 hours. 
(DE) Prerequisite(s): Previous course in Chaucer.

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. 
Repeatability: May be repeated. Maximum 6 hours. 
(DE) Prerequisite(s): 463 or consent of instructor.

582 Special Topics in Writing (1-3) Topics vary. 
Repeatability: May be repeated. Maximum 6 hours. 
Comment(s): Enrollment by consent of director of graduate studies.

583 Special Topics in Literature (3) Topics vary: genres, modes, and other literary subjects not in standard period divisions. 
Repeatability: May be repeated. Maximum 9 hours.

584 Topics in Feminist Studies (3) Topics vary. 
Repeatability: 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. 
Repeatability: May be repeated. Maximum 6 hours.

589 Special Topics in Language (3) Topics vary. 
Repeatability: May be repeated. Maximum 6 hours.

590 Topics in Critical Theory (3) Topics vary. 
Repeatability: May be repeated. Maximum 9 hours.

591 Foreign Study (1-15) 
Repeatability: Not repeatable. May be taken once for 1-15 hours.

592 Off-Campus Study (1-15) 
Repeatability: Not repeatable. May be taken once for 1-15 hours.

593 Independent Study (1-15) 
Repeatability: May be repeated once. 
Comments: May be taken once in the MA program and once in the PhD program.

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) 
Grading Restriction: P/NP only. 
Repeatability: May be repeated.

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. 
(DE) Prerequisite(s): 610 or consent of instructor.

620 Studies in Medieval English Literature (3) Seminar in literature and literary genres of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year. 
Repeatability: May be repeated. Maximum 9 hours.

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer’s writings. 
Repeatability: May be repeated. Maximum 6 hours. 
(DE) Prerequisite(s): Previous course in Chaucer.

630 Studies in Renaissance Literature (3) Seminars: Spenser, Milton, 17th-century prose and poetry, Shakespeare, 16th-century prose and poetry, non-Shakespearian drama. 
Repeatability: May be repeated. Maximum 9 hours.

Repeatability: May be repeated. Maximum 9 hours.

Repeatability: May be repeated. Maximum 9 hours.

641 Studies in Restoration and 18th-Century Literature (3) Topics vary. Swift, satire, restoration literature. Johnson and Boswell, Addison and Steele, restoration drama, Dryden. 
Repeatability: May be repeated. Maximum 9 hours.

650 Studies in English Romanticism (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus. 
Repeatability: May be repeated. Maximum 9 hours.

651 Studies in Victorian Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus. 
Repeatability: May be repeated. Maximum 9 hours.

652 Studies in Victorian Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus. 
Repeatability: May be repeated. Maximum 9 hours.

660 Studies in American Literature (3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain. 
Repeatability: May be repeated. Maximum 9 hours.

661 Studies in American Literature (3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain. 
Repeatability: May be repeated. Maximum 9 hours.

662 Studies in American Literature (3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain. 
Repeatability: May be repeated. Maximum 9 hours.

670 Studies in 20th-Century Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus. 
Repeatability: May be repeated. Maximum 9 hours.

671 Studies in 20th-Century Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus. 
Repeatability: May be repeated. Maximum 9 hours.

672 Studies in 20th-Century Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus. 
Repeatability: May be repeated. Maximum 9 hours.

680 Topics in English Language (3) 
Repeatability: May be repeated with consent of director of graduate studies.

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. 
Repeatability: May be repeated. Maximum 9 hours.

686 Studies in Creative Writing (3) Content varies. Connection between theory and practice in writing. 
Repeatability: May be repeated. Maximum 9 hours.

688 Studies in Literary Criticism (3) Content varies. Advanced work in theory and history of literary criticism. 
Repeatability: May be repeated. Maximum 9 hours.

690 Special Topics (3) Content varies. History of ideas, humor, biography, autobiography, extra-literary disciplines. 
Repeatability: May be repeated. Maximum 9 hours.

694 Studies in Film (3) Content varies. Advanced work in film history and analyses. 
Repeatability: May be repeated. Maximum 6 hours.

English Education (340)

459 Teaching English in the Secondary School (3) Techniques of teaching composition, language, and literature. 
Comment(s): Admission to teacher education required.

460 Teaching Reading and Literature in the Secondary School (3) Teaching basic reading skills and 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.

543 Teaching Language Arts in the Middle Grades (3) Activities in this class are intended to promote the professional growth of pre-service and in-service language arts teachers through study, design, and implementation of language arts curriculum and instructional strategies. In particular, methods of teaching contemporary language arts content in grades 4-8 will be explored.

590 Seminar in Teaching English in Secondary Schools (3) Content varies. Theoretical and practical approaches to teaching English in secondary school.

Repeatability: May be repeated. Maximum 9 hours.

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 dramatics, 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.

(DE) Prerequisite(s): 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. (Same as Plant Sciences 451.)

Contact Hour Distribution: Lecture and lab.

(DE) Prerequisite(s): 110 and 120 or Biology 130 and 140 and Chemistry 120 and 130.

Recommended Background: 310, 321 and 412; Microbiology 310 or 319; Plant Sciences 330.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

Registration Restriction(s): Master of Science – entomology and plant pathology major.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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.

Contact Hour Distribution: 2 hours and 1 lab.

Credit Restriction: Students cannot receive credit for both 405 and 505.

(DE) Prerequisite(s): Biology 111 and 112 or Biology 130 and 140.

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.

Credit Restriction: Students who receive credit for 512, may not enroll in 512.

(DE) Prerequisite(s): 313 or consent of instructor.

Comment(s): Master’s students only.

513 Plant Pathogenic Fungi (2) Morphology, taxonomy, and biology of fungal plant pathogens. (Same as Plant Sciences 513.)

Contact Hour Distribution: 2 hours and 2 labs weekly for 7 weeks.

(DE) Prerequisite(s): 313 or consent of instructor.

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.

Contact Hour Distribution: 3 hours and 1 lab for 7 weeks.

(DE) Prerequisite(s): 313 or consent of instructor.

515 Physiology of Plant Disease (3) Biochemical and physiological events involved in host-pathogen interactions. Mechanisms of disease resistance.

Credit Restriction(s): Students taking 515 cannot receive credit for 615.

(DE) Prerequisite(s): Introductory plant physiology and pathology or consent of instructor.

Comment(s): Master’s students only.

520 Plant Parasitic Nematodes (2) Morphology, physiology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships.

Contact Hour Distribution: 2 hours and 2 labs weekly for 7 weeks.

Recommended Background: 8 hours of biology.

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 spiroplasmas.

Contact Hour Distribution: 2 hours and 1 lab.

Prerequisite(s): 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.

Contact Hour Distribution: 1 hour and 1 lab.

(DE) Prerequisite(s): 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.

Contact Hour Distribution: 2 hours and 1 lab.

(DE) Prerequisite(s): 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. (Same as Plant Sciences 530.)

(DE) Prerequisite(s): 321 or consent of instructor.

531 Special Problems in Entomology (1-3) Comprehensive individual study of current problems.

Repeatability: May be repeated. Maximum 6 hours.

532 Special Problems in Plant Pathology (1-4) Comprehensive individual study of current problems.

Repeatability: 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.

Repeatability: May be repeated. Maximum 6 hours.

Comment(s): Master’s students only.

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. (Same as Plant Sciences 544.)

Contact Hour Distribution: 1 hour and 4 labs weekly for 5 weeks.

Recommended Background: 8 hours of biology or botany and 8 hours of chemistry.

545 Plant Microtechnique (1) Practical light and scanning electron microscopy methods for investigating aspects of plant development, histology and pathological structures in ornamental forest and crop species. (Same as Plant Sciences 545.)

Contact Hour Distribution: 1 hour and 4 labs weekly for 5 weeks.

Recommended Background: 8 hours of biology or botany and 8 hours of chemistry.

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.

Credit Restriction: Students cannot receive credit for both 548 and 448.

Registration Permission: Consent of instructor.

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. (Same as Microbiology 550.)

Registration Restriction(s): Minimum student level – senior.

Registration Permission: Consent of instructor.
600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Doctor of Philosophy – plant, soils, and insects major.

602 Advanced Topics in Entomology (1-3)
Morphology, systematics, physiology, ecology and genetics of arthropods, acapulture, medical and veterinary entomology, insect biodiversity, and insect pathology.
Repeatability: 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 seedborne pathogens, and virology.
Repeatability: May be repeated. Maximum 12 hours.

606 Advanced Topics in Bioactive Natural Products (1-3)
Bioactive pesticides, ethnobotany and paleoethnobotany, ethnomedicine, 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.
Repeatability: 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.
Repeatability: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 530 or consent of instructor.

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.
Credit Restriction(s): Students who have received credit for 512 may not enroll in 612.
(DE) Prerequisite(s): 313 or consent of instructor.
Comment(s): PhD students only.

615 Physiology of Plant Disease (3)
Biochemical and physiological events involved in host-pathogen interactions. Mechanisms of disease resistance.
Credit Restriction: Students who have taken 515 cannot receive credit for 615.
(DE) Prerequisite(s): Introductory plant physiology and plant pathology or consent of instructor.
Comment(s): PhD students only.

640 Seminar (1)
Review of literature and current research in entomology and plant pathology.
Repeatability: May be repeated. Maximum 2 hours.
Comment(s): 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. (Same as Plant Sciences 643.)
Contact Hour Distribution: 1 hour and 4 labs weekly for 7 weeks.
(DE) Prerequisite(s): 12 hours biological science and 8 hours chemistry.
Registration Permission: Consent of instructor.

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. Topics include 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.
Recommended Background: Organic chemistry.

442 Soil Genesis and Classification (3)
Soil genesis and formation; observing and describing morphology of agricultural and forest soils; chemical and physical properties, classification. Includes 3 weekend field trips.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: General soils.

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.
Recommended Background: General soils and physics.

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.
Recommended Background: Computer proficiency.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Master of Science – environmental and soil sciences major.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

503 Seminar (1)
Presentations and discussions of current scientific material. (Same as Biosystems Engineering 503; Biosystems Engineering Technology 503.)
Repeatability: May be repeated. Maximum 3 hours.

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-plant root interface; and responses to adverse soil environmental conditions.
Contact Hour Distribution: 3 hours and 1 rec.
Recommended Background: Plant physiology.

512 Pedology (3)
Physical and chemical weathering processes, factors of soil formation, soil forming processes.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: Soil genesis and classification.

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.
Recommended Background: Soil chemistry.

514 Environmental Soil Physics (3)
Principles of water, gas, 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 solutions of contemporary problems in water conservation, prevention of surface/ground water contamination, and management of plant water status.
Recommended Background: Soil physics.

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.
Contact Hour Distribution: 2 hours and one 3-hour lab.
Recommended Background: General soils.

593 Special Problems in Plant and Soil Science (1-3)
Repeatability: May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Doctor of Philosophy – plants, soils, and insects major.

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.
Repeatability: May be repeated. Maximum 6 hours.

603 Seminar (1)
Presentations and discussion of current scientific material. (Same as Biosystems Engineering 603.)
Repeatability: May be repeated. Maximum 3 hours.

613 Advanced Topics in Soil Chemistry and Fertility (2)
Topics of current significance: scientific literature.
(Re) Prerequisite(s): 513.

614 Advanced Topics in Soil Biology and Biochemistry (2)
Topics of current significance: scientific literature.
(Re) Prerequisite(s): 514.
615 Advanced Topics in Soil Physics, Genesis, and Morphology (2) Topics of current significance; scientific literature.

Environmental Engineering (344)

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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

508 Seminar (1)
Reports on current research in environmental engineering at the University of Tennessee, Knoxville.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 10 hours.
Comment(s): Graduate standing required.

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.
(DE) Prerequisite(s): Civil Engineering 390.

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.
(DE) Prerequisite(s): 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. (Same as Biosystems Engineering 525.)
(DE) Prerequisite(s): Civil Engineering 395 or 416.

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.
(DE) Prerequisite(s): Civil Engineering 395 or 416.

535 Applied Ground Water Hydrology (3)
Applied hydrology of multi-layered aquifer systems. Modeling of complex groundwater 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. (Same as Geology 535.)
(DE) Prerequisite(s): 485 or Geology 485 or consent of instructor.

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.
(DE) Prerequisite(s): Civil Engineering 380 and 390.

552 Biological Treatment Theory (3)
Theory and design applications of biological processes to treatment of wastewater and solid wastes. (Same as Biosystems Engineering 552.)
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): Civil Engineering 380.

553 Aquatic Chemistry (3)
Theoretical, applied and analytical chemistry related to generation, measurement and treatment of environmental contaminants.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): General chemistry course.

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.
(DE) Prerequisite(s): 1 year of chemistry
Registration Permission: 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.
Comment(s): Senior standing required for undergraduates.

556 Hazardous Waste Management (3)
Analysis and design of operations and processes for hazardous waste disposal and processing; regulations; industrial applications.
Comment(s): Requires 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.
Registration Permission: 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.
(DE) Prerequisite(s): 570.

572 Air Quality Dispersion Modeling (3)
Diffusion in atmosphere; application of atmospheric dispersion models and evaluation of meteorological and air quality data.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment limited to students with graduate standing.

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

651 Industrial Waste Unit Operations and Processes (3)
Theoretical design and laboratory modeling of industrial waste treatment processes and operations.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 551 and 553.
(DE) Prerequisite or (DE) Corequisite(s): 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 earth; solids in environment. Methods of assessing risk posed by presence of those chemicals.
(DE) Prerequisite(s): 551.

691 Special Topics in Environmental Engineering (3)
Selected advanced problems of current interest.
Repeatability: May be repeated.
Registration Permission: Consent of instructor.

Exercise Science (347)
480 Physiology of Exercise (3)
Lecture and laboratory class dealing with functions of the body in muscular work. Topics include physiological aspects of fatigue, training, and adaptation to environment. (Same as Biochemistry and Cellular and Molecular Biology 480.)
Contact Hour Distribution: 2 lectures and 1 lab.
(DE) Prerequisite(s): Biochemistry and Cellular and Molecular Biology 230 or 440.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Special Project (3)
Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work.
Grading Restriction: 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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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). (DE) Prerequisite(s): 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.

531 Biomechanics (3) Biomechanical principles and applications to analyses of human movements. Quantitative analysis of human movements. (DE) Prerequisite(s): General physics course.

533 Exercise Physiology (3) Physiology of human performance: acute and chronic effects of exercise on metabolic, cardiac, pulmonary, and skeletal systems. Contact Hour Distribution: 2 hours and 1 lab. (DE) Prerequisite(s): Human physiology or general physiology course and a general chemistry course.

541 Special Topics (1-3) Advanced study in selected areas of exercise science. Repeatability: May be repeated. Maximum 6 hours.

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. (DE) Prerequisite(s): 480 or 533.


569 Clinical Exercise Physiology (3) Cardiac structure and function, interpretation of 12-lead electrocardiograms, exercise considerations for cardiac and pulmonary patient. (DE) Prerequisite(s): 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. Repeatability: May be repeated. Maximum 6 hours. (DE) Corequisite(s): 533 or 567 or consent of instructor.

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

593 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

601 Research Seminar (1) Research topics in different aspects of exercise science, sport psychology, and sport sociology. (Same as Sport Studies 601.) Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.

622 Directed Independent Research (3-6) Grading Restriction: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours. Comment(s): For doctoral students. Others must obtain 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. (Same as Public Health 635.) (DE) Prerequisite(s): Elementary statistics course, 480 or 533 and 567 or consent of instructor.

664 Research Participation in Exercise Science (1-6) Participation in research with faculty member whose interests coincide with those of student. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.

681 Practicum (1-3) Intern experience in areas of major interest. May be repeated. Repeatability: May be repeated. Maximum 6 hours.

693 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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. (DE) Prerequisite(s): 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. (DE) Prerequisite(s): 511 and 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. (DE) Prerequisite(s): 511 and 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. (DE) Prerequisite(s): 511 and 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. (DE) Prerequisite(s): 511 and 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. (DE) Prerequisite(s): 511 and Business Administration 511, 512, 513, and 514 or consent of instructor.
593 Independent Study (3) Directed research and study.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Business Administration 511, 512, 513, and 514, or consent of instructor.

599 Special Topics in Finance (1-3) Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

641 Seminar in Finance (1-3) Capital markets, utility theory, asset pricing, theory of the firm, capital structure, dividend policy.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

651 Seminar in Corporate Finance (1-3) Recent theoretical and empirical developments in micro-finance literature. Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

652 Seminar in Asset Pricing and Markets (1-3) Recent theoretical and empirical developments in finance. Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

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.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

654 Special Topics (1-3) Recent developments in finance.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and advisor. Supervised experience in food industry or governmental laboratories.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

Food Science and Technology (390)

410 Food Chemistry (3) Reactions of water, proteins, lipids, carbohydrates, minerals, enzymes, vitamins, and additives in foods.
Contact Hour Distribution: 3 hours lecture.
(DE) Prerequisite(s): Chemistry 110, Biochemistry and Cellular and Molecular Biology 310.

415 Food Analysis (4) Principles, methods and techniques for qualitative and quantitative analyses of composition and physical, chemical, and biological properties of food and food ingredients.
Contact Hour Distribution: 3 hours and one 2-hour lab.
(DE) Prerequisite(s): Chemistry 110 or 350.

419 Food Chemistry Lab (1) Interaction of water, proteins, lipids, carbohydrates, minerals, enzymes, vitamins, and additives in foods and methods of evaluation of chemical properties of foods.
Contact Hour Distribution: One 2-hour lab.
(RE) Corequisite(s): 410.

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.
(DE) Prerequisite(s): Microbiology 210.

429 Food Microbiology Lab (3) Methods for examination, enumeration, cultivation and identification of foodborne microorganisms.
(DE) Prerequisite(s): Microbiology 210.
(RE) Corequisite(s): 420.

430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): Basic statistics course.

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.
Contact Hour Distribution: 3 hours lecture and 1 lab.
(DE) Prerequisite(s): 410 and 410 or consent of instructor.

461 Fresh Meats (3) Basic principles in the conversion of muscle to meat and the factors that contribute to the utilization and marketing of quality fresh meat products.

462 Manufactured Meat Technology (2) Basic principles of manufacturing valued added meat products.
Contact Hour Distribution: 1 hour lecture and 1 lab.

490 Food Laws and Regulations (3) A comprehensive examination of the laws and regulations designed to preserve safety, wholesomeness, and nutritional quality of the United States food supply with an in-depth analysis and discussion of precedent case studies and their impacts on laws and regulations.
(DE) Prerequisite(s): 140.
Registration Permission: Consent of instructor for non-majors.

495 Quality Assurance and Sanitation Practices (3) Design and evaluation of a food processing operation to produce a safe and acceptable quality food product.
(DE) Prerequisite(s): 320 and 340 or consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Seminar (1) Individual reports and discussion on topics from current literature.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 3 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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

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.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 410.

515 Food Carbohydrates, Proteins and Lipids (4) Advanced study of chemical and physical attributes 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.
Contact Hour Distribution: 3 hours and 1 lab.
(DE) Prerequisite(s): 410.

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.
(DE) Prerequisite(s): 410.

540 Food Product Development (3) Art, science and technology of developing and marketing new food products.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 410.

541 Food Engineering (3) Transport processes in food engineering; unit operations; thermal and non-thermal processing of foods; food separations; processing and physicochemical properties of foods; calculations, design practices, and equipment used in food processing operations.
Contact Hour Distribution: 2 hours and one 2-hour lab. Recommended Background: Basic calculus and physics.

590 Special Topics in Food Technology and Science (1-3) Critical reviews of current research and production concerns of food industry.
Repeatability: 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.
Repeatability: May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
601 Seminar (1) Reports and directed discussion on research topics from current literature.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 3 hours.

615 Food Biopolymers (3) Study of biopolymers obtained from food and used in food and other industries. Chemical, physical and mechanical characterizations, chemical and physical modifications, and applications as functional ingredients, carriers, and packaging materials.
   Contact Hour Distribution: 3 hours lecture.
   Recommended Background: Organic chemistry and food chemistry.

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.
   (DE) Prerequisite(s): 410 and 521 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.
   (DE) Prerequisite(s): Completion or near completion of foreign language hours for certification.
   Comment(s): Enrollment requires admission to teacher education.

555 Foreign Language in the Elementary Schools Practicum (3) Experiences designing, implementing and assessing second language instruction in elementary school settings.
   (DE) Prerequisite(s): 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. Course is required for ESL certification.
   (DE) Prerequisite(s): 578 or consent of instructor.

578 Teaching English as a Second Language (3) Examines ESL pedagogy, practices, and instructional strategies that accommodate students in all levels of ESL/EFL settings. Required for Tennessee (PreK-12) licensure.
   (DE) Prerequisite(s): 588 or consent of instructor.

588 Content-Based ESL Methods (3) Focused on designing and implementing content-based English as a Second Language instruction to enhance English language learners academic achievement. Offered for ESL education students...
   Registration Permission: Consent of instructor.

678 Advanced Studies in English as a Second Language (3) Research, curricula, assessment, and trends in English as a second language.
   (DE) Prerequisite(s): 578 or consent of instructor.

687 Advanced Studies in Foreign Language Education (3) Research, curricula, assessment, and trends in foreign language education.
   (DE) Prerequisite(s): 578 or consent of instructor.

Forestry (396)

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.
   Comment(s): Senior standing or consent of instructor required.

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 may be required.
   Contact Hour Distribution: 2 hours and 1 lab.

500 Thesis (1-15)
   Grading Restriction: P/NP only.
   Repeatability: May be repeated.

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.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated.
   Credit Restriction: May not be used toward degree requirements.

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.
   Comment(s): Available only to forestry majors in the non-thesis option.

512 Seminar (1) Current developments in forestry. Required of all graduate students in residence in the fall.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 2 hours.

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.
   Credit Restriction: Students cannot receive credit for both 514 and 414.
   (DE) Prerequisite(s): Biology 111 and 112 or Biology 101 and 102.

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.
   Repeatability: May be repeated. Maximum 3 hours
   Comment(s): Not available to students in forestry or wildlife and fisheries science.

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.
   Comment(s): Requires 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.
   (DE) Prerequisite(s): Basic understanding of polymer chemistry, engineering, physics, a silvicultural methods course, 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. Contact Hour Distribution: 6.5 hours and 1 lab weekly for 6 weeks.
   (DE) Prerequisite(s): 6 hours of biology sciences or consent of instructor.
   Comment(s): Not available to students in forestry or wildlife and fisheries science.

530 Advanced Forest Resource Management (3) Analysis of forest resource and 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.
   (DE) Prerequisite(s): Senior-level forest management course or consent of instructor.

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. Includes overnight field trips.
   (DE) Prerequisite(s): Senior-level course in forest recreation or consent of instructor.

555 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. Includes overnight field trips.

580 Advanced Silviculture (3) Silvical characteristics, silvicultural practices and systems applied to commercially important hardwoods 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.
   Contact Hour Distribution: 2 hours and 1 lab.
   Recommended Background: Silviculture course.

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 multistage sampling. Growth and yield predictions for even-aged and uneven-aged forests.
   Recommended Background: Forest inventory and sampling coursework.

590 Advanced Topics in Forestry (1-3) Recent advances and concepts; research techniques and analysis of current problems.
   Repeatability: May be repeated. Maximum 6 hours.
   Registration Permission: Consent of instructor.

593 Independent Study in Forestry (1-4)
   Repeatability: May be repeated. Maximum 6 hours.

530 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.
   Contact Hour Distribution: 2 hours and 1 lab.
   Recommended Background: Undergraduate course in silviculture.
Forestry, Wildlife and Fisheries (398)

410 Wildlife Habitat Evaluation and Management (3) Ecological relationships between wildlife and habitat. Evaluation, modeling, and management of wildlife habitat. Effects of land-use practices on wildlife habitat. Weekend field trips required.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: Undergraduate course in wildlife and fisheries.

416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildlife resource management through developing land management plans and analyzing case studies including conflict resolution.
Contact Hour Distribution: 1 hour and 2 labs.
Comment(s): To enroll, students must be at least a senior.

520 Natural Resource Issues at International Level (2) Identification and analyses of issues regarding forestry, wildlife, fisheries and wildlife park resources beyond U.S. borders. Political, economic, social, and biophysical elements impacting natural resources in different parts of world: Northern Europe, Latin America, Asia, Africa, and South America. In-depth case study and class presentation required by student teams.
Credit Restriction: Not available to students who have taken 420.

535 Environmental Impacts to Natural Ecosystems (3) Current environmental problems impacting natural ecosystems: climatic change, acidic deposition, air pollution, species declines, and introductions of exotic species. Management methodologies to mitigate environmental problems. Overnight field trips required.
Recommended Background: Undergraduate course in natural resource management.

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.
Credit Restriction(s): Students who received credit for Forestry 570 may not receive credit for Forestry, Wildlife and Fisheries 570.
Comment(s): Graduate standing required.

590 Advanced Topics in Forestry, Wildlife and Fisheries (1-3) Recent advances and concepts, research techniques, and analysis of current problems.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only.
Repeatability: May be repeated.

Registration Permission: Consent of instructor.

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.
Repeatability: May be repeated. Maximum 3 hours.

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 the fall.
Repeatability: May be repeated. Maximum 3 hours.

French (405)

410 Medieval French Literature (3) Major representative works of Medieval French literature. Texts in modern French. (Same as Medieval Studies 410.)
(DE) Prerequisite(s): 300-level literature course.

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.
(DE) Prerequisite(s): 300-level literature course.

(DE) Prerequisite(s): 300-level literature course.

413 French Literature of the 18th Century (3) Major works of the Enlightenment.
(DE) Prerequisite(s): 300-level literature course.

(DE) Prerequisite(s): 300-level literature course.

(DE) Prerequisite(s): 300-level literature course.

420 French Cinema (3) The French cinema from its earliest days through New Wave directors. May be applied toward the French major. (Same as Cinema Studies 420.)
(DE) Prerequisite(s): 300-level literature course.

421 Phonetics (3) Foundation in the science of phonetics. Practical exercises and individual performance.
Credit Restriction(s): Graduate credit is not available to students majoring in a Romance language.
(DE) Prerequisite(s): 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 the French language. Writing creative free-style compositions.
(DE) Prerequisite(s): 333 or 334 or 345.

423 Advanced Conversation (1) Informal conversation with native speaker on contemporary topics. Stresses in-class contact rather than outside preparation.
Contact Hour Distribution: Meets 2 hours a week.
(DE) Prerequisite(s): 333 or 334 or 345.

424 Advanced Conversation (1) Informal conversation with native speaker on contemporary topics. Stresses in-class contact rather than outside preparation.
Contact Hour Distribution: Meets 2 hours a week.
(DE) Prerequisite(s): 333 or 334 or 345.

425 Introduction to Descriptive Linguistics (3) Initiation into the theory and practice of techniques of linguistic analysis in the subfields of phonetics, phonology, morphology, syntax, semantics, pragmatics and historical linguistics; discussion of their relevance to the learning and teaching of foreign languages and to the study of literary texts. (Same as German 425; Linguistics 425; Russian 425; and Spanish 425.)
Recommended Background: Linguistics 200.

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. May be applied toward the major as a literature course.
(DE) Prerequisite(s): French 351 or French 352.

431 Highlights of French Civilization (3) Survey of French civilization from the Gauls to World War II. Historical events, daily life, all forms of art.
(DE) Prerequisite(s): 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. May be applied toward the French major.

434 Literature of Quebec (3) Survey of literature of Quebec, as well as French literature connected with North America. Readings include exploratory and missionary works, such as Voyages of Champlain and Journals of the Jesuits, as well as literature of contemporary Quebec.
(DE) Prerequisite(s): 300-level literature course.
445 Advanced French for Business (3) Study of advanced contemporary French language and culture as they relate to business transactions. A comparative approach is used to explore differences and similarities between Francophone business culture(s) and those of North America and Japan. Students build upon their knowledge of business terminology while being sensitized to cultural differences and the dangers of simplistic stereotyping.

(DE) Prerequisite(s): 345 or consent of instructor.

500 Thesis (1-15) Grading Restriction: P/INP grading only. Repeatability: May be repeated.

501 Techniques in Literary Analysis (3) Close stylistic analysis of texts representative of different eras and of different genres. Development and improvement of student’s written French. Required for MA students.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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 the 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 French Middle Ages.

550 French Literature and Culture II (3) Literary and cultural heritage of 16th- and 17th-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 the 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 the late 20th century to present.


584 Modern Theory and Criticism (3) Survey of 20th-century critical theory, including psychoanalysis, Marxism, structuralism, and more.

591 Foreign Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.

594 French Directed Readings (3)

595 French Directed Readings (3)

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/INP only. Repeatability: May be repeated.

610 Doctoral Seminar in French and Francophone Studies, or Linguistics (3) Content varies. Repeatability: May be repeated with consent of department. Maximum 12 hours.

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, including coordinate systems, datum issues, scanning digitizing, map standards, and uncertainty in Geographic Information Systems.

Contact Hour Distribution: 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.

Contact Hour Distribution: 2 hours lecture and 2 hours lab. (DE) Prerequisite(s): 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.

Contact Hour Distribution: 2 hours and 2 labs. (DE) Prerequisite(s): 310 or consent of instructor.

