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)

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

521 Governmental, Not for Profit, and Management Accounting (3)
Accounting principles and reporting models for governmental and not for profit organizations. Uses of management accounting information in decision making and performance evaluation.
Comment(s): Admission to a graduate program or consent of instructor required.

530 Tax Research, Accounting Practice, and Procedures (3)
Methods of researching tax issues within the federal tax system with emphasis on Internet-based research tools. Tax accounting periods and methods. Tax procedures for dealing with the Internal Revenue Service. Tax practice standards and ethical concerns.
Comment(s): Master of Accountancy admission or consent of instructor required.

531 Tax Strategy and Entity Taxation (3) Introduction to tax research. Current issues in tax strategy and planning including investment models, implicit taxes, organizational form, and other selected topics. Income taxation of business entity operations including financial statement implications of income taxes.
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.

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.

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

611 Doctoral Seminar in Accounting (3-15)
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. Maximum 4 hours.
Registration Permission: Consent of PhD program advisor.

622 Accounting Colloquium (1) Research and discussion of contemporary issues in practice of accounting.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 4 hours.
Registration Permission: Consent of PhD program advisor.

Comment(s): Master of Accountancy admission or consent of instructor required.
693 Independent Study (3) Directed research in topic of mutual interest. Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Admission to the Ph.D./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/NP only.
Repeatability: May be repeated.
Comment(s): Admission to a degree program in Communication and Information required.

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.
(DE) Prerequisite(s): Statistics 531 or equivalent.

540 Advertising Decision Making (3) Analysis of decision making in budgeting, creative strategy, media strategy, research, evaluation, and agency-client relationships. Advertising response functions.
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.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Admission to a degree program in Communication and Information required.

597 Independent Study (3) Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Must be a graduate student. Advanced undergraduate students who wish to be considered must seek permission 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.
(DE) Prerequisite(s): 351 and 370.

424 Astronautics (4) Solar system, orbital mechanics, propulsion, atmospheric entry including thermal protection materials, human factors in space flight, the space environment, and current topics.
(DE) Prerequisite(s): 351.

(DE) Prerequisite(s): 370, and 363.

426 Introduction to Aerospace Design (2) Design process, synthesis, design studies, individual design reports required.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 422, 425, and 426.

449 Aerospace 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): 345, 351, and 425.

494 Selected Topics in Aerospace Engineering (1-4) Problems and topics related to developments and practice in aerospace engineering. Repeatability: Not repeatable. May be taken once for 1 – 4 hours.
Registration Permission: Consent of instructor.

495 Selected Topics in Aerospace Engineering (1-4) Problems and topics related to developments and practice in aerospace 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 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.
(DE) Prerequisite(s): 422 or 541, and Mathematics 425.

512 Viscous Flow (3) Derivation of fundamental equations of compressible inviscid 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 521.

525 Hypersonic Flow (3) Slender body flow; similitude; Newtonian theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow.
(DE) Prerequisite(s): 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.
(DE) Prerequisite(s): 521, 541, and Mechanical Engineering 522.

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

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

533 Dynamics (3) (See Mechanical Engineering 533.)
Africana Studies (023)

421 Comparative Studies in African and African-American Societies (3) Comparative studies of African and African-American societies in such areas as education, religion, and social stratification. Includes the respective views African-Americans and Africans have of each other and concept of Pan-Africanism.

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

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

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

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

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

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

470 African-American Art (3) (See Art History 470.)

473 Black Male in American Society (3) Examines historical images, myths and stereotypes which have developed concerning African-American males in American society. Includes the impact of such critical factors as black feminism, violence, concepts of masculinity, the family, white males, white females, homosexuality, nationalism, and athletics on African-American males in America.

484 African-American Women in American Society (3) Focuses on historical and contemporary social, economic, and political factors in American society as they relate to the black woman. (Same as Women's Studies 484.)

510 Special Topics (3)

Repeatability: May be repeated. Maximum 6 hours.

Agricultural and Extension Education (042)

440 Communication Techniques in Agriculture (3) Elements of effective use of mass media in agricultural and extension education. Effective technical writing and presentation strategies for agricultural audiences.

450 Agricultural Leadership Development (3) Identification of styles and roles of leadership; development of leadership techniques and skills required in working with organizations and youth groups; methods of resolving conflict, of communicating, of guiding and evaluating; and ethical considerations for leaders.

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

501 Creative Component in Lieu of Thesis (3) Capstone experience completed under supervision of major professor and committee. Individual project: literature survey; development of teaching software; development of curriculum materials; development of white paper; or other suitable project.

Grading Restriction: Satisfactory/No Credit grading only.

Comment(s): Students in the non-thesis option only.

Registration Permission: Consent of major professor.

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 change 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): 435 and 436.

527 Adult Education Strategies in Agricultural and Extension Education (3) Methods of developing and implementing educational programs for adults in agricultural and extension education and related contexts: different learning of adults and children (andrology vs. pedagogy); understanding and determining adult needs, priorities and motivation for participating in educational programs; adoption of new ideas by adult learners; methods and materials effective in teaching adults; developing favorable attitudes toward post-secondary education and life-long learning. (