413 Remote Sensing: Types and Applications (4) Principles and uses of remote sensing imagery, digital data, and spectral data, with particular emphasis on geographic interpretation and mapping techniques.

Contact Hour Distribution: 3 hours lecture and 2 hours lab. (DE) Prerequisite(s): 312.

414 Spatial Databases and Data Management (3) Types, sources, acquisition, and documentation of spatial data. Spatial database management methods and strategies for data sharing.

Contact Hour Distribution: 2 hours lecture and 2 hours lab. (DE) Prerequisite(s): 411 or consent of instructor.

415 Quantitative Methods in Geography (4) Geographic application of statistical techniques, point pattern analysis, spatial analyses, and correlation and regression techniques.

Contact Hour Distribution: 3 hours lecture and 2 hours lab per week. (DE) Prerequisite(s): Mathematics 115 or Statistics 201.

421 Geography of Folk Societies (3) Geographical study of folk culture, emphasizing traditional material culture and rural settlement, with examples drawn from eastern North America and selected foreign areas.

423 Geography of American Popular Culture (3) Geographical study of regional variation in popular cultures, especially focused on youth cultures in the 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.

Contact Hour Distribution: 3 hours and 2 hours lab per week. (DE) Prerequisite(s): 132.

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.

(DE) Prerequisite(s): 132.

434 Climatology (3) General circulation system leading to world pattern of climates. Climatic change and modification, and interrelationships of climate and human activity.

(DE) Prerequisite(s): 131 or consent of instructor.

435 Biogeography (3) Study of the changing distribution patterns of plants and animals on a variety of spatial and temporal scales. The effects plate tectonics, Pleistocene climatic change, and human activity of world biota.

Recommended Background: Introductory physical geography or coursework in botany or ecology.

436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues examined from physical and economic geographical perspectives.

(DE) Prerequisite(s): 132.


Recommended Background: Introductory physical geography or coursework in botany or ecology.

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.
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.

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.

449 Geography of Transportation (3) Examination of transportation systems, emphasizing 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. Recommended Background: 132 or Geology 101 and 102 or Geology 107 and 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 the K-12 schools. Course organization and content based largely on that of National Geography Standards.

495 Special Topics in Geography (1-4) Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated with consent of instructor. Maximum 8 hours.
Registration Permission: Consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. May be applied toward graduate degree. Registration required of resident graduate students whenever offered.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 4 hours.

502 Registration for Use of Facilities (1-15) Required of new graduate students.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

504 Introduction to Geographical Research (1) Research interests and methods of departmental faculty. Research frontiers in geography. Required of new graduate students.
Grading Restriction: Satisfactory/No Credit grading only.

505 Directed Research (2-6) Research on problems as defined by individual students.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated with consent of instructor. Maximum 9 hours.
Registration Permission: Written consent of instructor and department.

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated with consent of instructor. Maximum 9 hours.
Registration Permission: Written consent of instructor and department.

507 Research in Human Geography (3) Introduction to human geography's questions, methods, and norms.

509 Topics in Geography (2-3) Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
Registration Permission: Consent of instructor.

510 Geographic Software Design (3) Algorithms for spatial analysis, software design, and program implementation in stand alone and distributed computing environments.
Registration Permission: Consent of instructor.

513 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 413 or consent of instructor.

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.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 415 or consent of instructor.

517 Geographic Information Management and Processing (3) Concepts and methods in management of geographic information. Database design, manipulation, sampling and analysis.
(DE) Prerequisite(s): Consent of instructor.

518 GIS Project Management (3) Interactions between management, technical, and application aspects of Geographic Information Systems projects through simulated environment of real-world GIS sites.
(DE) Prerequisite(s): 411 or consent of instructor.

519 Graduate Practicum in Cartography/Remote Sensing/GIS (2-6)
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
Registration Permission: Written consent of department before registration.

521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 421 or consent of instructor.

532 Topics in Global Change (3) Emerging trends, anticipated problems and methods in global change research and response.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 434 or consent of instructor.

533 Topics in Physical Geography (3) Trends, problems, and methods in geomorphology or other areas of physical geography.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
Registration Permission: Consent of instructor.

534 Topics in Climatology (3) Trends, problems and methods in area of climatology.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 434 or consent of instructor.

535 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
Registration Permission: Consent of instructor.

541 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 441 or consent of instructor.

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.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 449 or consent of instructor.

591 Foreign Study (1-15)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Written consent of department prior to registration.

592 Off-Campus Study (1-15)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Written consent of department prior to registration.

593 Independent Study (1-15)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Written consent of department prior to registration.

599 Geographic Concept and Method (3) Traditional and modern geographic thought; readings on nature, scope, problems, and methods of geography.
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

609 Seminar in Geography (2-3) Topics vary.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

611 Seminar in Geographic Information Science (3) Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 517 and 518 or consent of instructor.

631 Seminar in Natural Hazards (3)
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.
632 Seminar in Dendrochronology (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 432 or consent of instructor.

633 Seminar in Physical Geography (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 533 or consent of instructor.

634 Seminar in Climatology (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 534 and 532 or consent of instructor.

635 Seminar in Biogeography (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 535 or consent of instructor.

641 Seminar in Urban Geography (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 541 or consent of instructor.

643 Seminar in Rural Geography (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 443 or consent of instructor.

649 Seminar in Geography of Transportation (3)
Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 549 or consent of instructor.

663 Seminar in Geography of the American South (3)
Repeatable: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

Geology (424)

401 Quantitative Methods in Geology (3) Applications of calculus and differential equations to problems in the earth sciences. Examples of the diffusion equation in hydrogeology; the wave equation in geophysics; mechanical modeling and boundary conditions in structural geology and tectonics.

Contact Hour Distribution: 3 lecture hours. Recommended Background: Introductory geology and calculus or consent of instructor.


Contact Hour Distribution: 2 lecture hours and one 2-hour lab. Recommended Background: Mineralogy or consent of instructor.

411 Optical Mineralogy (2) Laboratory course on the principles of optical mineralogy. Use of petrographic microscope to identify rock-forming minerals with applications to petrology and environmental mineralogy.

Recommended Background: Mineralogy or consent of instructor.

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.

Recommended Background: Mineralogy or consent of instructor.

440 Field Geology (5) Summer field course for advanced undergraduate geology majors and first-year graduate students in geology. Taught off-campus and requires the full time of the student. Course provides a synthesis of the major aspects of the geological sciences in societal context. Field techniques demonstrated, practiced, and applied to solution of geologic problems.

Recommended Background: At least 16 hours of mineralogy, petrology, paleontology, sedimentology and stratigraphy, or structural geology and geophysics.

Registration Permission: Consent of instructor.

450 Process Geomorphology (3) Integrative approach to the development of the surface of Earth based upon case histories, maps, remote sensing imagery. (Same as Geography 450.)

Contact Hour Distribution: 2 hours and one 2-hour lab. Recommended Background: Introductory geology or consent of instructor.

455 Basic Environmental Geology (3) Applications of the geological sciences toward a comprehension of the effects of geological processes on humans and effects of human activities on the Earth’s environments.

Contact Hour Distribution: 2 hours and one 3-hour lab or field period. Recommended Background: Introductory geology or consent of instructor.

460 Principles of Geochemistry (4) Applications of chemical principles to geologic systems with emphasis on problem-solving techniques. Topics include 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.

Contact Hour Distribution: 3 lecture hours and one 2-hour tutorial. Recommended Background: General chemistry, calculus, mineralogy and petrology or consent of instructor.

470 Applied Geophysics (3) Basic principles of data collection, processing, and analysis for several common geophysical techniques will be presented through lectures, computer assignments (labs), and field work. Passive (earthquake) and active (reflection and refraction) seismology, potential fields (gravity and magnetics), heat flow, electromagnetics (including ground penetrating radar), and electrical techniques.

Contact Hour Distribution: One 3-hour meeting per week consisting of lecture, computer lab, or field work. One optional day or weekend field trip will be scheduled.

Recommended Background: Calculus, physics, petrology, sedimentology and stratigraphy and structural geology or consent of instructor.

480 Principles of Economic Geology (4) Ore-forming processes, classification of mineral deposits, survey of different types of mineral deposits with examples, and metallogenesis.

Contact Hour Distribution: 3 hours lecture and one 2-hour lab. Recommended Background: Mineralogy, petrology and geochemistry or consent of instructor.

485 Principles of Hydrogeology (3) Physical principles of flow, flow equations, geologic controls, aquifer analysis, water well design/testing, introduction to transport processes. (Same as Civil Engineering 485.)

Recommended Background: Calculus, physics and introductory geology or consent of instructor.

486 Hydrogeology Laboratory (1) Application and demonstration of hydrogeological principles in the field and laboratory. (DE) Corequisite(s): 485 and Environmental Engineering 535.

Registration Permission: Consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only. Repeatable. May be repeated.

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.

Recommended Background: 6-8 hours of coursework in earth sciences, calculus, 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.

Grading Restriction: Satisfactory/No Credit grading only. Credit Restriction: May not be used toward degree requirements.

505 Structure of the Southern and Central Appalachians (2) Structural development of Southern and Central Appalachians from extensional Late Proterozoic to 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.

Recommended Background: Structural geology or consent of instructor.

510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques in clay mineral studies.

Contact Hour Distribution: 2 lecture hours and one 2-hour lab. Recommended Background: Mineralogy and geochemical analysis or consent of instructor.

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.

Contact Hour Distribution: 3 lecture hours and one 2-hour lab. Recommended Background: Advanced mineralogy or consent of instructor.

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, instrumentaion 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.

Contact Hour Distribution: 2 hours lecture and one 2-hour lab. Recommended Background: Mineralogy, Calculus and physics or consent of instructor.
### 545 Siliciclastic Petrogenesis (4) Origin and evolution of siliciclastic sediments from a geochemical and petrographic perspective. Emphasis on a quantitative treatment of major elements, trace elements and rare earth elements to extract provenance, weathering, and diagenesis information.

- **Contact Hour Distribution:** 2 lectures per week, one 2-hour lab.
- **Recommended Background:** Mineralogy, optical mineralogy and sedimentology and stratigraphy or consent of instructor.

### 546 Carbonate Sedimentology and Geochemistry (4) Environments of deposition and diagenesis of carbonate rocks; introduction to carbonate chemistry, carbonate equilibria, and the precipitation of carbonate minerals; abiotic vs. biotic control of carbonate precipitation; secular change in carbonate mineralogy and fabric through geology time. Petrographic observation, synthesis of petrographic and geochemical datasets, critical analysis of scientific literature, and oral/written presentation.

- **Contact Hour Distribution:** 3 lecture/discussion hours per week and one 2-hour lab.
- **Recommended Background:** General chemistry, mineralogy and sedimentology and stratigraphy or consent of instructor.

### 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.

- **Contact Hour Distribution:** 3 lecture hours.
- **Recommended Background:** General chemistry 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.

- **Recommended Background:** General chemistry or consent of instructor.

### 565 Chemical Petrology (3) Application of thermodynamics to geologic materials. Thermodynamics of condensed phases, solutions, thermodynamic stability, heterogeneous multicomponent phase equilibria, and conduction of heat through earth.

- **Recommended Background:** Calculus, general chemistry and physical chemistry or consent of instructor.

### 568 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, x-ray fluorescence, and atomic absorption spectrophotometry techniques.

- **Contact Hour Distribution:** 2 hours lecture and one 2-hour lab.
- **Recommended Background:** General chemistry and mineralogy or consent of instructor.

### 570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; recent literature.

- **Contact Hour Distribution:** 3 hours lecture and 1 lab or seminar.
- **Recommended Background:** Structural geology or consent of instructor.

### 572 Fracture Analysis (3) Field and subsurface characterization, and mechanical development of natural fractures: role in groundwater flow. (Same as Civil Engineering 572.)

- **Recommended Background:** Structural geology or consent of instructor.

### 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, Uralis, Caledonians, Cordillerans, Andes, and Himalayas.

- **Contact Hour Distribution:** 3 hours lecture and 1 seminar.
- **Recommended Background:** Structural geology course.
- **Registration Permission:** 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.

- **Recommended Background:** Geophysics.
- **Registration Permission:** 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.

- **Recommended Background:** Calculus, physics, hydrogeology and geochemistry or aquatic chemistry.
- **Registration Permission:** 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.

- **Recommended Background:** Calculus, physics, and hydrogeology.
- **Registration Permission:** Consent of instructor.

### 590 Special Problems in Geology (1-3) Student- or instructor-initiated course offered at the convenience of the department, with focus on specialized topics in the geological sciences.

- **Repeatability:** May be repeated. Maximum 12 hours.
- **Registration Permission:** Consent of instructor.

### 591 Foreign Study (1-12)

- **Repeatability:** May be repeated. Maximum 12 hours.
- **Credit Restriction:** Only 3 hours may be applied to the geology major.
- **Registration Permission:** Consent of instructor.

### 592 Off-Campus Study (1-12)

- **Repeatability:** May be repeated. Maximum 12 hours.

### 593 Independent Study (1-12) Student or instructor initiated independent study.

- **Repeatability:** May be repeated. Maximum 12 hours.
- **Credit Restriction:** Only 3 hours may be applied to the geology major.
- **Registration Permission:** Consent of instructor.

### 595 Selected Topics in Geology (1) Presentation of research by faculty and visiting scientists.

- **Grading Restriction:** Satisfactory/No Credit grading only.
- **Comment(s):** Registration required each spring and fall semester for resident full-time graduate students, except when registered for 596.

### 596 Geology Colloquium (1) Preparation and oral presentation of scientific material. Grade based on content, preparation, presentation, and instructor critique in departmental seminar.

- **Comment(s):** Registration required once during residence for each graduate student.

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

- **Grading Restriction:** P/NP only.
- **Repeatability:** May be repeated.

### 630 Seminar in Petrology (3)

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### 640 Seminar in Sedimentary Geology (3)

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### 650 Seminar in Geomorphology and Quaternary Geology (3)

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### 660 Seminar in Geochemistry (3)

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### 670 Seminar in Structural Geology (3)

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### 675 Seminar in Geophysics (3) Advanced treatment of selected topics in geophysics.

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### 685 Seminar in Hydrogeology (3)

- **Repeatability:** May be repeated. Maximum 9 hours.
- **Registration Permission:** Consent of instructor.

### German (433)

#### 411 Advanced Conversation and Composition (3)

- **(DE) Prerequisite(s):** 311 and 312 or consent of department.

#### 412 Advanced Conversation and Composition (3)

- **(DE) Prerequisite(s):** 311 and 312 or consent of department.

#### 415 German Special Topics (3)

- **Repeatability:** 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.

- **(DE) Prerequisite(s):** 101 and 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, religion and literary history, as well as exploring the relationship between literary, musical, and artistic representations of specific themes. 
(DE) Prerequisite(s): 6 hours of 300-level courses, excluding 331 and 332.

420 Selected Topics in German Literature from 1750 to the Present (3) 
(DE) Prerequisite(s): 6 hours of 300-level courses, excluding 331 and 332 and courses in English translation.

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. Non-phonological linguistic change, language families, Proto-Indo-European, and other proto-languages. (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. 
(DE) Prerequisite(s): 6 hours of 300-level courses, excluding 331 and 332.

432 German Creative Thinking: Interdisciplinary Dialogues (3) Interdisciplinary component, focusing on literary and artistic forms that depict struggles involving religion, politics and gender.

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.

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.

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. (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 German speech. (Same as Linguistics 436.)

450 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

510 German Phonetics and Advanced Grammar (3) Advanced work in phonetics, pronunciation, and selected topics in German grammar. For teachers and prospective teachers. Registration Permission: 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 Graduate Teaching Assistantships, except those whose previous training or experience warrants their being excused by the 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.

541 Medieval German Language and Literature (3) Introduction to Middle High German.

550 Studies in German Literature (3) Content varies. Repeatability: May be repeated. Maximum 6 hours.

552 German Enlightenment, Rococo, and Sturm und Drang (3) Content varies. Repeatability: May be repeated. Maximum 6 hours.

553 German Classicism and Romanticism (3) Content varies. Repeatability: May be repeated. Maximum 6 hours.

554 German Realism and Naturalism (3) Content varies. Repeatability: May be repeated. Maximum 6 hours.

555 Modern German Literature 1890-1945 (3) Content varies. Repeatability: May be repeated. Maximum 6 hours.

556 Modern German Literature 1945-Present (3) Content varies. Repeatability: May be repeated. Maximum 6 hours.

560 German Literary Theory and Criticism (3)

561 Directed Readings in German Language and Literature (3)

562 Directed Readings in German Language and Literature (3)

591 Foreign Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

621 Seminar in German Literature (3) Repeatability: May be repeated. Maximum 18 hours.

622 Seminar in German Literature (3) Repeatability: May be repeated. Maximum 18 hours.

631 Seminar in German and Germanic Philology (3)

632 Seminar in German and Germanic Philology (3)

Global Studies (440)

482 Special Topics in Global Cinema (3) (See Modern Foreign Languages and Literatures 482.)

Health (449)

400 Consumer Health (3) 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.)

406 Death, Dying and Bereavement (3) Aspects of dying, death and handling the trauma of loss. Medical, financial, physical, legal, and social implications of death.

420 Sex Education As It Relates to Human Sexuality (3) Science of human sexuality. Emphasis on the trends, issues, and content of sex education.

425 Women’s Health (3) Factors influencing women’s health and women as consumers in nation’s health service delivery systems. Study of health problems/concerns of women and techniques for prevention, maintenance and/or correction. (Same as Women’s Studies 425.)

430 Suicide and Crisis Intervention (3) Factors which make suicide a serious health problem. Assessment, intervention, and prevention techniques.
<table>
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<tr>
<th>Course Code</th>
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<th>Grading Restriction</th>
<th>Repeatability</th>
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<td>601</td>
<td>Internship/Research in Safety and Health (3-6)</td>
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<td>Critical Analysis of Writing and Research (3)</td>
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<td>Advanced Research Techniques in Health (3)</td>
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<td>590</td>
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<td>593</td>
<td>Directed Independent Studies (1-3)</td>
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<td>605</td>
<td>Health Aspects of Gerontology (3)</td>
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<td>455</td>
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<td>502</td>
<td>Registration for Use of Facilities (1-15)</td>
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<td>Problems in Lieu of Thesis (2-3)</td>
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<td>May be repeated.</td>
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<td>513</td>
<td>Administrative and Organizational Theory (3)</td>
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<td>Leadership Themes in Literature (3)</td>
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<td>530</td>
<td>Health Promotion and Health Education Program Development (3)</td>
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<td>Evaluation in Health Promotion and Health Education (3)</td>
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<td>570</td>
<td>Special Topics (1-3)</td>
<td>For graduate students, in-service teachers and other health professionals. Health/wellness or health promotion issues. Repeatability: May be repeated. Maximum 12 hours.</td>
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<td>Seminar in Gerontology (1)</td>
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<td>Repeatability: May be repeated.</td>
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<td>572</td>
<td>Student Assessment in Higher Education (3)</td>
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<td>574</td>
<td>The College Student (3)</td>
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<td>575</td>
<td>Student Affairs Administration in Higher Education: Theory and Practice (3)</td>
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<td>600</td>
<td>Doctoral Research and Dissertation (3-15)</td>
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<td>Grading Restriction: P/NP only.</td>
<td>May be repeated</td>
<td>Maximum 12 hours.</td>
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<tr>
<td>510</td>
<td>Foundations of Graduate Study in History (3)</td>
<td>Assumptions and methods of historians. Required of all candidates for advanced degrees.</td>
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<tr>
<td>512</td>
<td>Teaching Western Civilization (3)</td>
<td>Methodology, conceptualization, historiography, text book selection and syllabus construction to prepare students to teach courses in western civilization.</td>
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<tr>
<td>518</td>
<td>Teaching United States History (3)</td>
<td>Methodology, conceptualization, historiography, text book selection and syllabus construction to prepare students to teach courses in U.S. history.</td>
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<tr>
<td>515</td>
<td>Introduction to American History to 1840s (3)</td>
<td>Survey of major themes, methodologies, and interpretations in early American historiography.</td>
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<tr>
<td>516</td>
<td>Introduction to American History, 1840s – present (3)</td>
<td>Survey of major themes, methodologies, and interpretations in modern American historiography.</td>
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<tr>
<td>521</td>
<td>MA Readings (3)</td>
<td>Directed readings in preparation for MA examinations. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours. Comment(s): Open only to master's candidates in history.</td>
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<tr>
<td>531</td>
<td>Topics in Pre-modern Europe (3)</td>
<td>Reading seminar: secondary sources on pre-modern European movements and trends. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>532</td>
<td>Topics in Modern Europe (3)</td>
<td>Reading seminar: secondary sources on movements and trends that are multinational in focus. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>533</td>
<td>Topics in European National History (3)</td>
<td>Reading seminar: secondary sources on intra-national topics, usually British, Russian, German, or French. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>541</td>
<td>Topics in Early American History (3)</td>
<td>Reading seminar: secondary sources on early North American history. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>542</td>
<td>Topics in 19th-Century United States (3)</td>
<td>Reading seminar: secondary sources on 19th-century United States. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<td>543</td>
<td>Topics in 20th-Century United States (3)</td>
<td>Reading seminar: secondary sources on 20th-century United States. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>544</td>
<td>Topics in U.S. Environmental History (3)</td>
<td>Reading seminar: secondary sources on U.S. environmental history. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>545</td>
<td>Topics in the History of Foreign Relations (3)</td>
<td>Reading seminar: secondary sources on foreign relations. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>552</td>
<td>Topics in Military History (3)</td>
<td>Reading seminar: secondary sources on military history, military operations, social impact of war, and naval strategy in foreign policy. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>555</td>
<td>Topics in United States Social and Economic History (3)</td>
<td>Reading seminar: secondary sources on U.S. social and economic history. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>556</td>
<td>Topics in European Social and Economic History (3)</td>
<td>Reading seminar: secondary sources on social or economic history of European nations. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>557</td>
<td>Topics in Cultural and Intellectual History (3)</td>
<td>Reading seminar: secondary sources on cultural and intellectual history. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>558</td>
<td>Topics in United States Regional and Local History (3)</td>
<td>Reading seminar: secondary sources on regions, states and cities of the South. Repeatability: May be repeated. Maximum 15 hours.</td>
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<td>559</td>
<td>Topics in Jewish History (3)</td>
<td>Reading seminar: secondary sources on Jewish history. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<td>561</td>
<td>Topics in Latin American History (3)</td>
<td>Reading seminar: secondary sources on Latin America. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<td>562</td>
<td>Topics in Asian History (3)</td>
<td>Reading seminar: secondary sources on Asian history; East Asia and Middle East. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>580</td>
<td>Topics in History (3)</td>
<td>Reading seminar: secondary sources for new topics. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>585</td>
<td>Topics in World History (3)</td>
<td>Reading seminar in transnational themes involving analysis of two or more world cultures. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<td>591</td>
<td>Foreign Study (1-12)</td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>592</td>
<td>Off-Campus Study (1-12)</td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>593</td>
<td>Independent Study (1-12)</td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>600</td>
<td>Doctoral Research and Dissertation (3-15)</td>
<td>Grading Restriction: P/NP only. Repeatability: May be repeated.</td>
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<tr>
<td>621</td>
<td>Directed Readings (3)</td>
<td>Directed readings to prepare candidate for doctoral comprehensive examination. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.</td>
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<tr>
<td>631</td>
<td>Seminar in Pre-Modern European History (3)</td>
<td>Research seminar in primary sources. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>632</td>
<td>Seminar in Modern European History (3)</td>
<td>Research seminar in primary sources culminating in scholarly paper in modern European history. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>641</td>
<td>Seminar in 17th- and 18th-Century America (3)</td>
<td>Research seminar in primary sources. Focus varies. Repeatability: May be repeated. Maximum 15 hours.</td>
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Repeatability: May be repeated. Maximum 15 hours.

Repeatability: May be repeated. Maximum 15 hours.

561 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.
Repeatability: 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.
Repeatability: 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. 
(DE) Prerequisite(s): 210, 211, 224, and 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. 
(DE) Prerequisite(s): 210, 211, and 390 or consent of instructor.

500 Thesis (1-15) Grading Restriction: P/NP only. 
Repeatability: May be repeated.

501 Professional Project (3-6) Application-oriented, capstone project to show competence in major academic area. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. Maximum 6 hours. 
Comment(s): Enrollment limited to hotel, restaurant, and tourism students in non-thesis option. 
Registration Permission: 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. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. 
Credit Restriction: May not be used toward degree requirements.

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.

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. 
Repeatability: May be repeated. 
Registration Permission: Consent of instructor.

535 Directed Study in Foodservice and Lodging Administration (1-3) Problems selected for study by student with guidance of faculty member. 
Repeatability: May be repeated. Maximum 6 hours. 
Registration Permission: Consent of instructor.

537 Seminar in Foodservice and Lodging Administration (1) Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated.

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. 
(DE) Prerequisite(s): 531 and 532.

547 Field Experience (3-9) Experience in food- or lodging-related industry or agency under supervision of faculty member. 
Grading Restriction: Satisfactory/No Credit grading only. 
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. 
Repeatability: May be repeated.

615 Trends and Issues in Hospitality and Tourism (3) Examination of contemporary issues in hospitality and tourism.

616 Literature and Thought in Hospitality and Tourism (3) Examination of the development of thought and the evolution of the field of hospitality and tourism studies.

Human Ecology (520)

500 Thesis (1-15) Grading Restriction: P/NP only. 
Repeatability: May be repeated.

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. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. 
Credit Restriction: May not be used toward degree requirements.

503 Problems in Lieu of Thesis (3) 
Grading Restriction: 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. 
(DE) Prerequisite(s): 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.

511 Issues and Trends in Human Resource Development (3) Study of current, emerging, and future issues and trends in Human Resource Development research and practice. Linking research and practice, importance of theory to inform practice, research needs reflected in practice, cycle of how researchers and practitioners learn, how they design practice, and how they evaluate to inform policy. 
(DE) Prerequisite(s): 510.

513 Special Topics in Human Resource Development (1-3) Topics vary in research, theory and current issues in human resources. 
Repeatability: May be repeated. Maximum 9 hours. 
Registration Permission: Consent of instructor.

514 Individual Study in Human Resource Development (3) Approval form must be filed in the office of the program liaison. 
Repeatability: May be repeated. Maximum 6 hours. 
Registration Permission: Consent of supervising instructor.
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.

(DE) Prerequisite(s): 510 and 511.

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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 510.

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.

(DE) Corequisite(s): 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.

(DE) Corequisite(s): 510.

558 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.

(DE) Prerequisite(s): 557.

561 Strategic Human Resource Development (3) Overviews how human resource development increases organizational competitive advantage. Human capital theory, systems theory and systems integration emerge as theoretical frameworks for linking human resource development with business strategy to attain strategic initiatives. Value creation for human resource development stakeholders, management of human resource development resources, and continuous improvement of human resource development processes are emphasized. Students explore the role of human resource development in organizational visioning, planning, leadership development, innovating, and economic development.

(DE) Corequisite(s): 510.

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)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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 the first year of study in the program.

Registration Permission: Consent of instructor for non-program 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 the first year of study in the program.

Registration Permission: Consent of instructor for non-program 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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 ergonomics issues in utilizing technologies to improve human performance in organizations.

(DE) Prerequisite(s): 602 and 603.

611 Internship in Human Resource Development (3) Field experience in relevant organizations.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

613 Seminar in Selected Topics (3) Topics in human resource development.
Repeatability: May be repeated Maximum 6 hours.

(DE) Prerequisite(s): 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Credit Restriction: May not be used toward degree requirements.

525 Research in Industrial/Organizational Psychology (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Available only to students admitted to program or by reassignment with program director.

567 Proseminar in Industrial/Organizational Psychology (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.
Registration Permission: Consent of instructor required for non-program students.

568 Proseminar in Industrial/Organizational Psychology (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.
Registration Permission: 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)  
Grading Restriction: P/NP only. 
Repeatability: May be repeated.

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.  
(DE) Prerequisite(s): 567 and 568 or consent of instructor.

612 Seminar in Work Motivation (3) Current theories, concepts, and issues associated with psychology of work motivation.  
(DE) Prerequisite(s): 567 and 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.  
(DE) Prerequisite(s): 567 and 568 or consent of instructor.

614 Seminar in Employee Selection (3) Current issues, concerns, and methods used in employee selection.  
(DE) Prerequisite(s): 567 and 567 or consent of instructor.

615 Seminar in Organizational Training and Development (3) Current issues, problems, and research in training and development.  
(DE) Prerequisite(s): 567 and 568 or consent of instructor.

625 Topics in Organizational Psychology (3) Topics vary.  
Repeatability: May be repeated. Maximum 9 hours.

626 Topics in Industrial Psychology (3) Topics vary.  
Repeatability: May be repeated. Maximum 9 hours.

627 Structural Equation Models in Organizational Research (3) Issues related to analysis of organizational data using structural equation and related techniques.

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.  
Grading Restriction: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 15 hours.

Industrial Engineering (556)
Note: Any 400-level course required for the Bachelor of Science in Industrial Engineering 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 materials handling systems, hard automation, alternative integrated manufacturing systems, and manufacturing information/control systems.  
(DE) Prerequisite(s): 330.

402 Production System Planning and Control (3) Theory and application of forecasting systems including regression and time series models. Independent demand inventory models, including development of safety stock. All modules of Manufacturing Resource Planning (MRP) Systems: master production scheduling, resource requirements planning, bill of material and inventory file structures, material requirements planning, capacity planning, shop floor and purchase order control. Overview of just-in-time inventory concepts and MRP’s role in manufacturing automation.  
(DE) Prerequisite(s): 202.


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.

422 Senior Problems Analysis (3) Current real-world problems will be drawn from local production and service organizations and presented by personnel from these organizations. Senior industrial engineering student teams will solve these real-world problems under the guidance of their instructor using industrial engineering methodology. These problems emphasize problem definitions, analysis, and presentation with considerations for engineering standards and realistic economic, environmental, ethical, safety, social, political, and other pertinent constraints.


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.  
(DE) Corequisite(s): 396 and 402.

440 Process Improvement Through Planned Experimentation (3) Review of fundamentals of continuous improvement, advanced statistical process control techniques, and strategies for short production runs. Use of experimental design techniques to improve processes, including single and multiple-factor designs, blocking and confounding, and fractional designs. Full factorial designs are compared to fractional designs to balance experimental efficiency with loss of information. Lab component utilizes statistical and simulation software to provide hands-on experience.  
(DE) Prerequisite(s): 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/software requirements, input/output device design, and error message handling.  
(DE) Prerequisite(s): Computer programming course.

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

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

500 Thesis (1-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

501 Design Project (1-3)  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 6 hours.  
Comment(s): Enrollment limited to industrial engineering students in non-thesis option.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

503 Industrial Engineering Methods Review (3) Survey of industrial engineering tools and techniques applied to analysis, design, and improvement of manufacturing systems. Students who do not have an undergraduate degree in industrial engineering must enroll in this course.  
Grading Restriction: Satisfactory/No Credit grading only.  
Credit Restriction: May not be applied toward degree requirements.  
Comment(s): Admission to dual MS-MBA program required.

504 Product Development Process (1) (See Mechanical Engineering 504.)

506 Product Selection and Evaluation (2) (See Mechanical Engineering 506.)

507 Application of Linear Algebra in Engineering Systems (3) (See Chemical Engineering 507.)
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 influencing system design. Case studies and team projects. (Same as Mechanical Engineering 508.)

Registration Permission: Consent of instructor.

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. (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.)

Repeatability: May be repeated. Maximum 3 hours.

Registration Permission: Consent of instructor.

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.

Registration Permission: Consent of instructor.

513 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, application of operation research models, and use of these to design manufacturing facility. (DE) Prerequisite(s): 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. (DE) Prerequisite(s): 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 organizational improvement; descriptive statistics and distribution theory; relationships between statistical process control techniques and classical statistical tools; parameter estimation and hypothesis testing; goodness-of-fit testing; linear regression and correlation; analysis of variance; single and multiple factor experimental design. (DE) Prerequisite(s): Statistics 251 or equivalent.

517 Reliability Engineering (3) Continuous time random processes with applications to availability of equipment and manufacturing systems. Failure densities and failure data analysis. Maintainability. Reliability-based criteria for product acceptance. (DE) Prerequisite(s): 516.

518 Advanced Engineering Economic Analysis (3) Application of engineering economic analysis in complex decision situations. Inflation and price changes; uncertainty evaluation using non-probabilistic techniques; capital financing and project allocation; evaluations involving equipment replacement, investment in utilities, and public works projects; probabilistic risk analysis including computer simulation and decision trees; multi-attribute decision analysis; and other advanced topics. (DE) Prerequisite(s): 405 and Statistics 251.

519 Human Factors Engineering and Ergonomics (3) Application of human factor and ergonomic concepts and principles to design and analysis of man-systems and products. Human as biomechanical system; human information processing; minimization of human error; anthropometry; 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. (DE) Prerequisite(s): Statistics 251 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. (DE) Prerequisite(s): 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 prediction; evaluation of human-machine interface; modeling techniques; questionnaire and survey design; experimental design, and other selected topics. (DE) Prerequisite(s): 519 or consent of instructor.

522 Optimization Methods in Industrial Engineering (3) Classical optimization applied to constrained and unconstrained, non-linear, multivariable functions; search techniques; decision making under uncertainty; game theory; and dynamic programming. (DE) Prerequisite(s): 401 and 508 or consent of instructor.

525 Systems Modeling and Simulation (3) Modeling of discrete systems using current simulation software and Monte-Carlo simulation. 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.

Registration Permission: 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. (Same as Management Science 526.) (DE) Prerequisite(s): 306 or 525.

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. (DE) Prerequisite(s): 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. Grading Restriction: Satisfactory/No Credit grading only. Comment(s): Admission to graduate program required.

552 Advanced Linear Programming and Extensions (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis; and quadratic, separable, integer, and goal programming. (DE) Prerequisite(s): 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. (DE) Prerequisite(s): 314 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 design and web designs. The course includes lectures, discussions, demonstrations and field trip to a local usability lab. (DE) Prerequisite(s): 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. (Same as Chemical Engineering 556.)

(DE) Prerequisite(s): 516 or equivalent.

561 Application of Multivariate Statistics to Process Modeling and Data Analysis (3) (See Chemical Engineering 561.)

591 Special Topics in Industrial Engineering (1-3) Individual or group research projects.

Repeatability: May be repeated.

Registration Permission: Consent of instructor.

592 Special Topics in Industrial Engineering (1-3) Individual or group research projects.

Repeatability: May be repeated.

Registration Permission: Consent of instructor.

593 Special Topics in Industrial Engineering (1-3) Individual or group research projects.

Repeatability: May be repeated.

Registration Permission: Consent of instructor.

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

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

(DE) Prerequisite(s): 518 and 523.

602 Nonlinear Optimization (3) (See Management Science 651.)


(DE) Prerequisite(s): 516.

606 Advanced Topics in Human Factors, Safety and Biomechanical Engineering (3) Application of advanced engineering analysis and design methods to manned system safety, epidemiology of accidents and injuries, and study of injury causal mechanisms. Injury models and theories and development of injury, loss, and risk reduction techniques. Current research issues in manned systems analysis and design. Research into system failures: prevention of injuries.

Registration Permission: Consent of instructor.

691 Advanced Topics in Industrial Engineering (3) Forum to study individually or in groups.

Repeatability: May be repeated with consent of instructor.

Comment(s): Requires graduate standing.

Registration Permission: Consent of instructor.

692 Advanced Topics in Industrial Engineering (3) Forum to study individually or in groups.

Repeatability: May be repeated with consent of instructor.

Comment(s): Requires graduate standing.

Registration Permission: Consent of instructor.

693 Advanced Topics in Industrial Engineering (3) Forum to study individually or in groups.

Repeatability: May be repeated with consent of instructor.

Comment(s): Requires graduate standing.

Registration Permission: 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.

(DE) Prerequisite(s): 341 or consent of instructor.

542 Application Security and Controls (3) Introduces students to data security, systems controls, and privacy issues regarding Internet applications.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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 policies for organizations.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>540</td>
<td>Research Methods for Information Professionals (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>550</td>
<td>Management of Information Organizations (3)</td>
<td></td>
<td>Supervisory and management concepts, strategies, and techniques applicable to information professionals working in libraries, archives, records management, and other information organizations.</td>
</tr>
<tr>
<td>551</td>
<td>School Library Media Centers (3)</td>
<td></td>
<td>Planning, implementing, and evaluating school library programs. Curricular involvement, role of technology, site-based management, relationships with district and state services.</td>
</tr>
<tr>
<td>552</td>
<td>Academic Libraries (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>553</td>
<td>Specialized Information Agencies and Services (3)</td>
<td></td>
<td>Development and present status, scope and objectives. Information resources external to organization.</td>
</tr>
<tr>
<td>554</td>
<td>Public Library Management and Services (3)</td>
<td></td>
<td>Development, roles, political environment, governance, organization, fiscal management, services, marketing, and performance evaluations.</td>
</tr>
<tr>
<td>555</td>
<td>Scientific and Technical Communications (3)</td>
<td></td>
<td>Evolution of scientific and technical communication; current trends; role of formal and informal communications; major STI organizations and their roles.</td>
</tr>
<tr>
<td>556</td>
<td>Knowledge Management for Information Professionals (3)</td>
<td></td>
<td>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 repurposing of information, uses of information technology, and roles of information professionals in developing knowledge management initiatives.</td>
</tr>
<tr>
<td>557</td>
<td>User Instruction (3)</td>
<td></td>
<td>Theory, strategy, design, and practice in providing instructional services and technology for end users of information and information systems.</td>
</tr>
<tr>
<td>558</td>
<td>Library Services for a Diverse Society (3)</td>
<td></td>
<td>Examines the issues of diversity and multiculturality 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.</td>
</tr>
<tr>
<td>560</td>
<td>Development and Management of Collections (3)</td>
<td></td>
<td>Selecting and preserving a variety of items (tangible and intangible) to meet needs of particular users; community analysis; policies and procedures; evaluation; purchasing.</td>
</tr>
<tr>
<td>561</td>
<td>Contemporary Book Publishing (3)</td>
<td></td>
<td>Creation, design, production, marketing, and distribution; various types of publishers.</td>
</tr>
<tr>
<td>563</td>
<td>Graphic Design and Media (3)</td>
<td></td>
<td>Principles and practice in visual aspects of communications. Graphic design, typography, production techniques and publication design, as these apply to electronic information delivery systems.</td>
</tr>
<tr>
<td>564</td>
<td>Archives and Records Management (3)</td>
<td></td>
<td>Objectives and functional elements of records systems, archival programs, management information systems and techniques within various types of organizations. Management of information internal to organizations.</td>
</tr>
<tr>
<td>566</td>
<td>Business Intelligence for Information Professionals (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>567</td>
<td>Information Network Applications (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>572</td>
<td>Resources and Services for Young Adults (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>573</td>
<td>Programming for Children and Young Adults (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>574</td>
<td>Resources and Services for Adults (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>575</td>
<td>Valuing Diversity: International and Intercultural Resources for Youth (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>576</td>
<td>Storytelling in Libraries and Classrooms (3)</td>
<td></td>
<td>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 audiences.</td>
</tr>
<tr>
<td>580</td>
<td>Information Science Theory (3)</td>
<td></td>
<td>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 informetrics; relationships with other disciplines.</td>
</tr>
<tr>
<td>582</td>
<td>Information Systems Planning and Evaluation (3)</td>
<td></td>
<td>Information systems used in libraries and information agencies. Emphasizes planning, evaluation and system implementation. Covers usability engineering, interface design, and human computer interaction.</td>
</tr>
<tr>
<td>583</td>
<td>Information Systems Problems and Principles (3)</td>
<td></td>
<td>Use of systems theory and analytical tools for understanding and improving information systems. Emphasizes the interaction between technology, processes, and stakeholders. Focuses on problem identification and problem-solving techniques, system design representations, object-oriented system design, system prototyping, and project management.</td>
</tr>
<tr>
<td>584</td>
<td>Database Management Systems (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>585</td>
<td>Information Technologies (3)</td>
<td></td>
<td>Evolution, trends, capabilities, and limitations of technologies applied to information capture, storage, preservation, access, and distribution.</td>
</tr>
<tr>
<td>586</td>
<td>Information Retrieval Systems (3)</td>
<td></td>
<td>Historical perspective on information retrieval research; statistical and probabilistic retrieval techniques; cognitive user modeling; expert intermediary systems; associations, relations and hypertext.</td>
</tr>
<tr>
<td>587</td>
<td>Mining the Web (3)</td>
<td></td>
<td>Covers strategies for mining the Web, Web engines and directories, cognitive accessibility, Web design and development, and usability engineering.</td>
</tr>
<tr>
<td>588</td>
<td>Human-Computer Interaction (3)</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>590</td>
<td>Problems in Information Sciences (3-6)</td>
<td></td>
<td>Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>591</td>
<td>Independent Project or Research (3)</td>
<td></td>
<td>Registration Permission: Consent of instructor.</td>
</tr>
</tbody>
</table>
594 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose area coincides with interests of student.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of advisor and research director.

595 Student Teaching in School Library Information Center (9) Planned professional semester: full day school library work and classroom observation activities.
Grading Restriction: 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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

599 Practicum (3-6) Opportunity to translate theory into practice under guidance of qualified information professionals.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Completion of core and pertinent advanced courses relevant to student’s practicum design.
Comment(s): 3.0 GPA required.
Registration Permission: Consent of advisor and approval of practicum coordinator.

601 Advanced Seminar in Information Sciences (3) Theories, research, and traditional practices of information representation, organization, 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.
(DE) Prerequisite(s): 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 presentations 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.

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.

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.
Comment(s): Requires admission to an ITES program or consent 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.
(DE) Prerequisite(s): 573.

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.
(DE) Prerequisite(s): 575 or 521.

578 Web Design (3) Design and development of instructional Web sites using basic design principles and visual Web editor software.

669 Instructional Media Research (3) Identification, location, and collection of developmental and experimental research on instructional media. Application of research.

670 Constructivist Perspectives in Instructional Technology (3) Effectively designed technology based teaching strategies can enhance learning in a wide variety of subjects and learners from K-12 students to adults. This course will examine the theories, principles, and applications of constructivism with emphasis on technology based constructivist strategies and instructional designs for online and classroom learning.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 3 hours.
Registration Permission: Consent of instructor.


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.

Instructional Technology and Educational Studies (570)

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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

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

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

594 Supervised Readings (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated.

595 Special Topics (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

601 Foundations of Research, Scholarship & Doctoral Study (3) Introduction to PhD program concentrations in ITES: research requirements, meaning of scholarship in academy and issues/problems in education.
Comment(s): Admission to a PhD program in ITES required.

689 Internship (1-3) Experiences in application of principles and practices of curriculum development and instructional improvement.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): Program prerequisites.
Registration Permission: Consent of instructor.

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

694 Supervised Reading (1-3)
Grading Restriction: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated.

695 Special Topics (1-3)
Grading Restriction: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated.
460 Electronic News Operations (3) Production of news programs for television, cable and the Internet. Advanced course in electronic news gathering, reporting, digital videography, non-linear editing, and producing. Computerized newsroom and studio are utilized. (DE) Prerequisite(s): 411.

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. Regulatorcy, policy, programming, and management issues arising from new media and digital technologies. (DE) Prerequisite(s): 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. Registration Permission: Consent of instructor.

490 Advanced Photojournalism (3) Advanced principles and methods of black-and-white photography. Introduction to color photography. News and feature photographs, photo essays. (DE) Prerequisite(s): 290 or consent of instructor.

491 Foreign Study (1-15) Repeatability: May be repeated. Maximum 15 hours. Comment(s): Approval of hours and topics by advisor required.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated. Comment(s): Requires admission to the program or consent of the instructor.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

503 Workshop in Journalism across the Media I (3) Techniques of writing, reporting, and editing for print and Web. Also includes graphics, layout, and photography. Overview of the history, technology, and economics of newspapers, magazines, and the Internet. Consideration of the First Amendment. Credit Restriction: Cannot be counted toward the number of hours required for the Master of Science degree.

504 Workshop in Journalism across the Media II (3) Techniques of writing, reporting, and editing for electronic media. Also includes video production. Overview of the history, technology, and economics of cable broadcasting, and satellite. Consideration of the impact of rules, regulations, and policies of the Federal Communications Commission. Comparison of techniques in print, Web, and electronic media. Creating material for one medium and using it in another. Credit Restriction: Cannot be counted toward the number of hours required for the Master of Science degree.

510 International Journalism (3) Studies the development and impact of international and trans-national media systems on journalism today. Examines the implications for reporters, editors, and publishers in print, broadcasting, cable, satellite, and the Internet as well as the effects on audiences, societies, global cultures, and political economies. Comparative analysis of media, media practices, and flow of information throughout the world. Comment(s): Requires admission to the program or consent of the instructor.

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. Comment(s): Requires admission to the program or consent of the instructor.

515 Advanced Reporting across the Media (3) Developing good story ideas, researching them, and translating them into suitable material for news in print, broadcasting, cable, and the Internet. Using video and graphics to reinforce the story concept. Considering the needs of the media and the audience. Theories of how content changes as the medium changes.

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.
522 Seminar in Journalism Issues and Theory (3) Discussion of the important issues in journalism from a variety of theoretical viewpoints. Study of the basic literature on theory involving journalism (print, broadcasting, cable, and the Internet) and its application to current problems.

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.)


550 Writing And Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science, technical, general publications.

Registration Permission: Consent of instructor.

554 Seminar in Mass Media and Health and Risk (3) Mass communication and health communication theories examined as they relate to intended and unintended effects on individual behavior and on public health policy. Setting of media’s agenda on health and risk. Interaction of scientists, journalists, and public on scientific, technological, and medical questions.

Registration permission: 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.

Comment(s): Requires admission to the program or consent of the instructor.

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.

(See Art History 431.)

590 Project (3) Capstone project under guidance of faculty. Applications of principles from previous coursework.

Grading Restriction: Satisfactory/No Credit grading only.

593 Seminar in Journalism And Electronic Media Issues (3) Contemporary topics in communications.

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

597 Independent Study (3)

Registration Permission: Consent of instructor.

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)

431 Topics in the Literature and Language of Portuguese-Speaking World (3) (See Portuguese 431)
432 Topics in the Literature and Language of Portuguese-Speaking World (3) (See Portuguese 432.)
456 Latin American Government and Politics (3) (See Political Science 456.)
465 Latin American Film and Culture (3) (See Spanish 465.)
479 Disenchanted Texts in Hispanic Literature (3) (See Spanish 479.)
510 Special Topics (3)

Repeatability: 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.

(See Religious Studies 405.)

814 Legal Profession (3) Legal, professional and ethical standards applicable to lawyers.

Credit Restriction: 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 Fundamental Concepts 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.

819 Economic Principles of Income Taxation (3) Survey of time value of money and related economic principles in federal income tax system. Taxation of employment compensation arrangements and of various financial arrangements and products, and introduction to tax accounting.

(See Religious Studies 405.)
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 processes, 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.

(DE) Prerequisite(s): 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; periodicic reporting and other disclosure requirements; the regulation of proxy solicitations, tender offers, and security transactions involving officers, directors, and other insiders; and the regulation of stock markets and professional service providers in the securities industry.

(DE) Prerequisite or (DE) Corequisite: 827.

833 Representations in 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 reorganizations.

(DE) Prerequisite(s): 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.); 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 state 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.

Repeatability: May be repeated under different topic.

(DE) Prerequisite(s): 812.

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.

(DE) Prerequisite(s): 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.

868 Natural Resources (3) Considers how our society allocates and regulates the use of natural resources, including national parks, national forests, coastal resources, minerals, timber, and wildlife.

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 labor relations law; federal and state labor relations laws; collective bargaining; jurisdiction and constitution of collective bargaining agencies; enforcement of collective bargaining agreements; individual rights of employees; federal preemption and state regulation.

896 Employment Law (3) Legal regulation of employment relationships: state and federal statutory and constitutional development; employment discrimination; legally prescribed minimum standards of compensation and safety; restraints on termination of employment; regulation of retirement systems.

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.

908 Mediation Clinic (3) Mediation process, theory, strategies, tactics and skills through readings, simulations, and service as mediators in general sessions court; theory and mediation ethics; relationship of mediation to other dispute resolution methods; roles of attorneys in mediation and writing of mediation agreements.

909 Non-profit Corporations (3) Examines federal and state laws that govern non-profit corporations and offers practical clinical experience representing local corporations. Teams of students conduct "legal audits" of local non-profit corporations, make presentations to administrators and directors, draft corporate documents, and help clients resolve legal problems.

914 Alternative Dispute Resolution (3) Survey course on various alternatives to the conventional trial process. Introduces several of the more popular alternatives, including negotiation, mediation, and arbitration. Satisfies planning and drafting requirement.

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.

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.

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.

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.

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 disinheritance; and introduction of various legal issues and techniques of dispute resolution.

937 Estate Planning Seminar (2) Estate planning problems: relationship to estate law and practice of fiduciary administration, insurance, property, wills, future interests, trusts, corporations, and partnerships. Required drafting of wills and probate documents and explanations of documents.

940 Land Finance Law (3) Financing devices, 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.

941 Land Acquisition and Development Seminar (2) Land acquisition and development seminars in general sessions court and other settings: mediation ethics, relationship of mediation to other dispute resolution methods, roles of attorneys in mediation, and drafting of mediation agreements.

942 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, negotiation with other attorneys and parties, planning, negotiating and documenting transactions and dispute resolutions, conducting factual investigations and legal audits of businesses, and monitoring and ensuring compliance with federal, state and local statutes, rules and regulations.

947 Prosecution Externship (6) Supervised fieldwork required to be admitted as a 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, interviewing 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.

954 Copyright Law (3) Considers copyright theory, doctrine, and practice and how the law is changing in response to globalization and advances in information technology. Topics include the subject matter of the copyright, the exclusive rights provided by the Copyright Act, substantive law, infringements, remedies, and remedies. Satisfies expository writing requirement.

955 Patent Law (3) Covers the major aspects of patent law, primarily as applied in the U.S. Patentability, including patentable subject matter, utility, enablement and written description, novelty, and nonobviousness; infringement, ownership and licensing, and remedies. Emphasizes essential legal principles, useful as background for non-patent lawyers and as a foundation for patent lawyers.

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.
Legal Studies (617)
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.)
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)
Graduation Restriction: P/NP only.
Repeatability: May be repeated.

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

503 Graduate Research Participation (3-12) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor.
Repeatability: May be repeated. Maximum 12 hours.

505 Research Rotation (2) Laboratory rotations with faculty member on clearly defined projects. Written proposal and oral report.
Repeatability: 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.
Repeatability: 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.
Repeatability: May be repeated. Maximum 9 hours.

515 Introduction to Genome Science and Technology I (1) Introduction to research in genome science and technology concentration.
Graduation Restriction: Satisfactory/No Credit grading only.

516 Introduction to Genome Science and Technology II (1) Science and ethics of practice of science.
Graduation Restriction: Satisfactory/No Credit grading only.

520 Genome Science and Technology I (4) Overview of genomics, advanced genetics principles.

521 Genome Science and Technology II (4) Analytical technologies and special techniques.

540 Colloquium (1) Invited speakers. Topics announced in advance.
Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

541 Colloquium (1) Invited speakers. Topics announced in advance.
Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

550 Mammalian Genetics and Genomics (3) Genetic variation, inheritance, phenotypic traits, molecular genetics and genomics, mutagenesis in laboratory rodents and other mammals.
(DE) Prerequisite(s): 520 and 521.

591 Foreign Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

595 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in variety of special topics to be chosen by instructor.
Repeatability: May be repeated. Maximum 12 hours.

596 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in variety of special topics to be chosen by instructor.
Repeatability: May be repeated. Maximum 12 hours.

600 Doctoral Research and Dissertation (3-15)
Graduation Restriction: P/NP only.
Repeatability: May be repeated.

615 Journal Club in Genome Science and Technology (1) Reading and discussion based on current literature.
Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

695 Advanced Topics in Genome Science and Technology (1-3) Tutorials or lectures on variety of advanced topics to be chosen by instructor.
Repeatability: May be repeated. Maximum 12 hours.

696 Advanced Topics in Genome Science and Technology (1-3) Tutorials or lectures on variety of advanced topics to be chosen by instructor.
Repeatability: May be repeated. Maximum 12 hours.

Linguistics (623)
400 Topics in Linguistics (3)
Repeatability: May be repeated. Maximum 6 hours.

411 Linguistic Anthropology (3) (See Anthropology 411.)

423 The Development of Diachronic and Synchronic Linguistics (3) Development of Western linguistics thought from the Hebrews and Greeks through modern times. Readings from Boas, Sapir, Bloomfield, and others.
(DE) Prerequisite(s): 9 hours of courses required for undergraduate linguistics concentration (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)
Repeatability: 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 students use university facilities and/or faculty time before degree is completed.
Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

510 Statistics 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.
(DE) Prerequisite(s): 510 and Business Administration 511, 512, 513, and 514.

547 Global Logistics and Supply Chain Management (3) Logistics strategy in global firm: materials management, international sourcing and procurement, global production and distribution, import/export activity. Design and operation of supply chains in global environment.
(DE) Prerequisite(s): 510 and Business Administration 511, 512, 513, and 514.

593 Independent Study (3-6) Directed research and study.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

599 Special Topics in Logistics (3-6) Seminar designed to study specific current problem areas in logistics. Topic announced prior to offering.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.
600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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 Survey of Models in Marketing and Logistics Research (3) Survey of models and methodologies and their application in logistics and marketing research, topical coverage at discretion of instructor.

526 Advanced Applications of Systems Modeling and Simulation (3) (See Industrial Engineering 526.)

534 Management Science Methods in Business (3) Application of methods from 531, 532, and 533 to real world problems in business/industry.

551 Management of New Ventures (3) Cases, group projects, discussion; organizational theories, organizational effectiveness; contextual factors of organizations: environment, size, technology; organizational structure configurations, organization design; social influence 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.

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.

500 Thesis (1-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

505 Organizational Psychology (3) (See Psychology 440.)

520 Marketing and Customer Value (3) For students from other disciplines interested in obtaining knowledge of marketing discipline at graduate level.

602 Network Flows (3) Treatment of network optimization algorithms, transportation and transshipment models and primal-dual and primal-dual basis tree methods.

613 Supply Chain Management Thought (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queuing theory.

632 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.

510 Principles of Marketing Management for Non-MBA Students (3)

526 Advanced Applications of Systems Modeling and Simulation (3) (See Industrial Engineering 526.)
COURSES OF INSTRUCTION

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.

(DE) Prerequisite(s): 520 and Business Administration 511, 512, 513, and 514.

593 Independent Study (3) Directed research and study.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): MBA core.
Registration Permission: Consent of instructor.

599 Special Topics Seminar (3) Topics vary: market forecasting, market segmentation, services marketing, marketing channels, and related issues.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

611 Theoretical Foundations (3) Theoretical foundations and frame-work for conducting 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 perspectives 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 competitive behavior; marketing strategy; marketing mix tools; and ethical issues in marketing. Examination of research for contributions to advancing knowledge and opportunities for new research. Offered every other year.
Registration Permission: Consent of instructor.

615 Consumer Behavior Research (3) Theoretical perspective and research methods for 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. Offered every other year.
Registration Permission: Consent of instructor.

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.
Repeatability: May be repeated. Maximum 6 hours.

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.
(DE) Prerequisite(s): 302 and Engineering Science 321.

429 Introduction to Ceramic Matrix Composites (3) Characteristics of composites: ceramic matrix composites; macromechanics and materials design; overview of fabrication techniques; microstructural characterization; physical and mechanical property evaluation; current and potential applications.
(DE) Prerequisite(s): 201 and Engineering Science 321.

470 Environmental Degradation of Materials (3) Mechanisms, measurement techniques and control of environmental degradation processes in metals, polymers, ceramics and composites; materials selection and design considerations. Recommended for chemical engineering, mechanical engineering and engineering science and mechanics majors.
(DE) Prerequisite(s): 201.

472 Fundamental Principles of Composite Materials (3) Physical principles basic to the design, manufacture, and application of fiber reinforced polymers, metals and ceramics.
(DE) Prerequisite(s): 302 or equivalent.

474 Biomaterials (3) Metals, polymers and ceramics utilized in orthope-dic, cardiovascular, and dental surgical implant devices; corrosion and degradation problems; material properties of primary importance; tissue response to synthetic materials. Recommended for engineering science and mechanics majors.
(DE) Prerequisite(s): 201.

476 Overview of Intermetallic Compounds and Composites (3) Fabrication and processing, ultrafine-grained materials nanotechnology, thermodynamics and stability, microstructural characterizations, mechanical properties, corrosion and oxidation properties, theoretical modeling, and design and industrial applications of intermetallics and composites. Laboratory demonstrations and group projects.
(DE) Prerequisite(s): 201.

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

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

503 Graduate Seminar in Materials Science and Engineering (1)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Comment(s): Admission to graduate program required.

504 Graduate Seminar in Polymer Engineering (1)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Comment(s): Admission to graduate program required.

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.

(DE) Prerequisite(s): 511.

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.
(DE) Prerequisite(s): 512.

522 Defects in Crystals (3) Analytical and experimental analysis of defect interactions in solids.
(DE) Prerequisite(s): 421 or consent of instructor.
524 Metallurgical Thermodynamics (3) Applications of chemical thermodynamics to metallurgical problems: refining, oxidation, surface treatments, alloy systems.

(DE) Prerequisite(s): 570 or equivalent.

525 Welding Metallurgy (3) Welding processes; physical metallurgy of welding; phase transformations; heat flow; residual stresses; theories of hot cracking, cold cracking and porosity formation; applications to proper utilization of weldments.

526 Welding Metallurgy (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) Analyses 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.

(DE) Prerequisite(s): 470 or consent of instructor.


(DE) Prerequisite(s): Course in mechanical behavior.

540 Basic Polymer Chemistry (3) Synthesis, reactions and degradation of polymers. Molecular characterization: solution methods and spectroscopy.

(DE) Prerequisite(s): Semester of organic chemistry and thermodynamics.

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. (Same as Chemical Engineering 541.)

(DE) Prerequisite(s): Chemical Engineering 240 or equivalent.

542 Further Topics in Polymer Processing (3) Description and analysis of selected polymer processing operations.

(DE) Prerequisite(s): 541.

543 Basic Polymer Physics (3) Essential structure-property relations in materials. Physical structure of polymers. Mechanical, electrical and thermal properties.

(DE) Corequisite(s): 540.

544 Polymer Solution Thermodynamics and Characterization (3) Theories of solutions, statistical thermodynamics. Characterization, treatment of chromatography, viscosity, light scattering and osmotic pressure. (DE) Prerequisite(s): Undergraduate physical chemistry course.

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 microscopy, SEM, OM, FTIR, etc. Fundamentals of processing-structure-property relationships are documented in a literature review paper.

Registration Permission: 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 Laboratory Methods in Polymer Engineering (1) Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, calorimetry, rheometry, mechanical properties of solid polymers, polymer processing operations.

Grading Restriction: Satisfactory/No Credit grading only.

(DE) Prerequisite(s): 540 or equivalent.

550 Laboratory Methods in Polymer Engineering (2) Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, calorimetry, rheometry, mechanical properties of solid polymers, polymer processing operations.

(DE) Prerequisite(s): 540 or equivalent.

552 Fiber Science (3) Physical properties, mechanical properties and microstructure of polymeric fibers; relation to end-use properties.

(DE) Prerequisite(s): Organic chemistry course and thermal physics course.

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.

(DE) Prerequisite(s): Organic chemistry course 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.

(DE) Prerequisite(s): 553 or equivalent.

555 Laboratory Methods in Nonwovens Processing and Characterization (3) Laboratory experience in nonwoven fabrication processes and characterization techniques. Effect of processing conditions on structure development and properties of different types of webs.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 560 or equivalent.

570 Optical Microscopy (4) Basic compound and polarizing microscopy for imaging. Optical property measurements, and structure elucidation. Other methods of optical microscopy.

Contact Hour Distribution: 3 hours and 2 labs.

(DE) Prerequisite(s): Physics 232 and Physics 240.

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.

(DE) Prerequisite(s): 552.

576 Special Topics in Materials Science and Engineering (3) Topics of current significance and interest. Repeatability: May be repeated.

Registration Permission: Consent of instructor.


Registration Permission: Consent of faculty committee.

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

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

Repeatability: May be repeated.

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.

Registration Permission: 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

Grading Restriction: Satisfactory/No Credit grading only.

(DE) Prerequisite(s): 531 and 532 or consent of instructor.
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.

Registration Permission: Consent of instructor.

632 Advanced Topics in Intermetallic Compounds and Composites (3) Thermodynamics, mechanical behavior, corrosion and oxidation, and modeling of intermetallic compounds and composites.

(DE) Prerequisite(s): 476 or consent 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.

(DE) Prerequisite(s): 476 and 632 or consent of instructor.


(DE) Prerequisite(s): 552 and mechanics of materials course.

642 Advanced Topics in Polymer Processing (3) Application of theories of rheological behavior and of structure development to analysis of polymer processing operations. (Same as Chemical Engineering 642.)

(DE) Prerequisite(s): 541.

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.

(DE) Prerequisite(s): 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 of design and characterization of polymer optoelectronic devices, and (3) applications of laser spectroscopy in polymer characterization.

The focus is to understand electron related processes and optoelectronic characteristics of polymeric materials and devices. The fundamentals of laser spectroscopy are also explained in determining structure-property relationships in polymer research.

(DE) Prerequisite(s): 543 or equivalent.

Registration Permission: Consent 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 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.

(DE) Prerequisite(s): 405 or 511 or 572.

Registration Permission: Consent of instructor.

673 Introduction to Scanned Probe Microscopies (3) A survey of techniques for surface imaging and characterization. Young’s TopographAFM, 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.

Registration Permission: Consent of instructor.

676 Advanced Topics in Materials Science and Engineering (3) Latest developments and/or advanced special topics.

Repeatability: May be repeated.

Registration Permission: Consent of instructor.

678 Seminar in Recent Advances in Materials Science and Engineering (3) Directed and independent study of advanced topics.

Repeatability: May be repeated.

Registration Permission: Consent of instructor.

Mathematics (641)

400 History of Mathematics (3) Development of major ideas in mathematics from ancient to modern times and the influence of these ideas in science, technology, philosophy, art, and other areas. Includes at least one in-class essay examination and 3,000 words of writing outside class.

(DE) Prerequisite(s): 251 or 257 and 300.

403 Mathematical Methods for Engineers and Scientists (3) Matrix computations, numerical methods, partial differential equations, Sturm-Liouville Theory and special functions as used in engineering and science.

Credit Restriction: Does not satisfy major requirements for the mathematics major (Bachelor of Science or Master of Science).

(DE) Prerequisite(s): 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 the theorems of Gauss and Stokes.

(DE) Prerequisite(s): 241 or 247.

405 Models in Biology (3) Difference and differential equation models of biological systems.

Credit Restriction: May not be applied toward graduate degree.

411 Mathematical Modeling (3) Construction and analysis of mathematical models used in science and industry. Projects emphasized.

(DE) Prerequisite(s): 231, 241, and 251 or 257.

421 Combinatorics (3) Introduction to problems of counting and enumeration for discrete structures such as sequences, partitions, graphs, finite fields and geometries, and experimental designs.

(DE) Prerequisite(s): 323 or consent of instructor.

423 Probability I (3) Axiomatic probability, multivariate distributions, conditional probability and expectations, methods of moments, generating/characteristic functions. Laws of large numbers and central limit theorem.

(DE) Prerequisite(s): 300-level probability course or consent of instructor.

424 Probability II (3) Elements of stochastic processes: Random walk, Markov chains and Poisson processes. Other topics as selected by the instructor.

(DE) Prerequisite(s): 423.

425 Statistics (3) Derivation of standard statistical distributions: t, F and X2; 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.


(DE) Prerequisite(s): 200 or 251 or 257 or 231.

435 Partial Differential Equations (3) Separation of variables, Fourier series, solution of Laplace, wave, and heat equations.

(DE) Prerequisite(s): 231 or 241 or 247.

443 Complex Variables I (3) Introduction to the theory of functions of a complex variable, including residue theory and contour integrals.

(DE) Prerequisite(s): 241 or 247.

445 Advanced Calculus I (3) Introduction to the theory of sequences, series, differentiation, and Riemann integration of functions of one or more variables.

(DE) Prerequisite(s): 241 or 247 and 300 or consent of instructor.

446 Advanced Calculus II (3) Introduction to the theory of sequences, series, differentiation, and Riemann integration of functions of one or more variables.

(DE) Prerequisite(s): 241 or 247 and 300 or consent of instructor.

447 Honors: Advanced Calculus I (3) Honors version of 445.

(DE) Prerequisite(s): 341 or consent of instructor.

448 Honors: Advanced Calculus II (3) Honors version of 446.

(DE) Prerequisite(s): 341 or consent of instructor.

453 Matrix Algebra II (3) Advanced topics in matrix theory including Jordan canonical form.

(DE) Prerequisite(s): 251 or 257.

455 Abstract Algebra I (3) Introduction to algebraic structures such as groups, rings, fields, vector spaces, and linear transformations.

(DE) Prerequisite(s): 251 or 257 and 300 or consent of instructor.

456 Abstract Algebra II (3) Introduction to algebraic structures such as groups, rings, fields, vector spaces, and linear transformations.

(DE) Prerequisite(s): 251 or 257 and 300 or consent of instructor.
457 Honors: Abstract Algebra I (3) Honors version of 455.
(DE) Prerequisite(s): 351 or consent of instructor.

458 Honors: Abstract Algebra II (3) Honors version of 456.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 300 or consent of instructor.

461 Topology (3) Includes topology of line and plane, separation properties, compactness, connectedness, continuous functions, homeomorphisms, continua and topological invariants.
(DE) Prerequisite(s): 241 or 247 and 300 or consent of instructor.

471 Numerical Analysis (3) Introduction to 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. (Same as Computer Science 471.)
(DE) Prerequisite(s): 371 or consent of instructor.

472 Numerical Algebra (3) Direct and iterative methods for systems of linear equations. Solution of single nonlinear equation and nonlinear systems. Orthogonal decomposition, least squares and algebraic eigenvalue problem. (Same as Computer Science 472.)
(DE) Prerequisite(s): 371 or consent of instructor. Recommended Background: 453.

475 Industrial Mathematics (3) Modeling, analysis, and computation applied to scientific/technical/industrial problems.
(DE) Prerequisite(s): 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. Independent study with faculty guidance.
Repeatability: May be repeated. Maximum 9 hours.
Comment(s): Consent of faculty mentor to supervise independent work required.
Registration Permission: Consent of department head.

499 Seminar in Mathematics (1-3) Topics vary. Requires out-of-class projects and in-class presentations by students. Students must register for the number of credit hours announced for a particular seminar.
Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

504 Discrete Mathematics for Teachers (3) Mathematical logic and methods of argument, sets, functions and relations, combinatorics. Normally, the first graduate course for students seeking Master of Mathematics degree.
Credit Restriction(s): May not apply toward mathematics major (Master of Science).
Recommended Background: 1 year of calculus or equivalent.
Comment(s): For students in Master of Mathematics program and for students in graduate programs in the College of Education, Health, and Human Sciences.

505 Analysis for Teachers (3) Development of differential and integral calculus, proofs of basic theorems.
Credit Restriction(s): May not apply toward mathematics major (Master of Science).
Recommended Background: 1 year of calculus or equivalent.
Comment(s): For students in Master of Mathematics program and for students in graduate programs in the College of Education, Health, and Human Sciences.

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to algebra of integers and polynomials.
Credit Restriction(s): May not apply toward mathematics major (Master of Science).
Recommended Background: 1 year of calculus or equivalent.
Comment(s): For students in Master of Mathematics program and for students in graduate programs in the College of Education, Health, and Human Sciences.

Credit Restriction(s): May not apply toward mathematics major (Master of Science).
Recommended Background: 1 year of calculus or equivalent.
Comment(s): For Students in Master of Mathematics program and for students in graduate programs in the College of Education, Health, and Human Sciences.

509 Seminar for Teachers (3)
Repeatability: May be repeated. Maximum 12 hours.
Credit Restriction(s): May not apply toward mathematics major (Master of Science).
Comment(s): For Students in Master of Mathematics program and for students in graduate programs in the College of Education, Health, and Human Sciences.
Registration Permission: Consent of instructor.

(DE) Corequisite(s): 511 or 512.

511 Methods in Applied Mathematics (3) Fundamentals and techniques associated with discrete and continuous models of physical, engineering and biological systems: difference equations, networks and graphs, optimization, time series analysis, qualitative analysis of differential and delay-differential equations, and other topics.
(DE) Prerequisite(s) or (DE) Corequisite(s): 445 or 447 and 453.
(DE) Corequisite(s): 510.

512 Methods in Applied Mathematics (3) Fundamentals and techniques associated with discrete and continuous models of physical, engineering and biological systems: difference equations, networks and graphs, optimization, time series analysis, qualitative analysis of differential and delay-differential equations, and other topics.
(DE) Prerequisite(s) or (DE) Corequisite(s): 445 or 447 and 453.
(DE) Corequisite(s): 510.

(DE) Prerequisite(s): 431, 435, and 445 and 446 or 404 or consent of instructor.

(DE) Prerequisite(s): 431, 435, and 445 and 446 or 404 or consent of instructor.

515 Analytical Applied Mathematics (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.
(DE) Prerequisite(s): 446 or 448, 453, and either 511 and 512 or 431 and 435.

516 Analytical Applied Mathematics (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.
(DE) Prerequisite(s): 446 or 448, 453, and either 511 and 512 or 431 and 435.

517 Mathematical Methods in Physics I (3) (See Physics 571.)
518 Mathematical Methods in Physics II (3) (See Physics 572.)

519 Seminar in Applied Mathematics (1-3)
Repeatability: May be repeated. Maximum 12 hours.

521 Enumerative Combinatorics (3) Sieve methods, recursion, generating functions, and permutation groups applied to enumeration of discrete structures. Incidence algebras and combinatorics of partially ordered sets.

522 Enumerative Combinatorics (3) Sieve methods, recursion, generating functions, and permutation groups applied to enumeration of discrete structures. Incidence algebras and combinatorics of partially ordered sets.

523 Probability (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.
(DE) Prerequisite(s): 445 and 446.
Recommended Background: 423.
524 Probability (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 concepts, 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.

(DE) Prerequisite(s): 445 and 446.
Recommended Background: 425.

525 Statistics (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 linear models, estimation and tests in linear models; non-parametric models, rank methods for comparison, linear regression and independence, robust tests; topics from decision theory.

(DE) Prerequisite(s): 445 and 446.
Recommended Background: 425.

526 Statistics (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 linear models, estimation and tests in linear models; non-parametric models, rank methods for comparison, linear regression and independence, robust tests; topics from decision theory.

(DE) Prerequisite(s): 445 and 446.
Recommended Background: 425.

527 Stochastic Modeling (3) Models in probability applied to real world situations; queuing theory; branching processes; Monte Carlo simulation.

(DE) Prerequisite(s): 445 and 446 or consent of instructor.

529 Seminar in Stochastics (1-3)
Repeatability: May be repeated. Maximum 12 hours.


(DE) Prerequisite(s): 231, 251, 445, and 446.


(DE) Prerequisite(s): 231, 251, 445, and 446.

534 Calculus of Variations (3) Necessary conditions for extrema. Euler's equation, broken extremals, Weierstrass-Erdmann conditions. Sufficient conditions for extrrema-Lagrange's and Jacobi's conditions, conjugate points. Multiple integrals.

(DE) Prerequisite(s): 431.

535 Partial Differential Equations (3) First order equations, classification of equations and properties of elliptic, hyperbolic, and parabolic equations in several variables.

(DE) Prerequisite(s): 445, 446, and 231 or consent of instructor.

536 Partial Differential Equations (3) First order equations, classification of equations and properties of elliptic, hyperbolic, and parabolic equations in several variables.

(DE) Prerequisite(s): 445, 446, and 231 or consent of instructor.

537 Mathematical Principles of Continuum Mechanics (3) Conservation principles, equations of equilibrium and motion for fluids and elastic solids, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory.

(DE) Prerequisite(s): 431, 435, and 446 or 448 or consent of instructor.

538 Mathematical Principles of Continuum Mechanics (3) Conservation principles, equations of equilibrium and motion for fluids and elastic solids, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory.

(DE) Prerequisite(s): 431, 435, and 446 or 448 or consent of instructor.

539 Seminar in Differential Equations (1-3)
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.
(De) Prerequisite(s): 445, 446, 453, 471, and 472.

(De) Prerequisite(s): 435, 471, and either 453 or 472.
Recommended Background: 445, 446, and 573.

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. (Same as Computer Science 575).
Repeatability: May be repeated. Maximum 9 hours.
(De) Prerequisite(s): 453, 471, and 472 or consent of instructor.

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.
(De) Prerequisite(s): 453, 445, 446, and a numerical algorithms course.

(De) Prerequisite(s): 435 or 512 or 515, and a Fortran or C course or consent of instructor.

579 Seminar in Numerical Mathematics (1-3)
Repeatability: May be repeated. Maximum 12 hours.

581 Mathematical Ecology (3) Deterministic and stochastic models of populations, communities, and ecosystems. (Same as Ecology and Evolutionary Biology 581.)
(De) Prerequisite(s): 431 and 453 or consent of instructor.

582 Mathematical Ecology (3) Deterministic and stochastic models of populations, communities, and ecosystems. (Same as Ecology and Evolutionary Biology 582.)
(De) Prerequisite(s): 431 and 453 or consent of instructor.

583 Mathematical Evolutionary Theory (3) Population genetics and evolutionary ecology. (Same as Ecology and Evolutionary Biology 585.)
(De) Prerequisite(s): 431 and 453 or consent of instructor.

585 Optimal Control Theory (3) Deterministic optimal control. Examples involving calculus of variations, optimal trajectories, and engineering control problems. Introduction to stochastic control.
(De) Prerequisite(s): 431, 445, and 446 or consent of instructor.

589 Seminar in Mathematical Ecology (1-3)
Repeatability: May be repeated. Maximum 12 hours.

593 Independent Study (1-12)
Repeatability: May be repeated. Maximum 12 hours.

598 Graduate Reading in Mathematics (1-3) Independent study with faculty guidance.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Graduate standing required.
Registration Permission: Consent of instructor.

599 Seminar in Mathematical Presentations (1)

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

617 Lie Algebras in Mechanics and Physics (3) Analytical tools of mechanics and physics arising from differentiable manifolds, tensors, Lie derivatives, Lie groups, differential forms, Lie algebras, applications to Hamiltonian mechanics, adiabatic and barotropic fluids and plasmas, numerical methods in continuum mechanics.
(De) Prerequisite(s): 431, 435, 547, 571, and 572.

619 Seminar in Applied Mathematics (1-3)
Repeatability: May be repeated. Maximum 12 hours.

623 Advanced Probability (3) Selected topics in modern theory of probability and stochastic processes: Ito'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.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 523 and 524 or consent of instructor.

624 Advanced Probability (3) Selected topics in modern theory of probability and stochastic processes: Ito'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.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 523 and 524 or consent of instructor.

629 Seminar in Combinatorics (1-3)
Repeatability: May be repeated with consent of department. Maximum 12 hours.

631 Advanced Ordinary Differential Equations (3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests and preparations of students.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 531 and 532 or consent of instructor.

632 Advanced Ordinary Differential Equations (3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests and preparations of students.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 531 and 532 or consent of instructor.

635 Advanced Partial Differential Equations (3) Selected topics in classical and modern theoretical partial differential equations.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 545 and 548 or 574.
Registration Permission: Consent of instructor.

636 Advanced Partial Differential Equations (3) Selected topics in classical and modern theoretical partial differential equations.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 545 and 546 or 547 and 548.
Registration Permission: Consent of instructor.

Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 545 and 546.

Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 545 and 546.

643 Harmonic Analysis (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.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 545 and 546.

644 Harmonic Analysis (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.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 545 and 546.

649 Seminar in Analysis (1-3)
Repeatability: May be repeated with consent of department. Maximum 12 hours.

651 Advanced Modern Algebra (3) Selected topics in modern algebra or number theory.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 551 and 552 or consent of instructor.

652 Advanced Modern Algebra (3) Selected topics in modern algebra or number theory.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(De) Prerequisite(s): 551 and 552 or consent of instructor.

659 Seminar in Algebra (1-3)
Repeatability: May be repeated with consent of department. Maximum 12 hours.
Registration Permission: Consent of instructor.

661 Modern Topology (3) Technical background to current literature in topology. Topics vary.
Repeatability: May be repeated with consent of department. Maximum 12 hours.

662 Modern Topology (3) Technical background to current literature in topology. Topics vary.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
COURSES OF INSTRUCTION

663 Algebraic Topology (3) Homology, cohomology and homotopy theories: duality theorems and Hurewicz isomorphism theorem.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(DE) Prerequisite(s): One year of abstract algebra, 561, 562, 455 and 456 or 551 and 552.

664 Algebraic Topology (3) Homology, cohomology and homotopy theories: duality theorems and Hurewicz isomorphism theorem.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(DE) Prerequisite(s): One year of abstract algebra, 561, 562, 455 and 456 or 551 and 552.

667 Advanced Differential Geometry (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.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(DE) Prerequisite(s): 567 and 568 or consent of instructor.

668 Advanced Differential Geometry (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.
Repeatability: May be repeated with consent of department. Maximum 12 hours.
(DE) Prerequisite(s): 567 and 568 or consent of instructor.

669 Seminar in Topology (3)
Repeatability: May be repeated with consent of department. Maximum 12 hours.

Repeatability: May be repeated with consent of department. Maximum 12 hours.
(DE) Prerequisite(s): 547, 548, 573, and 574.

679 Seminar in Numerical Mathematics (1-3)
Repeatability: May be repeated with consent of department. Maximum 12 hours.

681 Advanced Mathematical Ecology (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. (Same as Ecology and Evolutionary Biology 681.)
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 581 and 582.

682 Advanced Mathematical Ecology (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. (Same as Ecology and Evolutionary Biology 682.)
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 581 and 582.

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.
Comment(s): Admission to teacher education required.

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.

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.
(DE) Prerequisite(s): 522 or consent of instructor.

530 Teaching Mathematics to Young Children: K-4 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. Course is for those with little preparation in teaching elementary school mathematics.

534 Teaching Mathematics in Middle School: 5-8 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. Course is for those with little preparation in teaching elementary 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.

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.

622 Research Trends in Mathematics Teacher Education (3) Analysis of current research trends in mathematics teacher education and impact of current research on development of teachers both pre-service and in-service.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 2 graduate courses in mathematics education.

Mechanical Engineering (650)
Not all the courses listed below are available at both the University of Tennessee, Knoxville, and UTSI campuses.

449 Mechanical Engineering Laboratory (3) Designing, conducting and reporting results of experimental exercises. Test standards and specifications. Analysis of data and formation of conclusions.
(DE) Prerequisite(s): 344 and 345.
(DE) Corequisite(s): 475.

451 Control Systems (3) Analysis and design of feedback control systems using transient and frequency response techniques, stability analysis in the time and frequency domain.
(DE) Prerequisite(s): 363.

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.
(DE) Prerequisite(s): 321, 344, and 363.

466 Elements of Machine Design II (3) Application of strength and properties of materials, design factors, theories of failure to design of machine elements. Mini-design experiences.
(DE) Prerequisite(s): 321 and Materials Science and Engineering 201.

475 Thermal Engineering (3) Thermal systems with emphasis on turbo-machinery, heat exchangers, gas-vapor mixtures and psychrometry, fuels and combustion; chemical equilibrium, system analysis and design.
(DE) Prerequisite(s): 344.

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

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

494 Selected Topics in Mechanical Engineering (1-4) Problems and topics related to developments and practice in mechanical engineering.
Repeatability: Not Repeatable. May be taken once for 1-4 hours.
Registration Permission: Consent of instructor.

495 Selected Topics in Mechanical Engineering (1-4) Problems and topics related to developments and practice in mechanical engineering.
Repeatability: Not Repeatable. May be taken once for 1-4 hours.
Registration Permission: Consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

504 Product Development Process (1) Basic elements in product development process and project management. Business and engineering interactions to development and commercial manufacturing of new products. Multidisciplinary teams to explore possible new product opportunities. (Same as Industrial Engineering 504.)
Registration Permission: Consent of instructor.

505 Mechatronics (3) Application of microcomputers to control electromechanical devices. Application and theory: dynamics of machine control, assembly language programming, microcontroller architecture, stepping and DC motors, photoelectric devices, A/D, D/A, integrated circuits
(DE) Prerequisite(s): Electronics and computer circuits course.
Registration Permission: Consent of instructor.
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. (Same as Industrial Engineering 506.)

(DE) Prerequisite(s): 504.

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

508 Integrated Product, 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 market-place. Prototype development managed using project management plan.

(DE) Prerequisite(s): 555.


(DE) Prerequisite(s): Undergraduate heat transfer course.

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.

(DE) Prerequisite(s): 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; condensation processes; heterogeneous nucleation; dropwise and filmwise condensation; flow condensation; liquid-solid phase change processes; moving phase fronts; mathematical modeling.

(DE) Prerequisite(s): 344 and 511.


(DE) Prerequisite(s): Undergraduate fluid mechanics and heat transfer course.

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 plan based on a technological product.

(DE) Prerequisite(s): 506 or consent of instructor.

521 Thermodynamics I (3) Macroscopic thermodynamics, 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.

(DE) Prerequisite(s): 332.

522 Thermodynamics II (3) Macroscopic thermodynamics, 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.

(DE) Prerequisite(s): 332.

523 Special Topics in Thermodynamics (3) Application of thermodynamics to topics of current interest in mechanical engineering.

Registration Permission: Consent of instructor.

525 Combustion and Chemically Reacting Flows I (3) Fundamentals: thermochemistry, chemical kinetics and conservation 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 laminar flames; introduction to turbulent flames.

(DE) Prerequisite(s): 522 and 541 or consent of instructor.

526 Combustion and Chemically Reacting Flows II (3) Advanced topics: phenomenological approaches to turbulent flames; fundamentals of turbulent flow; application of probability density functions to turbulent flames; turbulent reacting flows with premixed and/or non-premixed reactants; spray combustion models; fluidized bed combustion; chemically reacting boundary layer flows; gas turbine and/or rocket motor combustors; furnaces; introduction to supersonic combustion and hypersonic flows.

527 Thermal Systems Analysis I (3) Application of basic principles of heat transfer, fluid mechanics, and thermodynamics to develop solution models for parametric analysis of thermal systems problems via commercial software.

(DE) Prerequisite(s): 527.


(DE) Prerequisite(s): 344.

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. (Same as Aerospace Engineering 533; Engineering Science 533.)

(DE) Prerequisite(s): 391 or Mathematics 431 and an undergraduate vibrations course.

534 Mechanical Vibrations (3) Vibrations of linear, discrete, undamped and damped systems. Lagrange’s equations for holonomic systems. Modal analysis. Laplace transform. Response to mechanical transients. (Same as Aerospace Engineering 535; Biomedical Engineering 534; Engineering Science 534.)

(DE) Prerequisite(s): An undergraduate vibrations course.

537 Mechanical Systems Analysis (3) Application of basic principles of rigid body dynamics, strength of materials, and continuum mechanics to development of models for parametric analysis of mechanical systems using commercial software.

(DE) Prerequisite(s): 231 and 321.

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


Registration Permission: Consent of instructor.

541 Fluid Mechanics I (3) Derivation of equations governing flow of incompressible fluids (conservation of mass, Newton’s second law, conservation of energy). Equations of state and constitutive relations. Euler and Navier-Stokes forms and non-dimensionalization. Exact solutions and introduction to potential and boundary-layer flows. (Same as Aerospace Engineering 541; Biomedical Engineering 541; Engineering Science 541.)

(DE) Prerequisite(s): A fluid mechanics course.

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. (Same as Aerospace Engineering 542; Engineering Science 542.)

(DE) Prerequisite(s): 541.

547 Advanced Linear Control (3) Multivariable feedback systems; transfer function and state-space techniques; stability of linear systems; actuator and boundary layer flow; control system design.

(DE) Prerequisite(s): 507 or equivalent.

551 Mechanical Engineering Design (3) Design of mechanical engineering devices and systems.

Registration Permission: Consent of instructor.

552 Mechanical Engineering Design (3) Design of mechanical engineering devices and systems.

Registration Permission: Consent of instructor.

555 Human Vibration Analysis and Protection (3) (See Biomedical Engineering 555.)
559 Advanced Mechanics of Materials I (3) Elasticity in three dimensions: equations of equilibrium, strain-displacement relations, compatibility, constitutive equations. Energy methods. Beams on elastic foundation, unsymmetrical bending, shear center, beam-columns, buckling, plastic collapse. (Same as Aerospace Engineering 559; Biomedical Engineering 559; Engineering Science 559.)

(DE) Prerequisite(s): 321.

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

562 Computational Fluid-Thermal Systems (3) (See Engineering Science 552.)

563 Computational Solid Mechanics (3) (See Engineering Science 553.)


(DE) Prerequisite(s): 321 and 363 or consent of instructor.

577 Neural Networks in Engineering (3) (See Nuclear Engineering 577.)

581 Rocket Propulsion I (3) Rocket propulsion fundamentals; thermodynamics of nonreacting and chemically reacting ideal gases, rocket nozzle design; ideal rocket performance parameters; rocket heat transfer; chemistry of propellants; liquid rocket engine systems; ground testing; introduction to solid propellant rockets.

Registration Permission: 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.

Registration Permission: Consent of instructor.

584 Turbomachinery Systems I (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.

Comment(s): First-year graduate standing required.

Registration Permission: Consent of instructor.

585 Turbomachinery Systems II (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.

Comment(s): First-year graduate standing required.

Registration Permission: 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.

(DE) Prerequisite(s): 451 and 533.


(DE) Prerequisite(s): 363.

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.

Registration Permission: 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 transfer 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.

(DE) Prerequisite(s): 588 or consent of instructor.

590 Selected Engineering Problems (2-6)

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Comment(s): Enrollment limited to students in the problems option.

Registration Permission: Consent of advisor.

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. (Same as Chemical Engineering 594; Electrical and Computer Engineering 594; Industrial Engineering 594; Materials Science and Engineering 594; Nuclear Engineering 594.)

Registration Permission: Consent of instructor.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

599 Special Topics in Mechanical Engineering (1-3)

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

610 Advanced Topics in Thermal/Fluid Science (3) Advanced theory and applications in the thermal/fluid sciences.

Repeatability: May be repeated. Maximum 9 hours.

Registration Permission: 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.

(DE) Prerequisite(s): 511 and 512.

615 Engineering Optics and Optical Techniques (3) Closely related optical theories to engineering applications for advanced optical measurements and diagnostic techniques. This course also provides knowledge for engineers in the areas of micro/nano/bio-fluidics and energy transport using and developing optical techniques.

Registration Permission: Consent of instructor.

621 Advanced Topics in Solid Mechanics (3) Advanced theory and applications in mechanics, dynamics, vibrations, and strength of materials.

Repeatability: May be repeated. Maximum 9 hours.

Registration Permission: Consent of instructor.

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.

Registration Permission: Consent of instructor.


(DE) Prerequisite(s): 540 and 542.

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.

(DE) Prerequisite(s): 547 or Electrical and Computer Engineering 512.

651 Advanced Topics in Computational Fluid Dynamics (3) (See Engineering Science 651.)

652 Advanced Topics in Computational Fluid Dynamics (3) (See Engineering Science 652.)

653 Advanced Topics in Computational Solid Mechanics (3) (See Engineering Science 653.)

654 Advanced Topics in Computational Solid Mechanics (3) (See Engineering Science 654.)

659 Advanced Mechanics of Materials II (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. (Same as Aerospace Engineering 659; Biomedical Engineering 659; Engineering Science 659.)

(DE) Prerequisite(s): 559 or consent of instructor.
661 Advanced Vibrations (3) Analysis of linear and nonlinear single degree of freedom systems. Random vibration. Mechanical transients. (DE) Prerequisite(s): 534.

671 Advanced Topics in Applied Artificial Intelligence (3) (See Nuclear Engineering 671.)

686 Telerobotic Systems (3) Analysis of modern telerobotic concepts: review of current research and literature in telerobotics. Detailed comparison of teleoperated systems, robotic systems, and telerobotic systems: human-machine interfaces, control system architectures, data communications, and sensing. Virtual reality-based, and internet-based systems concepts. (DE) Prerequisite(s): 586 or consent of instructor.


Medieval Studies (674)

401 Dante and Medieval Culture (3) (See Italian 401.)

402 Petrarch and Boccaccio (3) (See Italian 402.)

405 Medieval Literature (3) (See English 401.)

406 Chaucer (3) (See English 402.)

410 Medieval French Literature (3) (See French 410.)

415 Medieval Architecture (3) (See Architecture 415.)

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.)

475 Ancient and Medieval Political Thought (3) (See Political Science 475.)

510 Special Topics (3)

Repeatability: May be repeated. Maximum 6 hours.

Microbiology (684)

410 Bacterial Physiology (3) Modern concepts of structure and function of bacterial cell. (DE) Prerequisite(s): 310.

411 Bacterial Genetics (3) Transmission and expression of genetic information by bacteria. (DE) Prerequisite(s): 310.

420 Medical Microbiology (3) Disease-producing microorganisms, including bacteria, rickettsia, chlamydia, and fungi. (DE) Prerequisite(s): 310.

429 Medical Microbiology Laboratory (2) Laboratory exercises in medically important areas of microbiology including microorganisms, pathogenesis, and immunity. (DE) Prerequisite(s): 319 and 430. (DE) Corequisite(s): 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. (DE) Prerequisite(s): Biology 240.

440 Virology (3) Pathogenesis and molecular biology of viruses. (DE) Prerequisite(s): 310.

470 Microbial Ecology (3) Physiological diversity and taxonomy of microorganisms from natural environments. Functional role of microorganisms in natural and simulated ecosystems. (DE) Prerequisite(s): 310.

500 Thesis (1-15)

Grading Restriction: P/NP only. Repeatability: May be repeated.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

540 Genomics and Bioinformatics (3) Fundamentals of a new scientific discipline based on sequencing genomes (entire DNA) of individual organisms. Goals, principles and types of genome analysis are covered in a traditional lecture course. Computational tools for genome analysis (bioinformatics) are presented in both lecture and hands-on (computer-laboratory) settings. Credit Restriction: Students may not receive credit for both 480 and 540.

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 (1-9)

Repeatability: May be repeated. Maximum 9 hours.

592 Off-Campus Study (1-9)

Repeatability: May be repeated. Maximum 9 hours.

593 Independent Study (1-9)

Repeatability: May be repeated. Maximum 9 hours.

595 General Seminar (1) Lectures and seminars by invited speakers, faculty, and graduate students. Repeatability: May be repeated. Maximum 18 hours.

596 Laboratory Rotation (1) Familiarization with research areas in department through series of rotations in laboratories of individual faculty members.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 3 hours.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only. Repeatability: May be repeated. Maximum 18 hours.

601 Journal Club in Microbial Physiology (1) Readings and discussions based on current literature.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 18 hours.

602 Journal Club in Microbial Pathogenesis (1) Readings and discussions based on current literature.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 18 hours.

603 Journal Club in Immunology (1) Readings and discussions based on current literature.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 18 hours.

604 Journal Club in Virology (1) Readings and discussions based on current literature.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 18 hours.

605 Journal Club in Microbial Genetics (1) Readings and discussions based on current literature.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 18 hours.

606 Journal Club in Microbial Ecology (1) Readings and discussions based on current literature.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 18 hours.

610 Topics in Microbial Physiology (1-3)

Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 410 or consent of instructor.

620 Topics in Microbial Pathogenesis (1-3)

Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 420 and 430 or consent of instructor.

630 Topics in Immunology (1-3)

Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 430 or consent of instructor.

640 Topics in Virology (1-3)

Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 440 or consent of instructor.

660 Topics in Eukaryotic Pathogens (3)

Repeatability: May be repeated. Maximum 12 hours. Registration Permission: Consent of instructor.

650 Topics in Microbial and Molecular Genetics (1-3)

Repeatability: May be repeated. Maximum 12 hours. (DE) 411 or consent of instructor.

670 Advanced Topics in Environmental Microbiology (1-3)

Repeatability: May be repeated. Maximum 12 hours. Registration Permission: Consent of instructor.
Modern Foreign Languages and Literatures (686)

482 Special Topics in Global Cinema (3) Content varies. Focus from global perspectives on directors, stars, film genres, national and regional cinema movements or other topics. Taught in English. (Same as Cinema Studies 482; Global Studies 482.)
Repeatability: May be repeated. Maximum 6 hours.

582 Special Topics in Global Cinema (3) Content varies. Focus from global perspectives on particular directors, stars, film genres, national and regional cinema movements, film theory/criticism, or other topics. Taught in English. (Same as Cinema Studies 582.)
Repeatability: May be repeated. Maximum 6 hours.

Music Education (707)

510 Foundations of Music Education (3) Historical, philosophical and aesthetic bases.
Registration Permission: 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.
Registration Permission: Consent of instructor.

Registration Permission: 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 (2) Examination and production of musicals appropriate for student in grades K-8. Addresses singing, dancing, acting, costumes, set design, traditional and non-traditional instrumental ensembles.
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Limited to students majoring or concentrating in art, dance or theatre.
Registration Permission: Consent of instructor.

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.
(DE) Corequisite(s): 575.

575 Professional Internship in Teaching (1-8) Teaching and teaching-related experiences in professional settings in public schools.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Admission to teacher education required. Enrollment limited to post-baccalaureate students in professional year program.
Registration Permission: Consent of School of Music.

580 Seminar in Music Education (3) Class investigation and individual reporting of pertinent topics and issues in music education.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

590 Special Topics in Music Education (1-3)
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

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.
(DE) Corequisite(s): 575.

593 Special Problems in Music Education (3)
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

Music Ensemble (708)

502 Jazz-Saxophone Ensemble (1)
Repeatability: May be repeated. Maximum 4 hours.
Comment(s): Requires audition or consent of instructor.

503 Small Jazz Ensemble (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

504 Jazz Ensemble (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

505 Studio Orchestra (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

506 Trombone Choir (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

510 Percussion Ensemble (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

511 Marimba Choir (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

515 Chamber Music Ensemble (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

530 Chamber Singers (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

540 Opera Theatre (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

550 Concert Band (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

551 Wind Ensemble (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

554 Varsity Band (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

559 Marching Band (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

570 Symphony Orchestra (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

580 Concert Choir (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

583 Men's Chorale (1)
Repeatability: May be repeated. Maximum 4 hours.
Comment(s): Requires audition or consent of instructor.

589 Women's Chorale (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

599 Accompanying (1)
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires audition or consent of instructor.

Music General (698)

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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.
Registration Permission: Consent of instructor.

521 Special Topics in Performance (1-3)
Registration Permission: Consent of school director.
Music Instrumental (710)

490 Instrumental Conducting (3) Knowledge and skills in instrumental conducting; various periods and composers and relationship of different styles to the conductor's art; musical analysis and practice in conducting. (DE) Prerequisite(s): 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. Grading Restriction: Satisfactory/No Credit grading only. Registration Permission: Consent of instructor.

584 Practicum for Instrumental Conductors (1) Intern experience in field other than area of major interest. Grading Restriction: 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. Repeatability: May be repeated. Maximum 8 hours. Registration Permission: Consent of instructor.

595 Instrumental Conducting Performance (1) Preparation and juried performance of band or orchestral work(s). Registration Permission: Consent of instructor.

Music Jazz (711)

410 Advanced Improvisation (3) Development of individual skills and solving individual problems in jazz improvisation. (DE) Prerequisite(s): 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. Registration Permission: 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. Repeatability: May be repeated. Maximum 3 hours. Comment(s): Requires organ proficiency at the 200 level.

420 Piano Literature I (3) From 1750 to the middle 19th century. Repeatability: May be repeated. Maximum 12 hours. Registration Permission: Consent of instructor.

430 Piano Literature II (3) Middle 19th century to the present. Repeatability: May be repeated. Maximum 12 hours. Registration Permission: Consent of instructor.

460 The Organ and its Literature I (3) Development of the organ and organ literature from the Middle Ages to approximately 1750; problems of style and interpretation; pedagogical literature and methods. (DE) Corequisite(s): Musicology 110. Registration Permission: Consent of instructor.

470 The Organ and its Literature II (3) Development of the organ and organ literature from 1750 to the present; problems of style and interpretation; pedagogical literature and methods. (DE) Corequisite(s): Musicology 110. Registration Permission: 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. Registration Permission: Consent of instructor.

485 Suzuki Piano Method I (2) Study of the philosophy, procedures, and literature of the Suzuki Piano Methods Books I and II. Comment(s): 485 and 495 must be taken in sequence. Registration Permission: Consent of instructor.

490 Internship (2) Opportunity for pedagogy students to gain experience in teaching beginning students under the supervision of experienced instructors. Contact Hour Distribution: Includes weekly discussion seminars.

491 Internship (2) Opportunity for pedagogy students to gain experience in teaching beginning students under the supervision of experienced instructors. Contact Hour Distribution: Includes weekly discussion seminars.

495 Suzuki Piano Method II (2) Study of procedures and literature of the Suzuki Piano Method Books III and above. Comment(s): 485 and 495 must be taken in sequence. Registration Permission: Consent of instructor.
425 Horn (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 326 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 326.  
Registration Permission: Consent of instructor.

426 Horn (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 425 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 425.  
Registration Permission: Consent of instructor.

430 Trumpet (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 311 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 311.  
Registration Permission: Consent of instructor.

431 Trumpet (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 430 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 430.  
Registration Permission: Consent of instructor.

435 Trombone (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 336 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 336.  
Registration Permission: Consent of instructor.

436 Trombone (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 435 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 435.  
Registration Permission: Consent of instructor.

441 Baritone (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 346 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 346.  
Registration Permission: Consent of instructor.

445 Tuba (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 445 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 445.  
Registration Permission: Consent of instructor.

450 Percussion (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 351 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 351.  
Registration Permission: Consent of instructor.

451 Percussion (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 450 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 450.  
Registration Permission: Consent of instructor.

455 Voice (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 356 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 356.  
Registration Permission: Consent of instructor.

456 Voice (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 455 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 455.  
Registration Permission: Consent of instructor.

460 Violin (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 361 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 361.  
Registration Permission: Consent of instructor.

461 Violin (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 460 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 460.  
Registration Permission: Consent of instructor.

465 Viola (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 366 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 366.  
Registration Permission: Consent of instructor.

466 Viola (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 465 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 465.  
Registration Permission: Consent of instructor.

470 Cello (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 371 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 371.  
Registration Permission: Consent of instructor.

471 Cello (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 470 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 470.  
Registration Permission: Consent of instructor.

472 Electric Bass (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 373 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 373.  
Registration Permission: Consent of instructor.

473 Electric Bass (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 472 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 472.  
Registration Permission: Consent of instructor.

474 String Bass (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 375 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 375.  
Registration Permission: Consent of instructor.

475 String Bass (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 474 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 474.  
Registration Permission: Consent of instructor.

480 Piano (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 381 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 381.  
Registration Permission: Consent of instructor.

481 Piano (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
(DE) Prerequisite(s): 480 and Music General 101.  
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 480.  
Registration Permission: Consent of instructor.
530 Trumpet (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

535 Trombone (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

540 Baritone (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

545 Tuba (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

550 Percussion (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

551 Accompanying and Coaching (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

555 Voice (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

560 Violin (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

565 Viola (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

570 Cello (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

572 Electric Bass (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

575 String Bass (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

580 Piano (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

583 Guitar (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

585 Harpsichord (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

590 Organ (1-4)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.

594 Composition (1-3)  
Repeatability: May be repeated. Maximum 8 hours.  
Comment(s): Requires audition.  
Registration Permission: Consent of instructor.
595 Composition with Electronic Media (1-3)
Repeatability: May be repeated. Maximum 8 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

599 Improvisation (1-4)
Repeatability: May be repeated. Maximum 8 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

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 workstation design.
Credit Restriction: May not be applied toward the concentration in music theory with technology emphasis.
Registration Permission: 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.
(PE) Prerequisite(s): 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.
(PE) Prerequisite(s): 550.

Music Theory (714)
430 Counterpoint I (3) Study of species counterpoint in modal and tonal styles on works of Palestrina and J.S. Bach.
(PE) Prerequisite(s): 210 with a grade of C or higher.

440 Counterpoint II (3) Writing of contrapuntal forms of the 18th century and fugue analysis of works from the 18th through the 20th centuries.
(PE) Prerequisite(s): 430 with grade C or higher.

450 Choral Arranging (2) Analysis of scores and writing of arrangements for choruses.
(PE) Prerequisite(s): 210 and 240 with grade C or higher or consent of instructor.

520 Analytical Techniques (3) Analytical techniques, contemporary approaches. Tonal and neotonal music.
Registration Permission: 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.
Registration Permission: Consent of instructor.

593 Independent Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of director.

Music Voice (715)
410 Song Literature I (2) German songs.
Credit Restriction: Graduate credit not available for students in vocal performance.

420 Song Literature II (2) French, Italian, Russian, Scandinavian, Czechoslovakian, British, and American art songs.
Credit Restriction: 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 the International Phonetic Alphabet; development of basic diction skills; overview of diction styles and traditions in each language; survey of diction resources and reference materials.
Comment(s): Does not fulfill deficiency requirements for graduate students in voice or accompanying.

510 Vocal Literature Seminar (3) Topics vary.
Repeatability: May be repeated. Maximum 6 hours.

520 Performance Techniques for Singers (1) Improvisation, movement, and basic techniques for dramatic vocal performance.
Repeatability: May be repeated. Maximum 2 hours.
Comment(s): Restricted to students in a vocal concentration.

530 Opera Performance (1) For satisfaction of performance requirement. May be fulfilled by undertaking a major operatic role or by demonstrating a cumulative performance record which may include a project approved and supervised by the voice faculty.
Repeatability: May be repeated. Maximum 4 hours.
Registration Permission: Consent of instructor.

540 Opera Production (1-3)
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

550 Advanced Vocal Pedagogy I (2) Study of vocal production, examination of different methods.

560 Advanced Vocal Pedagogy II (2) 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.
Registration Permission: Consent of instructor.

570 Vocal Chamber Music Performance (1) For satisfaction of performance requirement. May be used to substitute for Music Voice 530 when approved and supervised by the voice faculty.
Registration Permission: 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.
Repeatability: May be repeated. Maximum 2 hours.

580 Choral Literature I (2) A historical survey of the development of the major choral genre.

585 Choral Literature II (2) A survey by historical period of choral literature that is considered part of the standard choral repertoire.

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.
Repeatability: May be repeated. Maximum 8 hours.

594 Project in Choral Conducting Performance (1-3) Public performance, critical document; recording project.
Repeatability: May be repeated. Maximum 36 hours.
Registration Permission: Consent of instructor.

595 Choral Conducting Seminar (3) Topics vary.
Repeatability: May be repeated. Maximum 36 hours.
(PE) Prerequisite(s): 590 or consent of instructor.

Musicology (706)
410 Studies in Genre (3) Historical, cultural, analytical, and musicological issues related to a single musical genre, style, or repertory. Topics vary.
Repeatability: May be repeated. Maximum 6 hours.

420 History of Opera (3) The development of opera from its inception to the present. Readings and discussion focus on an understanding of the historical trajectory of opera, both as a musico-theatrical work and as a cultural practice.
Recommended Background: 100-level musicology course.
Registration Permission: Consent of instructor.

430 History of the Symphony (3) Overview of orchestral repertories from 1600 to the present.
Recommended Background: 100-level musicology course.
Registration Permission: Consent of instructor.

450 Composer Seminar (3) Biographical, historical, and cultural study of a composer, or a group of related composers. Topics vary.
Repeatability: May be repeated. Maximum 6 hours.

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 Medieval and Renaissance Music (3) Musical phenomena from c. 900 to c. 1600, selected from chant, troubadour song, early polyphony, madrigal, mass, and motet. Genres considered against historical, cultural, analytical, and literary frameworks, including words-music relationships, the role of music in devotion, sacred and secular intermediations, oral and written transmissions.
(PE) Prerequisite(s): 400.
(PE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.
550 Music in the Baroque Period (3) Aspects of western European art music, c. 1600 to c. 1750, from historical and cultural perspectives. Genre, national identities, the roles of voices and instruments, the emergence of tonality, issues of gender, and music’s role in social, religious and performance practices.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

560 Music in the Classic Period (3) The development of classical style from preclassic to the music of Haydn, Mozart and early Beethoven. Focus on aesthetic, cultural and social frameworks pertaining to various genres and composers. Selected vocal and orchestral works examined with respect to themes of appropriation, politics, narratives, and biographical references.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

570 Music in the 19th Century (3) Music of the nineteenth century from Beethoven to the post-Romantics with a focus on aesthetic, cultural and social contexts. Opera, symphony, art song, piano works, and others examined against the frameworks of cultural theory, gender studies, orientalism, politics and philosophy.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

580 Music in the 20th Century (3) Composers, repertories, and issues in twentieth-century art music of western Europe and the United States. New roles for composers and performers, influences of “high” and “low” art forms, influences of technology, and music’s place in the formation of national, political, and gendered identities.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

585 Topics in Music of the Americas (3) Historical or cultural study of a topic concerned with music and musical practice in the Americas. Topics vary.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

586 Topics in Opera (3) Topics vary within operatic repertory from the 17th century to the present including music and drama; interdisciplinary, race, or gender studies; realist; nationalism; expressionism; minimalism.

Repeatability: 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.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

595 Independent Study (1-15)

Registration Permission: Consent of director.

595 Seminar in Ethnomusicology (3) Exploration of a methodological, theoretical, or ethnographic topic in ethnomusicology. Topics vary.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.

596 Seminar in Historical Musicology (3) Topics vary; specific musical genre, composer, or phenomenon.

Repeatability: 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.

(DE) Prerequisite(s): 404.

404 Nuclear Fuel Cycle (3) Topics include mining, milling, fabrication, in-core management, reprocessing, waste disposal, regulatory and radiation health issues and requirements.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 301.

431 Radiation Protection (3) External and internal dosimetry, biological effects of radiation, radiation detection, radiation risk assessment.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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. (Same as Chemical Engineering 483; Industrial Engineering 483; Mechanical Engineering 483.)

Registration Permission: Consent of instructor.

484 Introduction to Maintainability Engineering (3) Principles of maintainability engineering, and measurement. Topics include information extraction from machinery measurements, rotating machine diagnostics, nondestructive testing, life prediction, failure models, lubrication oil analysis, establishing predictive maintenance programs, and computerized maintenance management systems. (Same as Chemical Engineering 484; Industrial Engineering 484; Materials Science and Engineering 484; Mechanical Engineering 484.)

Registration Permission: Consent of instructor.

494 Special Topics in Nuclear Engineering (3) Problems related to recent developments and practice.

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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

511 Transport Processes in Nuclear Engineering (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.

512 Transport Processes in Nuclear Engineering (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.

522 Experimental Methods in Reactor Dynamics (3) Introduction to time domain and frequency domain techniques. Measurement, analysis, and interpretation of process signals for reactor surveillance and diagnostics. Introduction to time-series modeling.

(DE) Prerequisite(s): 521.

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.

(DE) Prerequisite(s): 470 or consent of instructor.

542 Management of Radioactive Materials (3) Technology for process technologies. Reuse and recycle of used nuclear fuel. Radioactive waste classification, storage, reprocessing, and transport applications; overview of safety practices and regulatory requirements.

(DE) Prerequisite(s): Physics 232.

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.

(DE) Prerequisite(s): 551.

(ED) Prerequisite(s): 579.

552 Radiological Assessment and Dosimetry (3) Transport of radionuclides in environment, food chain pathways, internal dosimetry and personal dosimetry.

(ED) Prerequisite(s): 551 or consent of instructor.

553 Radiation Risk Analysis (3) Methods for radiation risk prediction, survival analysis, parameter estimation, real data analysis, extrapolation techniques.

(ED) Prerequisite(s): 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.

Contact Hour Distribution: Lecture and lab.

Registration Permission: 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.

Contact Hour Distribution: Lecture and lab.

(ED) Prerequisite(s): 567.

571 Reactor Theory and Design (3) Analytical and numerical techniques for neutron transport and nuclear systems, forward and adjoint Boltzmann transport equation. Multigroup diffusion theory. Core analysis methods and codes.

(ED) Prerequisite(s): 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.

Registration Permission: 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. (Same as Biomedical Engineering 577; Engineering Science 577; Mechanical Engineering 577.)

Registration Permission: Consent of instructor.

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.

(ED) Prerequisite(s): Statistics 571.

Registration Permission: Consent of instructor.

581 Reactor Shielding (3) Application of analytic/deterministic solutions of Boltzmann transport equation to shield design problems. Spherical harmonics, moments method, discrete ordinates, adjoint calculations, coupled analysis, and fast reactor shield design.

(ED) Prerequisite(s): 406 or equivalent.

582 Monte Carlo Analysis (3) General overview of the Monte Carlo Method for solving problems in physics and engineering. 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. Particular emphasis on solving neutral particle radiation transport problems using the MCNP code system.

Registration Permission: 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. (Same as Chemical Engineering 585.)

Registration Permission: Consent of instructor.

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

597 Special Topics in Nuclear Engineering (3) Lectures and recitation on recent advances in nuclear engineering.

Repeatability: May be repeated with consent of instructor.

Registration Permission: Consent of instructor.

598 Nuclear Engineering Practice (3-9) Experience in solving and reporting on engineering problems.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Comment(s): Enrollment limited to alternating plan students.

Registration Permission: Consent of department.

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

Repeatability: May be repeated.

611 Selected Topics in Reactor Theory (3) Transport theory, control rod theory, stochastic methods. Selected topics from literature.

(ED) Prerequisite(s): 572.

612 Selected Topics in Reactor Theory (3) Transport theory, control rod theory, stochastic methods. Selected topics from literature.

(ED) Prerequisite(s): 572.

621 Selected Topics in Radiation Protection (3) Repeatability: May be repeated with consent of department.

(ED) Prerequisite(s): 551 and 552.


(ED) Prerequisite(s): Statistics 571.

Registration Permission: Consent of instructor.

671 Advanced Topics in Applied Artificial Intelligence (3) Recent advances in engineering applications of artificial intelligence. (Same as Engineering Science 671; Mechanical Engineering 671.)

(ED) Prerequisite(s): 577.

697 Special Topics in Nuclear Engineering (3) Investigation of new developments.

Repeatability: May be repeated with consent of department.

Registration Permission: Consent of instructor.

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.

Comment(s): Open to students in all colleges.

402 Gerontology Practicum (3) Off-campus supervised experience in gerontology. Offered as part of the undergraduate gerontology minor.

Comment(s): Open to students in all colleges.

Registration Permission: 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.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

Registration Restriction(s): Master of Science in Nursing – nursing major.

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.

(ED) Prerequisite or (ED) Corequisite: Graduate level statistics course.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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.

Contact Hour Distribution: 2.5 didactic and 5 lab.

Registration Restriction(s): Master of Science in Nursing – nursing major.

505 Advanced Clinical Pharmacology (3) Pharmacological agents utilized to treat common, recurrent health problems; indications, contraindications, side and interactive effects of commonly prescribed drugs.

(ED) Prerequisite(s): Undergraduate pharmacology course or consent of instructor.
506 Advanced Anesthesia Pharmacology (3) 
(RE) Prerequisite(s): 505. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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. 
Contact Hour Distribution: 3 didactic and 1 seminar. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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.

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. 
(DE) Prerequisite(s): 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, intercalan surgical procedures for vascular and mass occupying lesions, patients requiring somatosensory evoked potential monitoring, and patients requiring anesthesia for non-cardiac and non-neurological procedures who present with either neurological and/or cardiovascular comorbidity. 
(RE) Prerequisite(s): 524 and 525. 
(DE) Corequisite(s): 523. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

517 Advanced Pathophysiology: Respiratory/Renal with Anesthesia Implications (2) 
Review of anatomy and physiology and integration of pathophysiology involved in administration of anesthesia for patients who present with renal or respiratory pathology. Pathological implications of acute and chronic renal failure, renal transplantation, pulmonary disease states: obstructive and restrictive diseases, one lung ventilation, and acute pulmonary disease states and their management. 
(RE) Prerequisite(s): 524 and 525. 
(DE) Corequisite(s): 523. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

518 Advanced Pathophysiology: Obstetrics/Regional Anesthesia (2) 
Review of anatomy and physiology and integration of pathophysiology involved in administration of regional blockade of upper and lower extremities. Local anesthetic pharmacology, indication for regional anesthesia, contraindications to specific blockade, and techniques for clinical administration of regional blockade. Regional anesthetic considerations for obstetric patient. 
(RE) Prerequisite(s): 524 and 525. 
(DE) Corequisite(s): 523. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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 psychotropic medications in relation to the use of other psychotherapeutic interventions. 
(DE) Prerequisite(s): Undergraduate pharmacology course or consent of instructor.

522 Integrated Health Science for Anesthesia (3) 
Fundamental principles of chemistry and physics as related to practice of nurse anesthesia. Correlation of principles to clinical anesthesia practice. 
(DE) Prerequisite(s) or (DE) Corequisite(s): 524. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

523 Advanced Principles of Nurse Anesthesia Practice (2) 
Advanced concepts/principles of anesthetic management and legal implications of nurse anesthesia practice. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

524 Basic Principles of Anesthesia I (3) 
An introduction to the scientific principles upon which nurse anesthetists implement plans of care which have been developed. 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. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

525 Basic Principles of Anesthesia II (3) 
A continuation of 524 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. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

526 Professional Issues in Nurse Anesthesia (2) 
Exploration of historical and current issues surrounding nurse anesthesia education, practice, and the profession. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

527 Nursing of Women and Children: Clinical Experience in Children’s Health (1-5) 
Clinical experience in the role of pediatric nurse practitioner or clinical nurse specialist in variety of health care settings serving children. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. Maximum 15 hours. 
(Re) Corequisite(s): 550 or 551.

528 Well Child Care: Assessment of Growth, Development, and Behavior (2) 
Comprehensive and preventative care for the well child. Appropriate screening tools and related development theories. Focus is on the well child ages 0 to 21 years. 
(Re) Corequisite(s): 550 and 527.

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. 
Contact Hour Distribution: 2 didactic and 4 practicum. 
(Re) Prerequisite(s): 524 and 525. 
(Re) Corequisite(s): 515. 
(Re) Prerequisite(s) or (DE) Corequisite(s): 507. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

531 Adult Health Nursing II (7) 
Continuation of 530. Delivery, provision, and management of health care for adult groups and communities. 
Contact Hour Distribution: 2 didactic and 5 practicum. 
(Re) Prerequisite(s): 530 and 501. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

532 Homeland Security Threats (3) 
A foundation course providing an in-depth and multi-perspective survey of disasters and other threats to homeland security and public health. Exploration of the phenomena of mass casualties and homeland security threats in modern society.

533 Homeland Security I (5) 
Advanced planning and leadership in response to human-made and natural disasters, as well as mass casualties related to terrorism or breach of homeland security. 
Contact Hour Distribution: 2 didactic and 3 practicum/field supervision. 
(Re) Corequisite(s): 532.

534 Homeland Security II (5) 
Continuation of Homeland Security I, providing emphasis on incident management, including ethical issues, and the impact of culture and psychology on the human response to terrorism, disaster, mass casualty events, and large population emergencies. 
Contact Hour Distribution: 2 didactic and 3 practicum/field supervision. 
(Re) Prerequisite(s): 533.

535 Homeland Security III (7) 
Application of advanced practice knowledge and skills to assess preparedness for mass casualty and homeland security disasters, toxic exposures or terrorist activity; to mobility available resources; and effectively use communication to integrate local response into broader area, national, and international response. 
Contact Hour Distribution: 2 didactic and 5 practicum/field supervision. 
(Re) Prerequisite(s): 534.

536 Homeland Security IV (8) 
Advanced care concepts provided to those affected by specific types of disasters, toxic exposures, terrorist events, or large population emergencies. 
Contact Hour Distribution: 2 didactic and 6 practicum/field supervision. 
(Re) Prerequisite(s): 535. 
Registration Restriction(s): Master of Science in Nursing – nursing major.
544 Clinical Nurse Anesthesia Practicum/Seminar I (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. 
(CE) Corequisite(s): Admission to nurse anesthesia concentration required. The nurse anesthesia practicum/seminars must be taken in sequence.

545 Clinical Nurse Anesthesia Practicum/Seminar II (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. 
(CE) Corequisite(s): 544.

546 Clinical Nurse Anesthesia Practicum/Seminar III (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. 
(CE) Corequisite(s): 544.

547 Clinical Nurse Anesthesia Practicum/Seminar IV (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. 
(CE) Corequisite(s): 546.

548 Clinical Nurse Anesthesia Practicum/Seminar V (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. 
(CE) Corequisite(s): 546.

549 Clinical Nurse Anesthesia Practicum/Seminar 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. 
(CE) Corequisite(s): 548.

550 Nursing of Women and Children I (2) Advanced practice nursing of women, infants and children; health promotion and nursing interventions for actual or potential health problems of women, children, and families. 
(CE) Corequisite(s): 504 and 505.

551 Nursing of Women and Children II (2) Continuation of 550. Advanced practice nursing of women, infants and children; role refinement of nurse practitioner or clinical specialist in health maintenance and restoration for women, children, and families. 
(CE) Corequisite(s): 550 and 501.

552 Care of the Critically-Ill Neonate (2) Advanced practice nursing of women, infants and children; health promotion and nursing interventions for actual or potential health problems of women, children, and families. 
(CE) Corequisite(s): 550.

553 Nursing Care of Women and Children: Clinical Experience in Women’s Health (1-5) Clinical experience in the role of women’s health care nurse practitioner or clinical nurse specialist in a variety of health care settings serving women. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. Maximum 15 hours. 
(CE) Corequisite(s): 550 or 551.

554 Care of the Well Woman and Minor Acute Illnesses (2) Comprehensive and preventative care for the well woman and the woman with minor acute conditions. Focus is on women of all ages. 
(CE) Corequisite(s): 550.

555 Care of the Pregnant Woman (2) Physiology and pathophysiology of the pregnant woman. Recommended advanced nursing interventions in selected conditions. Focus is on the pregnant and newly delivered woman. 
(CE) Corequisite(s): 550.

556 Care of Complex Health Problems in Women (2) Physiology and pathophysiology of the complex health problems common in women and the pregnant woman. Recommended advanced nursing interventions in selected health problems. 
(CE) Corequisite(s): 551.

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. 
Contact Hour Distribution: 2 didactic and 4 practicum. 
(CE) Corequisite(s): 504.

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. 
Contact Hour Distribution: 2 didactic and 5 practicum. 
(CE) Corequisite(s): 560 and 501.

562 Acute Illnesses in Children (2) Physiology and pathophysiology of acute minor illnesses in children and the recommended interventions in selected conditions for the APN. Focus is on ill children ages 0 to 21 years. 
(CE) Corequisite(s): 550.

563 Care of the Child with a Chronic Condition (2) Physiology and pathophysiology of chronic illnesses in children and the recommended interventions in selected conditions for the APN. Focus is on chronically ill children ages 0 to 21 years. 
(CE) Corequisite(s): 551.

564 Nursing of Women and Children: Clinical Experience in Infant’s Health (1-5) Clinical experience in the role of neonatal nurse practitioner or clinical nurse specialist in a Level III intensive care nursery. 
Grading Restriction: Satisfactory/No Credit grading only. 
Repeatability: May be repeated. Maximum 15 hours. 
(CE) Corequisite(s): 550 or 551.

565 Teaching Practicum (1-6) Individually designed teaching experiences in collegiate nursing program or nursing practice setting. Objectives to be developed collaboratively by student and faculty. 
Grading: Satisfactory/No Credit or letter grade. 
(CE) Corequisite or (CE) Corequisite: 566. 
Registration Permission: Consent of instructor.

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. 
Registration Permission: Consent of instructor.

567 Embryology and Neonatal Pathophysiology for Advanced Neonatal Nursing Practice (3) Pathophysiologic challenges confronting infants born at preterm gestation and neonates with clinical disorders arising from alterations in embryogenesis. Emphasis on the role of neonatal advanced practice nurses in assessing subtle changes in the clinical condition in these infants. 
(CE) Corequisite(s): 504 and 505.

568 Care of the Neonate (2) Physiology and pathophysiology of the neonate and the recommended interventions in selected conditions for the advanced practice nurse. Focus is on the well infant and health consequences of congenital conditions, prematurity and illness. 
(CE) Corequisite(s): 550.

569 Care of the Ill Neonate (2) Physiology and pathophysiology of the neonate and the recommended interventions in selected conditions for the advanced practice nurse. Focus is on the ill neonate. 
(CE) Corequisite(s): 550.

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. 
Contact Hour Distribution: 2 didactic and 4 practicum. 
(CE) Corequisite(s): 504.

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. 
(CE) Corequisite(s): 570.

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. 
Contact Hour Distribution: 2 practicum. 
(CE) Corequisite(s): 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.

Contact Hour Distribution: 2 didactic and 6 practicum.

(RE) Prerequisite(s): 572.

(DE) Prerequisite or (DE) Corequisite: 582.

577 Special Topics (1-3) Topic is determined by faculty and student interest.

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

582 Scholarly Inquiry for Advanced Practice Nursing (3) Non-thesis option. Utilization of research process through experimental or critical evaluation of science in area of interest. Conducted under faculty guidance and culminating in scholarly product.

Repeatability: 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.

Grading: Satisfactory/No Credit or letter grade.

Repeatability: May be repeated. Maximum 14 hours.

Comment(s): Enrollment in or completion of graduate-level courses in clinical nursing required.

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

590 Nursing Administration: Macro-Analysis (6) Exploration, analysis, and application of selected organizational, management, and leadership theories and financial principles to delivery of nursing services. Structure, functions, organization, behaviors, and adaptive processes of health care organizations.

Contact Hour Distribution: 2 didactic and 4 practicum.

(RE) Prerequisite(s): 510.

(DE) Prerequisite or (DE) Corequisite: 501 and 507.

591 Nursing Administration: Micro-Analysis (6) Utilization of human and financial resources, conflict resolution, and organizational development with application to mid-level and top-level nursing administration positions.

Contact Hour Distribution: 2 didactic and 4 practicum.

(RE) Prerequisite(s): 510.

(DE) Prerequisite or (DE) Corequisite: 501 and 507.

593 Independent Study (1-3)

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/INP only.

Repeatability: May be repeated.

Registration Restriction(s): Doctor of Philosophy – nursing major.

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.

Registration Restriction(s): Doctor of Philosophy – nursing major.

603 Nursing Research and Inquiry (3) Philosophical, theoretical and methodological bases for nursing inquiry.

(Re) Prerequisite(s): 601.

605 Middle-Range Theoretical Formulations for Nursing Science Development (3) Extant and emerging middle-range theories instrumental in nursing science development.

(Re) Prerequisite(s): 603.

(DE) Corequisite(s): 608.

Recommended Background: Inferential statistics course.

606 Nursing Research Seminar (3) Selected topics pertaining to dissertation proposal process, research experience, and defense.

(Re) Prerequisite(s): 603.

607 Qualitative Nursing Research (3) Critique and application of qualitative nursing research methods.

(Re) Prerequisite(s): 603.

608 Quantitative Nursing Research (3) Critique and application of quantitative nursing research methods.

(Re) Prerequisite(s): 603.

(DE) Prerequisite or (DE) Corequisite: Multivariate statistics course.

609 Research Practicum (1-3) Supervised individual or group research experience under guidance of faculty.

Repeatability: May be repeated. Maximum 12 hours.

Registration Permission: Consent of instructor.

610 Nursing Science Seminar (2) Critical Analysis and synthesis of literature in selected focus area within nursing science.

Registration Restriction(s): Doctor of Philosophy, nursing major.
472 Philosophy of Language (3) Problems of meaning, reference and truth. What is the relation between words and the world? How do sentences manage to be about the world? What is it for something to be true?
(DE) Prerequisite(s): 3 philosophy courses 200 level or above.

473 Philosophy of Mind (3) Problems of mind and body in relation to consciousness and personal identity.
(DE) Prerequisite(s): 6 hours of philosophy courses or consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
Credit Restriction: May not be applied toward degree requirements.

510 Philosophical Research (1-15) Paper workshop (writing, revising papers, getting papers ready to publish).
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
Credit Restriction: May not be applied toward degree requirements.

520 Topics in Ancient or Medieval Philosophy (3) Intensive critical work on major philosopher or school.
Repeatability: May be repeated. Maximum 9 hours.

522 Topics in Modern Philosophy (3) Intensive critical work on major philosopher or school.
Repeatability: May be repeated. Maximum 9 hours.

523 Topics in 20th-Century Philosophy (3) Intensive critical work on themes in late 20th-century philosophy.
Repeatability: May be repeated. Maximum 9 hours.

540 Topics in Ethics or Value Theory (3)
Repeatability: May be repeated. Maximum 9 hours.

542 Topics in History of Ethics (3) Dominant movements in history of ethics.
Repeatability: May be repeated. Maximum 9 hours.

543 Topics in Business Ethics (3) Content may vary.
Repeatability: May be repeated if content differs. Maximum 9 hours.

544 Topics in Applied Ethics (3) Content may vary. 
Repeatability: May be repeated. Maximum 9 hours.

545 Topics in Environmental Ethics (3) Content may vary.
Repeatability: May be repeated if content differs. Maximum 9 hours.

546 Topics in Bioethics (3) Content may vary.
Repeatability: May be repeated if content varies. Maximum 9 hours.

549 Practicum in Applied Ethics (1-3)
Repeatability: May be repeated if content differs. Maximum 9 hours.
Credit Restriction: Does not count toward hours required for the degree.

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.
Repeatability: May be repeated. Maximum 9 hours.

585 Special Topics (3)
Repeatability: May be repeated. Maximum 9 hours.

589 PhD Practicum in Applied Ethics (1-15) Supervised experience in such settings as health care, business, legal, or environmental institutions.
Repeatability: May be repeated. Maximum 30 hours.
Credit Restriction: Does not count toward hours required for the degree.
Comment(s): Open to PhD students in philosophy with consent of the Graduate 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.
Repeatability: May be repeated. Maximum 9 hours.

591 Foreign Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.
276 COURSES OF INSTRUCTION

593 Independent Study (1-15)
Grading Restriction: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

601 Proseminar (3) Topically focused seminar with emphasis on development of philosophical skills and methods. Required of all first-year graduate students in philosophy.

620 Topics in Ancient or Medieval Philosophy (3)
Repeatability: May be repeated. Maximum 9 hours.

622 Topics in Modern Philosophy (3)
Repeatability: May be repeated. Maximum 9 hours.

624 Topics in Contemporary Philosophy (3)
Repeatability: May be repeated. Maximum 9 hours.

640 Topics in Ethics or Value Theory (3)
Repeatability: May be repeated. Maximum 9 hours.

644 Topics in Applied Ethics (3) Content may vary.
Repeatability: May be repeated if content differs. Maximum 9 hours.

Physics (773)

411 Introduction to Quantum Mechanics (3) Fundamental principles of quantum mechanics and methods of calculation. Solution of the Schrödinger equation for simple systems. Application to atomic, molecular, nuclear, and condensed matter physics.
(DE) Prerequisite(s): 240 or equivalent and Mathematics 435.
Comment(s): 411 and 412 must be taken in sequence.

412 Introduction to Quantum Mechanics (3) Fundamental principles of quantum mechanics and methods of calculation. Solution of the Schrödinger equation for simple systems. Application to atomic, molecular, nuclear, and condensed matter physics.
(DE) Prerequisite(s): 240 or equivalent and Mathematics 435.
Comment(s): 411 and 412 must be taken in sequence.

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.
Contact Hour Distribution: 3 hours and 3 labs.
(DE) Prerequisite(s): 431 or 136 or 138 or 232.
Registration Permission: Consent of instructor.

431 Electricity and Magnetism (3) Electrostatics, magnetostatics, coupled electric and magnetic fields, Maxwell’s Equations, electromagnetic waves and radiation.
(DE) Prerequisite(s): 136 or 138 or 232.

432 Electricity and Magnetism (3) Electrostatics, magnetostatics, coupled electric and magnetic fields, Maxwell’s Equations, electromagnetic waves and radiation.
(DE) Prerequisite(s): 136 or 138 or 232.

461 Modern Physics Laboratory (3) Introduction to fundamental and modern techniques in experimental physics, and to the theory and practice of measurement and data analysis. Selected experiments in nuclear, atomic, molecular and solid state physics, and modern optics.
Contact Hour Distribution: 6 hours lab per week.
(DE) Prerequisite(s): 240 or 411.

462 Modern Physics Laboratory (3) Advanced experiments and experimental techniques in modern physics; experimental team work. Thorough quantum mechanical interpretation of results and preparation of scientific reports.
Contact Hour Distribution: 6 hours lab per week.
(DE) Prerequisite(s): 461.

490 Senior Seminar (1-3) Topics of current interest.
Repeatability: May be repeated with consent of department. Maximum 6 hours.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose research area coincides with interests of student.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated with consent of department. Maximum 18 hours.
Comment(s): Open to all graduate students in good standing.
Registration Permission: Consent of department and research director.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

503 Physics Colloquium (1) Lectures and discussion on current research topics. Continuous registration required for current graduate students.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

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, photo-electron, 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 Theoretical Physics I (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, and other modern applications of current interest, in areas of biophysics and astrophysics.
Recommended background: Familiarity with computational methods.

512 Theoretical Physics II (3) Concepts and applications in applied physics. Topics: 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 Quantum Mechanics (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, emission, absorption, and scattering of light, bremsstrahlung, pair creation and annihilation. Application of quantum mechanics to problems of atomic, molecular, nuclear, and solid state physics.

522 Quantum Mechanics (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, emission, absorption, and scattering of light, bremsstrahlung, pair creation and annihilation. Application of quantum mechanics to problems of atomic, molecular, nuclear, and solid state physics.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 531.
541 Electromagnetic Theory (3) Review of electrostatics, magnetostatics, and quasi-static problems; Maxwell’s field equations and their solutions in dielectric and conducting media; electromagnetics and relativity, retarded potentials and gauge transformations, radiation produced by accelerating charges.  
(DE) Prerequisite(s): 571.

542 Electromagnetic Theory (3) Advanced treatment of Electromagnetics, collisions between charged particles, bremsstrahlung, multipole fields. Topics may vary according to interest of students and instructor.  
(DE) Prerequisite(s): 541.

551 Statistical Mechanics (3) Ergodic theory, classical ensemble theory, quantum mechanical ensembles, relation of statistical mechanics to thermodynamics, transport theory and approach to equilibrium, phase transition, fluctuations and correlations.  
(DE) Prerequisite(s): 521, 531, and 571.


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.  
(DE) Prerequisite or (DE) Corequisite: 531 and 541.


572 Mathematical Methods in Physics II (3) Advanced Problems. Topics may vary according to interests of students and instructor.  
(Same as Mathematics 517.)  
(DE) Prerequisite(s): 571.

(DE) Prerequisite(s): 571 or consent of instructor.

591 Foreign Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

594 Special Problems (3) Especially assigned theoretical or experimental work on problems not covered in other courses.  
Repeatability: May be repeated. Maximum 9 hours.

599 Seminars (1-3) (a) Mechanics; (b) Radiation; (c) Heat and Thermodynamics; (d) Electricity and Magnetism; (e) Modern Physics.  
Repeatability: May be repeated with consent of department. Maximum 18 hours.

600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

601 Atomic Physics (3) Survey of research problems and methods. Topics of current interest.  
Comment(s): Intended for all graduate students.

602 Atomic Physics (3) Advanced problems.  
Comment(s): For students specializing in the 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.  
(DE) Prerequisite(s): 521 and 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.  
(DE) Prerequisite(s): 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.  
(DE) Prerequisite(s): 521.

611 Advanced Quantum Mechanics and Field Theory (3) Survey of problems and methods. Topics of current interest.  
Comment(s): 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.  
(DE) Prerequisite(s): 611 or consent of instructor.

615 Astrophysics and Cosmology (3) 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 Astrophysics and Cosmology (3) Galaxies and the interstellar medium. Active galaxies, quasars, and supermassive black holes. Large-scale structure, the expanding Universe, cosmology, big bang, cosmic background radiation, inflation, dark matter, formation of structure, and fate of the Universe. The Planck scale and quantum gravity.

621 Nuclear Physics (3) Survey of research problems and methods. Topics of current interest.  
Comment(s): Intended for all graduate students.

622 Nuclear Physics (3) Advanced problems.  
Comment(s): Intended for students specializing in the field.

626 Elementary Particle Physics (3) Survey of elementary particle physics: experimental methods, conservation laws, invariance principles, and models of interactions.  
Comment(s): Intended for all graduate students.

627 Elementary Particle Physics (3) Advanced topics – quark models, electroweak interactions, and unification of elementary forces.  
Comment(s): Intended for students specializing in the field.

642 Advanced Topics in Modern Physics (3) Advanced theoretical or experimental topics not covered in other courses.  
Repeatability: 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.

645 Advanced Solid State Physics (3) Survey of research problems and methods. Topics of current interest.  
Comment(s): Intended for all graduate students.

647 Advanced Solid State Physics (3) Advanced problems.  
Comment(s): Intended for students specializing in the field.

671 Advanced Problems.  
Comment(s): Intended for students specializing in the field.

672 Management and Administration of Public Horticulture Institutions (2) Management of resources in non-profit institutions, support organizations and communities. Theoretical framework and institutional responsibilities; 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.  
(DE) Prerequisite(s): 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 responsibilities; 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.  
(DE) Prerequisite(s): 226.

429 Field Study of Public Horticulture Institutions (2) Extended 10-12 day field study of various public horticulture institutions such as botanical gardens, arboretas, historical grounds, zoos, conservatories, cemeteries, and nature preserves. Application and travel fee required.  
(DE) Prerequisite(s): 226.

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 field trip is required.  
Contact Hour Distribution: 2 hours lecture and one 2-hour lab.  
(DE) Prerequisite(s): 120 and Biology 110 and 120.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Contact Hour Distribution</th>
<th>Grading Restriction</th>
<th>Repeatable?</th>
<th>Credit Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>435</td>
<td>Field and Forage Crops (2)</td>
<td>Agronomic principles of crop production and management. Crop improvement, cropping systems, tillage, fertilization, pest management, harvest and utilization of major field and forage crops.</td>
<td>2 hours and 1 lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>436</td>
<td>Plant and Garden Photography (2)</td>
<td>Principles and techniques of photography as they relate to plants and gardens. Study of equipment options and field shooting under various weather conditions and in different seasons.</td>
<td>1-hour lecture and one 1-hour lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>441</td>
<td>Advanced Turfgrass Management (2)</td>
<td>Principles and scientific basis of turfgrass culture; adaptation, ecology, physiology, climatic influences on grass culture; clipping and water management; design.</td>
<td>1-hour lecture and one 3-hour lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>442</td>
<td>Turf Root-zone Construction (2)</td>
<td>Construction and management of root-zones for home lawns, golf courses and athletic fields.</td>
<td>3 hours weekly for 5 weeks.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>446</td>
<td>Horticultural Therapy (2)</td>
<td>Introduction to the application of horticulture as therapy for treatment, rehabilitation and/or training of individuals with disabilities.</td>
<td>3 hours weekly for 5 weeks.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>448</td>
<td>Horticultural Internet Technology (3)</td>
<td>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.</td>
<td>3 hours weekly for 5 weeks.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>450</td>
<td>Specialty Landscape Construction (3)</td>
<td>Methods of design, materials, and construction techniques for specialized components of the landscape industry. Irrigation systems, outdoor lighting, garden ponds and water features.</td>
<td>3 hours weekly for 5 weeks.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>451</td>
<td>Plant Tissue Culture (3) (See Entomology and Plant Pathology 451.)</td>
<td></td>
<td></td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>454</td>
<td>Plant Biotechniques (3)</td>
<td>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 preps, genomic DNA preps, PCR, plant transformation, genomics techniques.</td>
<td>3 hours weekly for 5 weeks.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>457</td>
<td>Weed Management (2)</td>
<td>Principles of weed interference, integrated management, herbicide selectivity and behavior, specific recommendations for various crop and non-crop situations.</td>
<td>3 hours weekly for 5 weeks.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>458</td>
<td>Turf Weed Management Lab (1)</td>
<td>Laboratory addressing practices and principles presented in 457, from the standpoint of turf.</td>
<td>2 hours and 1 lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>459</td>
<td>Agronomy Weed Management Lab (1)</td>
<td>Laboratory addressing practices and principles presented in 457, from the standpoint of agronomy.</td>
<td>2 hours and 1 lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>480</td>
<td>Advanced Landscape Design (3)</td>
<td>Comprehensive application of landscape design skills to a variety of project experiences with an emphasis on landscape planning and analysis, planting design, and materials estimating.</td>
<td>2 hours and 1 lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
<tr>
<td>485</td>
<td>Computer Aided Landscape Design (3)</td>
<td>Overview of Computer Aided Design (CAD) as it relates to landscape design and construction. Emphasis on development of landscape design drawings through utilization of LANDCAD software.</td>
<td>2 hours and 1 lab.</td>
<td>P/NP only</td>
<td>Yes</td>
<td>May not be used toward degree requirements.</td>
</tr>
</tbody>
</table>

437 Public Garden Operations and Management (2) Analysis of year-round operation and management of public gardens. Case studies involving 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 a model.

438 Advanced Landscape Management (2) Scientific basis of turfgrass culture; adaptation, ecology, physiology, climatic influences on grass culture; clipping and water management; design. Contact Hour Distribution: 1-hour lecture and one 1-hour lab. Prerequisite(s): 430.

442 Turf Root-zone Construction (2) Construction and management of root-zones for home lawns, golf courses and athletic fields. Contact Hour Distribution: Two 3-hour labs. Grading Restriction: P/NP only. Repeatable: May be repeated.

443 Professional Horticultural Communications (3) Communication for public horticulturists through written, oral and visual media. Emphasis on 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. Prerequisite(s): Agriculture and Natural Resources 290 or Computer Sciences 100.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatable: May be repeated.

501 Special Topics in Plant Sciences (1-3) Topics to be assigned. Repeatable: May be repeated. Maximum 6 hours. Registration Permission: 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. Grading Restriction: Satisfactory/No Credit grading only. Repeatable: May be repeated.

504 Seminar (1) Presentations and discussion of topics. Repeatable: May be repeated. Maximum 4 hours. Repeatable: 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. Contact Hour Distribution: 3 hours weekly for 5 weeks. Prerequisite(s): 513.

522 Drought Physiology (1) Biophysical and biochemical aspects of plant-water relations and drought physiology. Contact Hour Distribution: 3 hours weekly for 5 weeks. Prerequisite(s): 513.

530 Integrated Pest Management (3) (See 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. Contact Hour Distribution: 2 hours and 1 lab. Prerequisite(s): 532.

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. Requires two-week field trip, inclusive report, and examination. Registration Permission: 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, polyploidy, extrachromosomal inheritance, apomixis, incompatibility systems, mutations, controlling elements, quantitative inheritance and heritability. Prerequisite(s): 561 and a general genetics course.
COURSES OF INSTRUCTION

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.
   Credit Restriction: Students may not receive credit for both 561 and 461.
   (DE) Prerequisite(s): Mathematics 125 or 152.

571 Design and Analysis of Biological Research (3) (See Animal Science 571.)

592 Internship (1-2) Application of horticulture and design principles and practices in supervised, professional setting, approved by department.
   Grading Restriction: Satisfactory/No Credit or letter grade.

593 Problems in Plant Sciences (1-3) Independent study. Current topic related to technology, science or design.
   Repeatability: May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/INP only.
   Repeatability: May be repeated.

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.
   Repeatability: 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. Parental germplasm, hybridization, population formation, inbreeding, genetic variance, heritability, selection methods, molecular genetic markers, genetically engineered crops.
   (DE) Prerequisite(s): Botany 521 or 522 and an organic chemistry or biochemistry course.

643 DNA Analysis (2) (See Entomology and Plant Pathology 643.)

   (DE) Prerequisite(s): 571 and a general genetics course.

Political Science (801)


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.
   Credit Restriction: May not be applied toward requirements for the Master of Science in Planning.

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) Judicial review, constitutional powers of the President and Congress, federalism, sources of regulatory authority, and constitutional protection of political and economic rights. (Same as Legal Studies 430.)

431 United States Constitutional Law: Civil Rights and Liberties (3) Current issues in civil rights and liberties including: first amendment freedoms, equal protection, privacy and the rights of the accused. (Same as Legal Studies 431.)

435 Criminal Law and Procedure (3) An overview of substantive and procedural law in the criminal justice field with emphasis on constitutional questions and public policy issues. (Same as Legal Studies 435.)

441 Public Budgeting (3) The process, participants, and politics of government budgeting with emphasis on federal government budgeting. Includes an overview of budget reform measures and their effectiveness.

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.

451 Ethnic Conflict in Foreign Countries (3) Examines political and violent conflict among ethnic and national groups and the 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 Africana Studies 452.)

454 Government and Politics of China and Japan (3) Political setting, structure and political processes in China and Japan.

456 Latin American Government and Politics (3) Introduction to the political development of Latin America with an emphasis on contemporary politics. (Same as Latin American Studies 456.)

459 Government and Politics of Russia and Eastern Europe (3) System transformation, political processes and governmental structure 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 the 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) Major western political thinkers from Socrates to Marsilio of Padua. (Same as Medieval Studies 475.)

476 Modern Political Thought (3) Major western political thinkers from Machiavelli to Marx.

500 Thesis (1-15) Grading Restriction: P/INP only.
   Repeatability: May be repeated.

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.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated.
   Credit Restriction: May not be used toward degree requirements.

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.
   Repeatability: 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.
Overview of public administration theory
sis of the roles, functions and decision-making processes of public poli-

tical problems of less developed countries.

Selected topics dealing with polit-

ern governments.

Comparative Government and Politics (3)

Moral-

 Ethics, Values, and Morality in Public Administration (3)

Ethics, Values, and Morality in Public Administration (3) Moral-

Area Seminar in Comparative Government and Politics (3) Se-

lected topics in area studies: African, Asia, Latin America, Middle East, Soviet Union and Eastern Europe or Western Europe.

Repeatability: May be repeated with consent of department. Maximum 9 hours.

International Politics (3) Survey of literature and major aspects of international politics.

Repeatability: May be repeated with consent of department. Maximum 9 hours.

Fundamentals of Planning (3) History of planning, structure and development of urban areas, operations of contemporary planning, trends and issues.

Land Use and Comprehensive Planning (3) Concept and framework for Land Use Planning. Development of comprehensive plans. Pop-

ulation, economic and employment forecasting.

Economic Analysis and Development (3) Basic methods of policy analysis and planning. Planning for economic change in cities and re-

gions. Economic development and planning process.

Environmental Planning (3) Role of planners and planning in main-

tenance of balance between natural and built environment.

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.

Planning and Property Development (3) Process of urban physi-

cal growth and change: functioning of private sector real estate develop-

ment and its relationship to planning. Partnership roles of public and pri-

vate sectors in urban development and redevelopment.

Legal Aspects of Planning (3) Legal basis for planning and guiding community development. Legal tools of planning.

Sustainable Communities (3) Overview of sustainable communi-

cies. Project-based classwork and final hands-on planning design.


Pacticum in Planning (3) Registration Permission: Consent of instructor.

Foreign Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

Off-Campus Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

Independent Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

College Teaching in Political Science (1) Instructional effective-

ness, techniques, organization, materials for teaching political science at college level.

Grading Restriction: Satisfactory/No Credit grading only.

Readings and Special Problems in Political Science (1-3)

Repeatability: May be repeated. Maximum 15 hours.

Workshops in Computer Applications (1) Training in software ap-

plications to support research and decision-making tasks in public serv-

ice. Successful completion certifies proficiency of MPA students in use of software applications for personal computer.

Grading Restriction: Satisfactory/No Credit grading only.

Special Topics in Planning (1-3)

Repeatability: May be repeated. Maximum 6 hours.

Problems in Planning (1-3)

Repeatability: May be repeated. Maximum 6 hours.

Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

Special Topics in Empirical Theory and Methodology (3) Ad-

vanced methods and procedures of analysis in political science.

Repeatability: May be repeated with consent of department. Maximum 9 hours.

Topics in Political Theory (3) Selected issues and problems in norm-

ative political theory. Specific content determined by instructor.

Repeatability: May be repeated with consent of instructor. Maximum 9 hours.

Special Topics in American Government and Politics (3) Ad-

vanced study of selected topics.

Repeatability: 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.

Repeatability: 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.

Repeatability: 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.

Repeatability: 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.

Repeatability: May be repeated. Maximum 9 hours.

670 Special Topics in Comparative Government and Politics (3) Research into selected topics.

Repeatability: 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.

Repeatability: 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.

Repeatability: 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.

(DE) Prerequisite(s): 3 hours at the 300-level in another Romance language.

431 Topics in the Literature and Language of Portuguese-speaking World (3) Outstanding works of literature and culture from the countries where Portuguese is spoken. Topics may vary. (Same as Latin American Studies 431.)

Repeatability: May be repeated. Maximum 12 hours.

(DE) Prerequisite(s): At least one course at the 300-level.

432 Topics in the Literature and Language of Portuguese-speaking World (3) Outstanding works of literature and culture from the countries where Portuguese is spoken. Topics may vary. (Same as Latin American Studies 432.)

Repeatability: May be repeated. Maximum 12 hours.

(DE) Prerequisite(s): At least one course at the 300-level.

591 Foreign Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

Psychology (830)


(DE) Prerequisite(s): 110 or consent of instructor.

409 Group Facilitation (3) Study of theory and technique through supervised experience in small groups.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): General psychology course or consent of instructor.

410 Sensory Processes and Perception (3) Physiological and psychological theories of perception. Emphasis on audition and vision.

(DE) Prerequisite(s): 385 or Mathematics 115 or Statistics 201 or graduate standing.

415 Psychology of Religion (3) History of psychology of religion with an examination of various philosophical and empirical orientations. Exploration of the psychological function of religion for individuals and society. (Same as Religious Studies 415.)

(DE) Prerequisite(s): 110 or consent of instructor.

420 History and Systems of Psychology (3) History of psychological thought. Classical approaches and recent developments.

(DE) Prerequisite(s): 110 or consent of instructor or graduate standing.

424 Psychology and the Law (3) Psychological aspects of legal systems.

(DE) Prerequisite(s): 110 or consent of instructor.

430 Health Psychology (3) Psychological factors related to health and illness, including stress, personality, and environment. Applications of psychological treatments to physical illness.

(DE) Prerequisite(s): 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. (Same as Women’s Studies 434.)

(DE) Prerequisite(s): 110 or consent of instructor.

440 Organizational Psychology (3) Social-psychological analysis of organizations, emphasizing role-theory and systems theory. (Same as Management 440.)

(DE) Prerequisite(s): 110 and 360 or consent of instructor.


(DE) Prerequisite(s): 110 and 385 or Statistics 201 or consent of instructor.

446 Advanced Measurement and Testing (3) Emphasis on mental test theories including classical test and item response theories.

(DE) Prerequisite(s): 445.

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.

(DE) Prerequisite(s): 110 or consent of instructor and one of the following sequences – Biology 101 and 102, Biology 130 and 140, or Anthropology 110 and 210.

470 Theories of Personality (3) Major theories of human personality and their development.

(DE) Prerequisite(s): 110 or consent of instructor.

475 Adolescent Development (3) Theoretical perspectives and empirical research findings pertinent to adolescent development.

(DE) Prerequisite(s): 110 or consent of instructor.

480 Theories of Learning (3) Classical and current approaches to learning and cognition.

(DE) Prerequisite(s): 110 or consent of instructor.

482 Topics in Psychology (3) Intensive analysis of special topics, such as African-American psychology or evaluation of programs in the community.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): 110 or consent of instructor.

489 Supervised Research (1-9)

Repeatability: May be repeated. Maximum 12 hours.

Registration Permission: Consent of instructor.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

502 Registration for Use of Facilities (1-15) Required for the student who is not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

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.

Registration Permission: 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.

(DE) Prerequisite(s): 505 and consent of instructor.
508 Readings and Special Issues in Psychology (1-3)
Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

509 Research Practicum (1-3)
Required of first-year graduate students in psychology.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.

510 Topics in Psychology (3)
Intensive examination of selected issues in psychology.
Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

511 Developmental Psychology (3)
Normal processes of human socialization; physical, cognitive, and emotional development from conception through infancy, childhood, and adolescence.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

512 Life-Span Development (3)
Theories and research concerning normal human development throughout lifetime, adulthood and old age.
Registration Permission: Consent of instructor.

513 Foundations of Psychology: Biological Factors, Perception, Learning, Thinking, Motivation (3)
Intensive survey.
Registration Permission: Consent of instructor.

515 Colloquium in Experimental Psychology (1)
Research and practical issues in experimental psychology.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 4 hours.
Registration Permission: Consent of instructor.

517 Foundations of Counseling Psychology (3)
History, theory, research and practice of counseling psychology.
Repeatability: 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 colinearity 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.
(De) Prerequisite(s): 451 or equivalent.
Registration Permission: Consent of instructor.

527 Behavioral Neurology (3)
Disorders of nervous system, organic brain dysfunctions. Diagnosis and treatment.
Registration Permission: Consent of instructor.

528 College Teaching in Psychology (3)
Concepts, techniques, and materials for teaching psychology at college and/or university level. Supervised practice.
Grading Restriction: Satisfactory/No Credit grading only.
Registration Permission: Consent of instructor.

543 Cognitive Science (3)
Theories and research. Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

545 Advanced Animal Behavior (3)
(See Ecology and Evolutionary Biology 545.)

546 Ethological Psychology (3)
Basic ethology and comparative psychology. Implications for human behavior. (Same as Ecology and Evolutionary Biology 546.)
Registration Permission: Consent of instructor.

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.
Registration Permission: 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.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: 555.

555 Psychometrics (3)
Basic concepts: factor analysis, scaling, test theories, probability models and their applications, computerized adaptive testing and other topics.
(De) Prerequisite(s): Statistics 537 and 538.
Repeatability: May be repeated. Maximum 6 hours.

556 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.
(De) Corequisite(s): 559.
Comment(s): Admission to doctoral program in clinical psychology or consent of instructor required.

559 Laboratory in Interviewing and Observation (1)
(De) Corequisite(s): 558.
Comment(s): Admission to doctoral program in clinical psychology or consent of instructor.

560 Psychology of Learning (3)
Review of current evidence from research involving human and/or non-human animals.
Repeatability: May be repeated. Maximum 6 hours.
(De) Prerequisite(s): 400.
Registration Permission: Consent of instructor.

565 History and Systems of Psychology (3)
History of philosophy concerning psychology. Major systems of psychology which emerged during 20th century.
Comment(s): Graduate standing required.

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.
Comment(s): Admission to doctoral concentration in counseling psychology required.

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.
Comment(s): Admission to clinical psychology concentration or consent of instructor required.

571 Personality: Theory and Research II (3)
Advanced survey of behavioral and humanistic approaches to personality; related research.
Comment(s): Admission to clinical psychology concentration or consent of instructor required.

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.
Grading Restriction: Satisfactory/No Credit grading only.
(De) Prerequisite(s): 445 and Counselor Education 525.

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.
Comment(s): Admission to clinical psychology concentration or consent of instructor required.

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.
Comment(s): Admission to clinical psychology concentration or consent of instructor required.

580 Research Questions and Designs (3)
Question-asking process in research and strategies or designs through which answers might be derived.
Comment(s): Admission to clinical psychology concentration or consent of instructor required.

593 Independent, Off-campus, or Foreign Study (1-15)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

594 Psychological Assessment I (3)
Basic concepts and techniques of adult assessment: intelligence tests and personality tests.
Comment(s): Admission to clinical psychology concentration or consent of instructor required.

595 Psychological Assessment II (3)
Basic concepts and techniques of adult assessment, intelligence tests and personality tests.
(De) Prerequisite(s): 594 or consent of instructor.
Comment(s): Admission to doctoral concentration in clinical psychology or consent of instructor required.
596 Laboratory in Psychological Assessment (1)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatable: May be repeated. Maximum 4 hours.
(DE) Corequisite(s): 594 or 595.
Comment(s): Admission to doctoral concentration in clinical psychology or consent of instructor required.

597 Developmental Psychopathology (3) Research and theory on pathways to psychological disorders and personal adjustment.
Repeatable: May be repeated.
Registration Permission: Consent of instructor.

598 Ethical Issues in Professional Psychology (3) Conceptual and practical applications in human services and research.
Registration Permission: Consent of instructor.

599 Clinical Psychopathology (3) Formal use of descriptive categories used in the diagnosis of abnormal behavior.
Repeatable: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 597 or consent of instructor.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/NP only.
Repeatable: May be repeated.

601 Seminar in Psychology (3)
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

602 Seminar in Applied Psychometrics (3)
Repeatable: May be repeated. Maximum 9 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

603 Seminar in Applied Psychology (3)
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

613 Seminar in Existential-Phenomenological Psychology (3)
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

617 Seminar in Cognitive Science (3)
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

623 Seminar in Methods of Naturalistic Research (3)
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

625 Advanced Study in Personality (3) Theory, research and conceptual analysis of studies with application to education and counseling.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

635 Ethical, Legal, and Professional Issues Psychology (3) Research, human services, teaching, and public policy.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

667 Personality and Vocational Assessment (3) Use and interpretation of personality and vocational measures in assessment of clients.
Repeatable: May be repeated.
Repeatable: May be repeated.
Repeatable: May be repeated.
Registration Permission: Consent of instructor.

670 Psychotherapy I (3) Theories and principles.
Comment(s): Admission to doctoral concentration in clinical psychology or consent of instructor required.

671 Psychotherapy II (3) Theories and principles.
Repeatable: May be repeated.
Comment(s): Admission to doctoral concentration in clinical psychology or consent of instructor required.

672 Psychological Dysfunction (3) Classification methods, dynamics and treatment of dysfunctional individuals in counseling.
Repeatable: May be repeated.
Repeatable: May be repeated.
Repeatable: May be repeated.
Registration Permission: Consent of instructor.

673 Laboratory in Psychotherapy (2)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatable: May be repeated. Maximum 6 hours.
Corequisite(s): 670 or 671.
Comment(s): Admission to doctoral concentration in clinical psychology or consent of instructor required.

674 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 135 clock hours required each semester.
Repeatable: May be repeated. Maximum 6 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

675 Advanced Theory and Practice in Group Counseling (3) Theories and supervised practice.
Repeatable: May be repeated. Maximum 6 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

676 Field Placement in Counseling Psychology (3)
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

678 Theory and Practice of Counseling Supervision (3) Theory and practice of supervision in counseling.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

679 Internship in Counseling Psychology (1-6) Supervised employment in departmentally approved counseling psychology internship sites.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

683 Seminar in Behavioral Medicine (3) Current research and theory concerning relationships between behavior and health.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

695 Field Placement in Clinical Psychology (3)
Repeatable: May be repeated. Maximum 24 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

696 Advanced Psychology Clinic Placement (1-3)
Repeatable: May be repeated. Maximum 24 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

697 Supervised Field Work in Applied Psychology (1-6) Guided practice in applying psychological principles and techniques in industrial, organizational, and community settings.
Repeatable: May be repeated. Maximum 24 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

Public Health (839)

400 Consumer Health (3) (Same as Exercise Science 509; Nursing 509; Nutrition 509; Social Work 509.)
Repeatable: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

493 Directed Independent Study (1-3) Individual study of selected issues.
Repeatable: May be repeated. Maximum 6 hours.
Registration Permission: 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.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Repeatable: May be repeated. Maximum 12 hours.
Credit Restriction: May not be used toward degree requirements.

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.
Repeatable: May be repeated. Maximum 4 hours.
Registration Permission: Consent of instructor.

510 Environmental and Occupational Health (3) Health risks and complexities of personal and community environments impacting individual’s health and response to a diverse and dynamic world. Principles of occupational safety and health. Survey of contemporary environmental issues and their implications for healthful living.
Repeatable: May be repeated. Maximum 4 hours.
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.

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.

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.

540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of public 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.


544 Statistical Software for the Health Professional (3) An intermediate level, survey of three software packages used by public health professionals for data analysis, including Microsoft Excel, Epi Info, and SAS. For students in the applied epidemiology graduate certificate program, data management and analysis using the software packages are explored. As a continuation of biostatistics and the introduction and advanced courses in epidemiology, this capstone course emphasizes application.

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.

555 Health and Society (3) Understanding of social and behavioral factors which influence health status and care in America. Application to behavior in health-related organization. Social and psychological aspects of disease; sociocultural aspects of health care delivery systems, political economy of health and illness, impact of social movements on health, and social consequences of health legislation.

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) Repeatability: May be repeated if topic differs. Maximum 6 hours.

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

587 Internship (3) Internship (community health education, gerontology, or health planning/administration) in either approved organization or research setting under supervision of designated preceptor.

588 Internship (3) Internship (community health education, gerontology, or health planning/administration) in either approved organization or research setting under supervision of designated preceptor.

589 Internship (3) Internship (community health education, gerontology, or health planning/administration) in either approved organization or research setting under supervision of designated preceptor.

590 Research Methods in Health (3) (See Health 590.)

593 Directed Independent Study (1-3) Repeatability: May be repeated. Maximum 6 hours.

595 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 a public relations project from inception to completion. Requires extensive out-of-class work.

490 Special Topics (3) Topics vary.

500 Thesis (1-15) Grading Restriction: 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.

516 Seminar in Public Relations Issues (3) Topics vary.

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, programs 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.

597 Independent Study (3) Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.
598 Internship (3) Professional work in public relations supervised by communications manager with faculty approval. No retroactive credit for previous work experience.
(DE) Prerequisite(s): Completion of core curriculum.

Reading Education (847)
434 Topics in Reading Education (1-6)
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Course in reading education.
Comment(s): Admission to teacher education required.

461 Developing Reading Skills in Content Fields (3) Teaching reading and study skills in content areas of school program. Extensive assessment of textbooks. Emphasis on 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.
(DE) Prerequisite(s): Course in teaching of reading or consent of instructor.

533 Reading in Community College: Research and Theory (3) Analysis of components of effective college community college reading programs. Attention to research bases.
(DE) Prerequisite(s): Course in reading education or consent of instructor.

534 Seminar in Reading Education (1-6)
Repeatability: May be repeated. Maximum 6 hours.

536 Psychology of Reading (3) Reading act, relationship between learning theory and reading, role of reading in child's overall intellectual development. Affective and cultural factors.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.

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.
(DE) Prerequisite(s): Course in reading education, or equivalent teaching experience, or consent of instructor.

543 Literacy and Literature in the Middle Grades (3) Problems and issues particular to teaching reading in the middle grades including teaching reading in an integrated curriculum, dealing with students reading below grade level, and teaching concept vocabulary. The literature base for early adolescents will be explored and analyzed.

554 Developmental Reading Practicum (3) Diagnosing and teaching children having developmental and corrective reading needs in regular classroom.
(DE) Prerequisite(s): Course in diagnosis and correction of reading problems or consent of instructor.

602 Seminar in Reading Education (1-6)
Repeatability: 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): Course in diagnosis and correction of reading problems or consent of instructor.

Recreation and Leisure Studies (853)
415 Development of Recreation, Leisure, and Athletic Facilities (3) Principles of designing, planning, equipping, and operating various facilities. Elements of risk management and safety are incorporated into the design process.
(DE) Prerequisite(s): 310 and 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, non-profit, and/or commercial enterprises. Organizational structures, human resource management, diversity, evaluation, legal authority, introduction to budgeting and fiscal procedures, professional responsibility, and career management.
(DE) Prerequisite(s): 310 or Sport Management 350.

440 Dimensions of Commercial Recreation and Leisure Enterprises (3) Organizational structures, delivery systems, financing private enterprises and operating selected profit centers in a variety of settings. Special attention is given to market performance and economic impact.
(DE) Prerequisite(s): 201 or consent of instructor.

450 Special Topics in Recreation and Leisure Studies (1-6) Development of special topics in recreation/therapeutic recreation and leisure. Repeatability: May be repeated. Maximum 6 hours.

470 Tourism and Leisure Industries (3) An examination of the symbiotic relationship between tourism and various sectors of the leisure industry. Use of resources, both natural and developed, and the economic impacts of these ventures. Sociocultural impacts upon the venue and how the venue impacts the local population.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.
Registration Restriction: Recreation and leisure studies major.

511 Perspectives and Trends in Leisure Studies and Services (3) Basic role of leisure delivery systems in today's society, scope of leisure behavior, developmental features of leisure and recreation. Current trends, problems, laws, and issues affected by and/or affecting delivery of leisure services.
Registration Permission: Consent of instructor.

515 Philosophical and Conceptual Foundations of Leisure (3) Philosophy of leisure and recreation; nature of philosophy, concepts of leisure, recreation, play, work, and other factors, history of field, and relationship of ideas to contemporary society and to professional practice.

520 Program Design and Evaluation in Therapeutic Recreation (3) History, philosophy, nature, purpose, special populations served, programming process, professional aspects of therapeutic recreation. Basic overview of aspects of leisure delivery systems.

521 Facilitation Techniques in Therapeutic Recreation (3) Role of therapeutic recreation in clinical and non-clinical settings; application of life-style planning, self-awareness, values clarification and assertiveness training in therapeutic recreation, relationship of leisure education to therapeutic recreation.
(DE) Prerequisite(s): 520 or consent of instructor.

522 Clinical Aspects in Therapeutic Recreation (3) Concepts and techniques utilized by experienced and advanced therapeutic recreation specialist: clinical issues, comprehensive program concerns, administrative funding and trends in practice of therapeutic recreation services.

540 Fiscal Policies for Recreation and Sports Related Organizations and Facilities (3) Application of fiscal policies and procedures to operation of recreation and sports related organizations and facilities. Finance, revenue generating strategies, cash and inventory control, commercial/public cooperative ventures and microcomputer applications.
(DE) Prerequisite(s): 430 or consent of instructor.

541 Management and Operation of Recreation and Sport Related Facilities (3) Research for making program and management decision, process of cost analysis, and basic design and maintenance of recreation and sport related facilities.
Registration Permission: Consent of instructor.
Rehabilitation Counseling (852)

530 Orientation to Rehabilitation (3) History, philosophy, legal and economic bases, current issues, and practices in public and private rehabilitation programs. Qualifications of service providers. Assessment, plan development, and provision of services to people who have disabilities and vocational handicaps. Identification, mobilization, and utilization of rehabilitation resources.

532 Case Load Management in Rehabilitation (3) Techniques and procedures involved in management of caseloads in Federal-State vocational rehabilitation agencies, private rehabilitation companies, and public or private rehabilitation facilities. Analysis of appropriate industrial management models related to rehabilitation programs.

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.

549 Internship in Rehabilitation Counseling (12) Supervised practice in rehabilitation counseling. Full time clinical experience for second-year students. Requires 600 clock-hours.

579 Special Topics (1-3) Grading Restriction: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 9 hours.

591 Research Project in Rehabilitation Counseling (3) Explore and research rehabilitation counseling issues directly related to employment, counselor functions, and/or treatment variables.

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) Grading Restriction: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.
550 Critical Explorations in Religious Studies (3) Critical examination of selected phenomena of religion from contemporary theoretical or thematic perspectives. Required for MA students in philosophy major/religious studies concentration.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): 503.

551 Comparative Historical Explorations in Religious Studies (3) Critical examination of parallel or contrasting historical phenomena from two or more religious traditions. Required for MA students in philosophy major/religious studies concentration.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): 503.

591 Foreign Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)

Repeatability: May be repeated. Maximum 15 hours.

Retail and Consumer Sciences (865)

412 Direct Retail Methods (3) Issues concerning the use of direct selling methods to sell goods and services. Emphasizes analysis of consumer and product/service types for integrated direct retail methods. The direct retailing methods in this course include direct mail, catalogs, telemarketing, infomercials, and electronic commerce (internet).

(DE) Prerequisite(s): 210, 341, and 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.

(DE) Prerequisite(s): 210, and Marketing 300.

500 Thesis (1-15)

Grading Restriction: P/NP only. Repeatability: May be repeated.

501 Professional Project (3-6) Application-oriented, capstone project to show competence in major academic area.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.

Comment(s): Enrollment limited to students in retail and consumer sciences concentration/non-thesis option.

Registration Permission: 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.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated.


(DE) Prerequisite(s): Retail management course.


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.

(DE) Prerequisite(s): Statistics 531 or equivalent.

590 Research Seminar (1) Research topics in retail and consumer sciences.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated.

593 Directed Study (1-3) Individual problems in retailing and consumer sciences.

Repeatability: May be repeated. Maximum 9 hours.

(DE) Prerequisite(s): 9 hours of graduate coursework in retail and consumer sciences.

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.

Repeatability: May be repeated. Maximum 9 hours.

(DE) Prerequisite(s): 9 hours of graduate coursework.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only. Repeatability: May be repeated.

614 Theory in Retail Environment (3) Analysis and evaluation of theory in retail environment and its application to research in retailing.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 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.

(DE) Prerequisite(s): 562 and Statistics 538.

625 Strategic Managerial Retailing (3) Decision-making orientation that integrates strategic framework components with preparation and analysis of specific retail case situations.

(DE) Prerequisite(s): 510 or equivalent.

641 Retail Consumer Behavior (3) Theories and concepts from social science in relation to ultimate consumer’s behavior.

(DE) Prerequisite(s): 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.

Repeatability: May be repeated. Maximum 9 hours.

(DE) Prerequisite(s): 9 graduate hours in consumer sciences.

Russian (886)

401 Advanced Grammar, Conversation, and Composition (3) (DE) Prerequisite(s): 312 or equivalent.

402 Advanced Grammar, Conversation, and Composition (3) (DE) Prerequisite(s): 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) Repeatability: May be repeated if topic differs. Maximum 9 hours.

451 Senior Seminar (3) Intensive study of language, literary style, and literary criticism based on selected major novels.

Comment(s): For majors in Russian; minors admitted at discretion of instructor.

452 Senior Seminar (3) Intensive study of language, literary style, and literary criticism based on selected major novels.

Comment(s): For majors in Russian; minors admitted at discretion of instructor.

510 Russian Phonetics and Advanced Grammar (3) Phonetics, pronunciation, stylistics, and selected topics in Russian grammar. For teachers and prospective teachers.

Registration Permission: Consent of instructor.

550 Studies in Russian Literature (3) Content varies. Repeatability: May be repeated. Maximum 9 hours.

591 Foreign Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15) Repeatability: May be repeated. Maximum 15 hours.
School Psychology (901)
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.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Counselor Education 525 or equivalent.
Comment(s): Requires admission to school psychology major or consent of instructor.

542 Practicum in Psychoeducational Assessment (3) Application of assessment skills to clients in learning environments.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Co-requisite(s): 541.
Comment(s): Requires admission to school psychology major or consent of instructor.

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 and Intervention (3) Application of consulting and intervention skills to educational settings.
Grading Restriction: Satisfactory/No Credit grading only.
(DE) Prerequisite(s): 545.
Comment(s): Requires admission to the school psychology major or consent of instructor.

549 Internship in School Psychology (1-6) Supervised employment in unit approved school psychology internship sites.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires admission to school psychology major.
Registration Permission: Consent of instructor.

649 Advanced Internship in School Psychology (1-9) Supervised experience as school psychologist in unit-approved internship site for doctoral level students.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.
Comment(s): Admission to doctoral school psychology concentration required.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.

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.

Science Education (899)
496 Teaching Science Grades 7-12 (3) Methods, materials, recent trends in science and environmental education programs for secondary schools.
Comment(s): Admission to teacher education required.

Repeatability: May be repeated. Maximum 9 hours.

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.
543 Teaching Science in the Middle Grades (3) Activities in this class are intended to promote the professional growth of pre-service and in-service science teachers by studying science curriculum and instructional strategies. In particular, methods of teaching contemporary science content in grades 4-8 will be explored.

556 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.

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; directed observation in public schools, preparation of teaching plans and materials; simulated teaching experiences.

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.

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.

543 Teaching Social Studies in the Middle Grades (3) Activities in this class are intended to promote the professional growth of pre-service and in-service social studies teachers through study, design, and implementation of social studies curriculum and instructional strategies. In particular, methods of teaching contemporary social science content in grades 4-8 will be explored.

585 Teaching Secondary School Social Studies (3) Strategies, projects, materials, and programs in social studies.

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.

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) Grading Restriction: P/NP only. Repeatability: May be repeated.

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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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 social work roles and intervention strategies pertaining to client systems.

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.

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

514 Human Behavior in the Social Environment I (3) Life cycle from infancy through adolescence. 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.

515 Human Behavior in the Social Environment II (3) From young adulthood through senescence. 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.

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 policy-making process through which macro social 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 interactional 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.

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.

Repeatability: 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.

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 limitations 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.


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.

581 Field Practice (3) Instruction and supervision in social work practice.

582 Field Practice (2-6) Advanced field practice in clinical social work or management and community practice. Full-time students must enroll for six credit hours.

583 Field Practice (2-6) Advanced field practice in clinical social work or management and community practice. Full-time students must enroll for six credit hours.

584 Field Practice (3) Field practice for summer session advanced standing students 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.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: 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.

605 Analysis of Social Work Data I (3) Techniques for quantitative analysis of social work data: unique data analysis problems encountered in social work research.

606 Analysis of Social Work Data II (3) Techniques for quantitative analysis of social work data: unique data analysis problems encountered in social work research.


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.


693 Directed Study in Social Work Research (3) Advanced individual study, under faculty guidance, of social work practice issues.

Sociology (915)

446 The Modern World System (3) Critical examination of the capitalist world-system as a 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.

451 Criminal Justice (3) A critical assessment of the criminal justice apparatus and its components. Brief examination of the police, with emphasis on the criminal courts and institutions and programs such as the prison, probation, and parole. Analysis of their operation and impacts. (Same as Legal Studies 451.)

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, the social impact of legal sanctions, relations between law and social justice. (Same as Legal Studies 455.)

459 White-Collar Crime (3) The 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) The relation of humans to their urban environment with emphasis on conservation and use of appropriate technology.

465 Social Values and the Environment (3) Human dimensions of ecosystem management and public policy. An applied focus on how social values are activated within specific biophysical and social settings. (DE) Prerequisite(s): 110 or 120 or consent of instructor.

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

(DE) Prerequisite(s): First-year required PhD 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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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; 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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

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.

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

591 Foreign Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15)
Repeatability: May be repeated. Maximum 15 hours.

599 Readings (3) Selected topics.
Repeatability: May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only.
Repeatability: May be repeated.

622 Sociological Theory II (3) Distinct schools of sociological theory and contributions of their principal exponents.

(DE) Prerequisite(s): 521 or consent of instructor.

629 Supplementary Readings in Sociological Theory (3) Individual guidance. Preparation for comprehensive examination.

Grading Restriction: Satisfactory/No Credit grading only.
Registration Permission: Consent of instructor.

633 Survey Design and Analysis (3) Systematic exploration of survey problems through student participation in design and analysis of survey.

(Same as Child and Family Studies 633.)

(DE) Prerequisite(s): 531 or consent of instructor.

636 Field Research (3) Research experience in selected field sites using techniques of interviewing, participant observation, and other methods of field research.

(DE) Prerequisite(s): 531 or consent of instructor.

639 Supplementary Readings in Methodology (3) Individual guidance. Preparation for comprehensive examination.

Grading Restriction: Satisfactory/No Credit grading only.
Registration Permission: Consent of department.

644 Political Sociology (3) Critical examination of theories of state and political processes.

645 Advanced Studies in Political Economy (3) Topical seminar.

(DE) Prerequisite(s): 504 or consent of instructor.
Repeatability: May be repeated. Maximum 6 hours.

649 Supplementary Readings (3) Grading Restriction: Satisfactory/No Credit grading only.
Registration Permission: Consent of instructor.

653 Sociology of Law (3) Intensive examination of selected topics in sociology of law.

(DE) Prerequisite(s): 505 or consent of instructor.

655 Advanced Studies in Criminology (3) Intensive examination of selected topics in criminology.

Repeatability: May be repeated. Maximum 6 hours.

661 Environmental Theory (3) Historical and contemporary studies of interaction between humans and their environment.

Registration Permission: Consent of instructor.

665 Advanced Studies in Environmental Sociology (3) Topical seminar covering particular lines of research and theory within area.

Repeatability: May be repeated. Maximum 6 hours.

675 Advanced Studies in Social Psychology (3) Selected contemporary research issues related to social psychological theories.

Repeatability: 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.

Registration Permission: Consent of instructor.

699 Tutorials in Advanced Topics (3) Individual instruction.

Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of department.

Spanish (924)

421 Phonetics (3)

(DE) Prerequisite(s): 323 or consent of instructor.

422 Advanced Grammar and Translation (3) Structure of the grammatical system of Spanish. In-depth analysis of selected syntactic phenomena with practical illustration/application and exercise in Spanish-English and English-Spanish translation. Emphasis on finer points of grammatical structures.

(DE) Prerequisite(s): 323.
Comment(s): Not available to native or bilingual students of Spanish without consent of department.

423 Advanced Composition and Conversation (3) Develops writing and speaking skills to the advanced level, covering a wide range of topics and situations and including a variety of in-class and extra-class activities.

(DE) Prerequisite(s): 323 or consent of department.
Comment(s): Not available for credit for students whose level of proficiency in Spanish is superior as defined by the ACTFL.

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.)

430 Topics in Hispanic Linguistics (3) Introduction to the study of the Spanish language through different areas of linguistics such as phonology, morphology, syntax, semantics, sociolinguistics, dialectology, and second language acquisition. (Same as Linguistics 431.)

Repeatability: May be repeated with consent of department. Maximum 6 hours.

(DE) Prerequisite(s): 323.
433 Images of Woman in Hispanic Literature (3) Examines major Hispanic texts (and/or women authors) in light of the relation of female individuality to a particular social context, the role of women in society, patriarchal tradition, woman as cultural and as aesthetic value (the feminine symbolic), and feminist theoretical issues.

(DE) Prerequisite(s): 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 a comparison of them with treatments of related subjects in other types of artistic production. Taught in Spanish. (Same as Cinema Studies 434.)

Repeatability: May be repeated with consent of department. Maximum 6 hours.

461 Special Topics (3) Focus on aspects of Hispanic literature, culture, linguistics, or foreign language pedagogy. Topics vary.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

465 Latin American Film and Culture (3) Explores 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. (Same as Cinema Studies 465; Latin American Studies 465.)

466 Latin American Film and Art (3) Study of selected topics on traditions in crisis. Content will vary. (Same as Latin American Studies 466.)

467 Disenchantment 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 will vary. (Same as Latin American Studies 467.)

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 will vary. (Same as Latin American Studies 479.)

Repeatability: May be repeated with consent of department. Maximum 6 hours.

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 the Hispanic world, including literature itself. Repeatability: May be repeated with consent of department. Maximum 6 hours.

(DE) Prerequisite(s): 323, 330, and completion of 9 additional hours of upper-division Spanish.

482 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. Repeatability: May be repeated with consent of department. Maximum 6 hours.

(DE) Prerequisite(s): 323, 330, and completion of 9 additional hours of upper-division Spanish.

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 the Hispanic world, with regard to identity and concepts of nationality. Possible course 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.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

(DE) Prerequisite(s): 323, 330, and completion of 9 additional hours of upper-division Spanish.

486 Literary and Artistic Movements in the Hispanic World (3) Examination of relationships (thematic, 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. Repeatability: May be repeated with consent of department. Maximum 6 hours.

(DE) Prerequisite(s): 323, 330, and completion of 9 additional hours of upper-division Spanish.

489 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 the Middle Ages to present day may be explored. Repeatability: May be repeated with consent of department. Maximum 6 hours.

(DE) Prerequisite(s): 323, 330, and completion of 9 additional hours of upper-division Spanish.

500 Thesis (1-15)

Graduation Restriction: P/NP only.
Repeatability: May be repeated.

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.

Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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 the department.

533 Old Spanish (3) Evolution of Spanish language from its origins through the 15th century.

532 Medieval Spanish Literature (3) Literary works of the 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.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

533 Golden Age Prose (3) Wide range of prose fiction in Spain during the 16th and 17th centuries. Moorish, picaronesque, 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.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

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.


Repeatability: May be repeated with consent of department. Maximum 6 hours.

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.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

542 20th-Century Spanish Literature: Generation of '98 through Civil War (3) Principal achievements and representative directions in literature of Spain from Civil War period.

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.

Repeatability: May be repeated. Maximum 6 hours.

552 Directed Readings (3)

561 Spanish American Colonial Literature (3) From the pre-Columbian era through the 18th century. Reading and analysis of selected works from the Colonial Spanish American period and their Continental sources. Indigenous texts and authors. Content varies.

Repeatability: May be repeated with consent of department. Maximum 6 hours.


Repeatability: May be repeated with consent of department. Maximum 6 hours.

571 Spanish American Narrative: Criolloismo to 1950 (3) Critical study of major trends and movements that shaped Spanish American narrative during the first half of 20th century. Content varies.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

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 the second half of the 20th century. Content varies.

Repeatability: May be repeated with consent of department. Maximum 6 hours.

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.

Repeatability: May be repeated with consent of department. Maximum 6 hours.
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. Repeatability: May be repeated with consent of department. Maximum 6 hours.

576 Contemporary Spanish American Poetry (3) Critical study of major poets in Spanish America from 1950 to present. Content varies. Repeatability: May be repeated with consent of department. Maximum 6 hours.

577 Contemporary Spanish American Theater (3) Reading and analysis of Spanish America’s major dramatic works published and performed since 1950. Content varies. Repeatability: May be repeated with consent of department. Maximum 6 hours.


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. Repeatability: May be repeated with consent of department. Maximum 6 hours.

591 Foreign Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

592 Off-Campus Study (1-15) Repeatability: May be repeated. Maximum 15 hours.

593 Independent Study (1-15) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

621 Seminar in Spanish Literature (3) Topics vary in field of Peninsular literature. Repeatability: May be repeated with consent of department. Maximum 9 hours.

631 Seminar in Spanish American Literature (3) Topics vary. Repeatability: May be repeated with consent of department. Maximum 9 hours.

Special Education (932)

410 Early Childhood Special Education Foundations (3) Introduction to the field of early childhood special education including the nature of disabling conditions; theoretical perspectives in the field; legislation; policies and procedures used in the field.

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. (DE) Prerequisite(s): 402. (DE) Corequisite(s): 420. Comment(s): Admission to teacher education required.

420 Field Experience in Special Education Programs (3) Practicum in teaching special education programs: planning, developing, implementing and evaluating instruction. Grading Restriction: Satisfactory/No Credit grading only. (DE) Prerequisite(s): 402. (DE) Corequisite(s): 419 and/or 471. Comment(s): Admission to teacher education required.

431 Field Experience in Comprehensive Programs (3) On-site teaching experience with moderately and severely handicapped children and youth. Grading Restriction: Satisfactory/No Credit grading only. (DE) Prerequisite(s): 402. (DE) Corequisite(s): 419 and/or 471. Comment(s): Admission to teacher education required.

432 Psychology and Education of Students with Moderate/Severe Disabilities (6) Nature and characteristics of persons with moderate/severe disabilities and educational strategies appropriate for those persons. (DE) Prerequisite(s): 402. (DE) Corequisite(s): 431. Comment(s): Admission to teacher education required.

454 Education of the Gifted and Talented Children (3) Psychometric and behavioral studies of giftedness. Analysis of past and present school practices in reference to curriculum and program implementation. Comment(s): Admission to teacher education required.

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) General characteristics and educational needs of exceptional children. Implications of developmental variations for functioning as adults.

471 Early Childhood Special Education (3) Assessment, curriculum planning and development and teaching approaches used in early childhood special 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.

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 assessment of handicapped infants and young children; screening, identification, diagnosis, placement and programming assessment issues.

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. (DE) Prerequisite or (DE) Corequisite: 555 or consent of instructor.

557 Positive Preventive Discipline (3) Instructional, classroom and preventive/proactive strategies for use in classroom which positively effects efficiency of classroom. Research on how curriculum can encourage appropriate interactions of children and youth. Comment(s): Admission to graduate program required.

558 Neuromuscular and Health Disorders: Educational Implications (3) Neurological impairments, physical disabilities and special health conditions. Implications of maladjustment. Practices for promoting social and emotional development.


565 Instructional Systems for the Gifted and Talented (3) Instructional methods and systems evaluated in terms of effectiveness in various educational environments. (DE) Prerequisite or (DE) Corequisite: 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.

550 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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.

630 Internship in Institutional Leadership in Special Education and Rehabilitation (3-9) Advanced level field experiences under supervision of practitioner.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

Sport Management (957)

440 Sport Marketing (3) Application of fundamental marketing concepts to the sport industry. Marketing research, promotions, fund raising, advertising, and assessment of marketing programs specific to sport will be covered. The historical development of sport marketing will be included.

(DE) Prerequisite(s): Marketing 300.

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 sporting events. Emphasis on developing balanced, multifaceted programs that target a variety of constituencies in the sport industry.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work.

(DE) Prerequisite(s): 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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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

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.

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.

560 Sport Governance (3) Principles of organizational governance theories as applied to sport organizations. Review of history, mission, and structure, administrative and legislative processes of amateur and professional governing bodies in sport.

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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated with consent of instructor. Maximum 3 hours.

580 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport.

Repeatability: May be repeated. Maximum 6 hours.

590 Practicum (3) Practical experience in areas of major interest.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

593 Independent Study (1-3)
Repeatability: May be repeated. Maximum 6 hours.

595 Internship (3) Full-time application of previous theoretical and applied knowledge and skills in appropriate sport setting.

Grading Restriction: Satisfactory/No Credit grading only.

Sport Studies (959)

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

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.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.

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.

Comment(s): Requires admission to the sport studies major or consent of instructor.


514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues. Comment(s): Requires admission to the sport studies major or consent of instructor.

515 Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport.

Comment(s): Requires admission to the sport studies major or consent of instructor.

533 Psychology of Sport (3) Social psychological factors influencing human behavior in a sport context; discussion of contemporary theory, research, and methodology.

(DE) Prerequisite(s): General psychology course or consent of instructor.

Comment(s): Requires admission to the sport studies major 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.

Comment(s): Requires admission to the sport studies major or consent of instructor.

535 Health and Exercise Psychology (3) Study and cultural critique of various aspects of health and exercise psychology.

Comment(s): Requires admission to the sport studies major or consent of instructor.
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.
Comment(s): Requires admission to the sport studies major or consent of instructor.

538 Professional Practice Issues in Sport Studies (3) Study and cultural critique of various aspects of professional practice in sport studies.
Comment(s): Requires admission to the sport studies major or consent of instructor.

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.
Comment(s): Requires admission to the sport studies major or consent of instructor.

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.
Comment(s): Requires admission to the sport studies major or consent of instructor.

542 Sociological Aspects of Sport (3) Social and cultural factors influencing sport and physical education. Pertinent issues and research applications.
Comment(s): Requires admission to the sport studies major or consent of instructor.
Registration Permission: 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) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

594 Supervised Readings (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

595 Special Topics (1-3) Advanced study in selected aspects of sport studies.
Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 9 hours.
Comment(s): Requires admission to the sport studies major or consent of instructor.

600 Doctoral Research and Dissertation (3-15) Major writing requirement.
Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 9 hours.
Credit Restriction(s): Students may not receive credit for both 537 and 531.

693 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

694 Supervised Reading (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

695 Special Topics (1-3) Study for doctoral students in selected aspects of sport studies.
Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 9 hours.

Statistics (962)
(DE) Prerequisite(s): 320.

(DE) Prerequisite(s): 330.

500 Thesis (1-15) Grading Restriction: Satisfactory/No Credit or letter grade. Repeatability: May be repeated.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.

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 Restriction(s): Students may not receive credit for both 531 and 537.
(DE) Prerequisite(s): 1 year of undergraduate 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.
(DE) Prerequisite(s): 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 Restriction(s): Students may not receive credit for both 537 and 531.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 531 and 537 or 571 or consent of instructor.

563 Introduction to Mathematical Statistics (3) Basic probability models and theory of distributions of random variables.
(DE) Prerequisite(s): Mathematics 241.

564 Theory of Statistical Inference (3) Introductory theory underlying common statistical procedures of hypothesis testing and estimation.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 571 or equivalent.

(DE) Prerequisite(s): 563 or Mathematics 242.

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.
(DE) Prerequisite(s): 1 year of calculus and a statistics course.
(DE) Prerequisite(s): 571 and matrix algebra.

(DE) Corequisite: 572.

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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 538 or 572 or consent of instructor.

(DE) Prerequisite(s): 1 year of graduate-level statistics and regression analysis and analysis of variance or consent of instructor.

(DE) Prerequisite(s): 538 or knowledge of regression and analysis of variance.

583 Special Topics in Applied Statistics (1-3) Repeatability: May be repeated. Maximum 9 hours.

585 Principles of Statistical Process Management (1-3) Statistical and other techniques applied to management of organizational processes. Repeatability: Not repeatable. May be taken once for 1-3 hours. Registration Permission: 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.
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of departmental director of graduate studies.

592 Internship (1-6) Supervised off-campus experience in application of statistical principles and methods in business, industry, or government. Written and oral report required.
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 4 courses in graduate-level statistics or consent of departmental director of graduate studies.

593 Independent Study (2-6) Faculty directed readings and investigation of specified topic in probability or statistics. Written report and oral presentation required.
Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 2 courses in statistics. Registration Permission: Consent of the departmental director of graduate studies.

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 required.
Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 572 or 538.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.

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.
(DE) Prerequisite(s): Knowledge of programming language and 572 or consent of instructor.

(DE) Prerequisite(s): 564 and Mathematics 445.

664 Advanced Statistics Theory II (3) Testing statistical hypotheses, Bayesian methods and estimation, linear model theory and model selection.
(DE) Prerequisite(s): 663.

(DE) Prerequisite(s): 564 and 566.

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.
(DE) Prerequisite(s): 573 or consent of instructor.

(DE) Prerequisite(s): 564, 579 and knowledge of programming language 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.
(DE) Prerequisite(s): 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, multisample cluster analysis, common principal component model, factor analysis model, covariance structural models with latent variables, mixture-model cluster analysis.
(DE) Prerequisite(s): 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.
Repeatability: 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. Grading Restriction: Satisfactory/No Credit or letter grade. Registration Permission: Consent of instructor.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and faculty member. Repeatability: 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. Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 320. Registration Permission: Consent of instructor.

425 Advanced Musical Theatre (3) Study and practice of musical theatre material, including dance and vocal work.
(DE) Prerequisite(s): 325.

430 Principles of Play Directing (3) Problems in composition, picturization, rhythm, movement.
(DE) Prerequisite(s): 220. Comment(s): 430 and 431 must be taken in sequence.
431 Principles of Play Directing (3) Problems in composition, picturization, rhythm, movement.  
(DE) Prerequisite(s): 220.  
Comment(s): 430 and 431 must be taken in sequence.

446 Costume Patterning (3) Draping patterns for period costumes. Includes corsery and study of historic patterns 1500-1900.  
(DE) Prerequisite(s): 345 or consent of instructor.

450 Special Studies in Entertainment Technology (1-3) Content varies.  
Repeatability: May be repeated. Maximum 9 hours.  
Registration Permission: Consent of instructor.

452 Entertainment Technology II (3) Automation systems in live entertainment, including advanced rigging and flying for stage and film.  
(DE) Prerequisite(s): 352 or consent of instructor.

454 Scenery Painting (2) Introduction to materials, techniques, and principles of craft. Emphasis on gaining skill and understanding through studio experience.  
Registration Permission: Consent of instructor.

456 Scenic Design II (3) Advanced studies in set design.  
(DE) Prerequisite(s): 355 or consent of instructor.

462 Lighting Design II (3) Advanced lighting design theory and practice. Lab and project intensive.  
(DE) Prerequisite(s): 362 or consent of instructor.

464 Computer Aided Drafting for the Theatre (3) Introduction to entertainment drafting. Emphasis on 2-D graphical standards, drafting techniques, drawing layout and presentation.

470 Playwriting (3) Advanced instruction in writing of plays.  
Registration Permission: Consent of instructor.

491 Foreign Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

492 Off-Campus Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

493 Independent Study (1-15)  
Repeatability: May be repeated. Maximum 15 hours.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.  
Credit Restriction: May not be used toward degree requirements.

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.  
Repeatability: 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.  
Repeatability: May be repeated. Maximum 18 hours.  
Comment(s): Theatre MFA students only.

523 Master Class in Performance: Movement (3) Master class in movement techniques.  
Repeatability: May be repeated. Maximum 18 hours.  
Comment(s): Theatre MFA students only.

525 Master Class in Performance: Voice (3) Master class in voice and speech techniques.  
Repeatability: May be repeated. Maximum 18 hours.  
Comment(s): Theatre MFA students only.

536 Projects in Play Directing (3) Practical work in play direction involving various lengths and kinds of scripts.  
Repeatability: 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.

Repeatability: May be repeated. Maximum 9 hours.  
Registration Permission: Consent of department.

545 Millinery for the Stage (2) Pattern making and construction techniques for hats from antiquity to present.  
Registration Permission: Consent of instructor.

546 Advanced Costume Patterning (3) Advanced studies in patterning period costume. Development of historic patterns through flat pattern method.  
(DE) Prerequisite(s): 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.  
Repeatability: May be repeated. Maximum 6 hours.  
Registration Permission: Consent of instructor.

550 Special Studies in Entertainment Technology (1-3) Content varies.  
Repeatability: May be repeated. Maximum 9 hours.  
Registration Permission: Consent of instructor.

551 Structural Design for Stage (3) Application of advanced theatre technology and analysis of common building materials to design of safe stage scenery.  
Comment(s): 551 and 552 must be taken in sequence.

552 Structural Design for Stage (3) Application of advanced theatre technology and analysis of common building materials to design of safe stage scenery.  
Comment(s): 551 and 552 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.  
Repeatability: May be repeated. Maximum 9 hours.

555 Model Building (3) Techniques of model building for scenic designer.  
(DE) Prerequisite(s): 401 and 1 semester of 580.  
Comment(s): Theatre MFA students only.

556 Drafting (3) Drafting techniques for scenic designer.  
Comment(s): Theatre MFA students only.

560 Lab Analysis of Realized Lighting Design (3) Realized lighting design projects from concept meeting through opening night.  
Repeatability: May be repeated. Maximum 18 hours.  
Registration Permission: Consent of instructor.

564 Advanced Computer Aided Drafting for the Theatre (3) Advanced drafting techniques. Emphasis on 3-D solid modeling, rendering, and publication.  
(DE) Prerequisite(s): 464 or consent of instructor.

580 Design Seminar (1-6) Analysis, research, interpretation, and design of plays in a cross-disciplinary environment.  
Repeatability: May be repeated. Maximum 18 hours.

584 Photography for the Theatre (3) Photographic techniques for shooting live performance events under challenging lighting environments.  
Registration Permission: Consent of instructor.

585 Production Workshops (1-6) Directed experience in production collaborations.  
Repeatability: May be repeated. Maximum 12 hours.  
Registration Permission: Consent of instructor.

587 Computer Aided Rendering for the Theatre (3) Computer rendering programs and their use by theatrical designers.  
Registration Permission: Consent of instructor.

593 Independent Study (1-3) Individual or group projects.  
Repeatability: May be repeated. Maximum 15 hours.  
Comment(s): Theatre MFA students only.  
Registration Permission: Consent of instructor.

599 Project in Lieu of Thesis (1-6)  
Repeatability: May be repeated. Maximum 9 hours.  
(DE) Prerequisite(s): Minimum of 30 hours toward the MFA.  
Registration Permission: Consent of advisor.
Theory and Practice in Teacher Education (978)

500 Thesis (1-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.

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.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated.

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

517 Trends and Issues in Education (3)  
Examination of contemporary trends and issues in education.

518 Educational Specialist Research and Thesis (3)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated. Maximum 15 hours.

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.  
(DE) Prerequisite(s): Classroom experience or admission to teacher education.

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 in-service programs.  
Grading: Satisfactory/No Credit or letter grade.  
Repeatability: Maximum 6 hours.

542 Integrated Middle Grades Methods (3)  
Activities in this class are intended to promote the professional growth of pre-service and in-service middle grades teachers through study, design, and implementation of curriculum, instruction, and assessment strategies. In particular, methods of integrating language arts, mathematics, science, and social science content in grades 4-8 will be explored. The use of technology in supporting learning of middle grades content will also be an emphasis throughout.

543 Middle Grades: Concepts and Practices (3)  
Designed as the introductory course for students pursuing middle-level teacher licensure. Attention is focused on the decline of the junior high and rise of the middle school (typically grades 6-8), the programmatic components that characterize exemplary middle schools, and the philosophy that forms the foundation for this movement. Looks at the theories, research, and exemplar practice concerning the components of middle schools. Helps to prepare middle school professionals who understand the rationale for and the role of teachers in interdisciplinary teams, teacher-based advisory, flexible scheduling and grouping, and with working with colleagues, families, resource persons, and community groups.

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.  
Comment(s): Admission to graduate program required.

593 Independent Study (1-3)  
Grading Restriction: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.

594 Supervised Readings (1-3)  
Grading Restriction: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.

595 Special Topics (1-3)  
Grading Restriction: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.

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.  
Grading: Satisfactory/No Credit or letter grade.  
(DE Corequisite(s): 597.)

600 Doctoral Research and Dissertation (3-15)  
Grading Restriction: P/NP only.  
Repeatability: May be repeated.  
Comment(s): Admission to candidacy required.

604 Trans-Departmental Seminar I (1)  
Introduction to doctoral programs in education: research requirements, academic integrity, the meaning of scholarship in academic and issues/problems in education.  
Grading Restriction: Satisfactory/No Credit grading only.  
Credit Restriction: May not be used to meet 600-level requirement.  
Comment(s): Admission to a doctoral program or consent of the doctoral program coordinator required.

605 Trans-Departmental Seminar II (1)  
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.  
Credit Restriction: May not be used to meet 600-level requirement.  
(DE Prerequisite(s): 604.)

610 Internship in College Teaching and Supervision (3-9)  
Supervised practice in college teaching and supervision.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 9 hours.  
Comment(s): Admission to doctoral program or consent of instructor required.

617 Advanced Studies in Education – An Interdisciplinary Perspective (3)  
Educational trends, issues, and policies related to curriculum and instruction, assessment, the organization and administration of schools, and preparation of educators for both K-12 and higher education settings.  
Comment(s): Admission to doctoral program or consent of instructor required.

620 Research in Literacy, Language, and ESL Education (3)  
Recent trends and historical traditions in language and literacy research: analysis of nature of research methods used, questions asked and topics studied.  
Comment(s): Admission to doctoral program or consent of instructor required.

640 Theoretical Analysis and Theory Construction (3)  
Comment(s): Admission to doctoral program required.

689 Internship (1-3)  
Experiences in application of principles and practices of curriculum development and instructional improvement.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 9 hours.  
(DE Prerequisite(s): Program prerequisites.  
Registration Permission: Consent of instructor.

693 Independent Study (1-3)  
Grading: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.

694 Supervised Reading (1-3)  
Grading: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.

695 Special Topics (1-3)  
Grading: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.

Veterinary Medicine (987)

801 Application Based Learning Exercise (ABLE) I (1)  
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.  
Grading Restriction: Satisfactory/No Credit grading only.

802 Application Based Learning Exercise (ABLE) II (2)  
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.  
Grading Restriction: Satisfactory/No Credit grading only.

804 Application Based Learning Exercise (ABLE) and Clinical Exposure I (2)  
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.  
Grading Restriction: Satisfactory/No Credit grading only.

805 Application Based Learning Exercise (ABLE) and Clinical Exposure II (2)  
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.  
Grading Restriction: Satisfactory/No Credit grading only.
Clinical rotations in medicine, surgery and specialty disciplines for companion and food animals and horses. Direct responsibility for diagnosis, care and treatment of clinical patients.

Clinical Rotation in Comparative Medicine (2) Clinical training in avian medicine, laboratory animal and zoo animal medicine, epidemiology, public health, and other related disciplines.

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.

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.

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.

General Pathology (3) Principles of pathobiology: causes of disease, disturbances of cell growth and inflammation.

Infection and Immunity – Parasitology (3) Principles of parasitology: protozoology, helminthology, and entomology and relationship to diseases in animals.

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.

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.

Elective Clinical Rotation I (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.

Elective Clinical Rotation II (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.

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.

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.

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.

Special Problems in Small Animal Clinical Sciences I (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.

Transition and Accreditation Seminars (2) Discussion of USDA, state, and local animal laws and regulations: preparation of animal movement forms, veterinary ethics, jurisprudence, basic practice management, and other topics involved in practice of veterinary medicine.

Clinical Rotations in Large Animal Clinical Sciences I (4) Clinical training in medicine, surgery, specialty disciplines and herd health of food animals and horses. Direct responsibility for diagnosis, care and treatment of clinical patients.

Clinical Rotations in Large Animal Clinical Sciences II (4) Clinical training in medicine, surgery, specialty disciplines and herd health of food animals and horses. Direct responsibility for diagnosis, care and treatment of clinical patients.

Clinical Rotations in Large Animal Clinical Sciences III (4) Clinical training in medicine, surgery, specialty disciplines and herd health of food animals and horses. Direct responsibility for diagnosis, care and treatment of clinical patients.

Special Problems in Large Animal Clinical Sciences (1-8) Extramural and specially designed study for students interested in select topics in medicine, surgery, herd health, reproduction, radiology and medical specialties of large animals.

Externship I (2) Educational experiences in private practice, research facility, zoological preserve, aquarium, or other veterinary-related facility outside Veterinary Teaching Hospital; to provide experiences not frequently available in large referral veterinary teaching hospitals.

Externship II (2) Educational experiences in private practice, research facility, zoological preserve, aquarium, or other veterinary-related facility outside Veterinary Teaching Hospital; to provide experiences not frequently available in large referral veterinary teaching hospitals.

Wildlife and Fisheries Science (993)

Wildlife Techniques (3) Methods in wildlife damage control, forest, farmland, wetland wildlife habitat management, identification of wildlife sign, wildlife capturing techniques and management plan preparation. Weekend field trips (2) required.

Fisheries Techniques (3) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; fish habitats 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 may be required.

Fisheries Science (3) Quantification and management of freshwater fisheries including population estimation, age and growth, biological assessment, and stocking.

Fisheries Science (3) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; fish habitats 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 may be required.

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. Weekend field trip required.

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. Weekend field trip required.

Ecology (1-15) Grading Restriction: P/ NP only.

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.

Grading Restriction: Satisfactory/No Credit grading only.

Ecology and Management of Wild Birds (3) Reading and discussion based on contemporary topics in avian ecology and management. Additional credit awarded for writing review paper on contemporary topic of interest to student.

Registration Permission: Consent of instructor.


Comment(s): Requires graduate standing or consent of instructor.

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. (Same as Comparative and Experimental Medicine – Veterinary Medicine 530.)

Recommended Background: Upper-division undergraduate course in wildlife sciences.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Description</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>531</td>
<td>Wildlife Physiology and Nutrition (2)</td>
<td>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.</td>
<td>Comment(s): Requires senior or graduate standing in the life sciences.</td>
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<tr>
<td>535</td>
<td>Floodplain Ecosystems (3)</td>
<td>Ecology, restoration and management of floodplain ecosystems: biotic and abiotic processes, social considerations, and wildlife and forest management; Lower Mississippi River Alluvial Valley.</td>
<td>Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>536</td>
<td>Advanced Wetland Ecology (3)</td>
<td>A comprehensive examination of wetland delineation and classification, wetland communities and hydrogeomorphic processes, wetland values, human impacts on wetlands, and the management and conservation of wetland communities.</td>
<td>Comment(s): Day or overnight field trips may be required.</td>
</tr>
<tr>
<td>545</td>
<td>Advanced Population Analysis (2)</td>
<td>Detail characteristics, assumptions, goals, methods, and current technologies for fish and wildlife population analysis. Use of computers.</td>
<td>(RE) Prerequisite(s): Animal Science 571 or Statistics 538.</td>
</tr>
<tr>
<td>546</td>
<td>Advanced Habitat Analysis (2)</td>
<td>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.</td>
<td>Use of computer programs.</td>
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<tr>
<td>550</td>
<td>Fish Physiology (3)</td>
<td>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.</td>
<td>Comment(s): Requires senior or graduate standing in the life sciences.</td>
</tr>
<tr>
<td>555</td>
<td>Fish Culture (3)</td>
<td>Principles, concepts and techniques of culturing economically important fish and shellfish species.</td>
<td>Contact Hour Distribution: 2 hours and 1 lab.</td>
</tr>
<tr>
<td>560</td>
<td>Advanced Topics in Wildlife and Fisheries Science (1-3)</td>
<td>Recent advances and concepts, research techniques and analysis of current problems.</td>
<td>Repeatability: May be repeated. Maximum 6 hours.</td>
</tr>
<tr>
<td>593</td>
<td>Independent Study in Wildlife and Fisheries Science (1-4)</td>
<td>Repeatability: May be repeated. Maximum 6 hours.</td>
<td>(DE) Prerequisite(s): 443, 444, and 445 or consent of instructor.</td>
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Women’s Studies (994)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>400</td>
<td>Topics in Women’s Studies (3)</td>
<td>Content varies.</td>
<td>Repeatability: May be repeated. Maximum 6 hours.</td>
</tr>
<tr>
<td>410</td>
<td>Sex Role Development: Implications for Education and Counseling (3)</td>
<td>(See Counselor Education 410.)</td>
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<tr>
<td>422</td>
<td>Women Writers in Britain (3)</td>
<td>(See English 422.)</td>
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<td>425</td>
<td>Women’s Health (3)</td>
<td>(See Health 425.)</td>
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<tr>
<td>434</td>
<td>Psychology of Gender (3)</td>
<td>(See Psychology 434.)</td>
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<tr>
<td>469</td>
<td>Sexuality and Cinema (4)</td>
<td>Explores issues surrounding sexuality, gender and cinema from points of view of feminist film criticism. (Same as Cinema Studies 469.)</td>
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<tr>
<td>484</td>
<td>African-American Women in American Society (3)</td>
<td>(See Africana Studies 484.)</td>
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<td>510</td>
<td>Special Topics (3)</td>
<td>Repeatability: May be repeated. Maximum 6 hours.</td>
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<td>512</td>
<td>History of Women’s Education (3)</td>
<td>(See Cultural Studies in Education 512.)</td>
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<tr>
<td>543</td>
<td>Women, Sport, and Culture (3)</td>
<td>(See Sport Studies 543.)</td>
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<tr>
<td>548</td>
<td>Transforming Critical Thinking: Constructive Thinking and Educational Implications (3)</td>
<td>(See Cultural Studies in Education 548.)</td>
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<tr>
<td>593</td>
<td>Independent Study (1-6)</td>
<td>Repeatability: May be repeated. Maximum 8 hours.</td>
<td>Registration Permission: Consent of Chair of Women’s Studies.</td>
</tr>
<tr>
<td>609</td>
<td>Feminist Theories and Education (3)</td>
<td>(See Cultural Studies in Education 609.)</td>
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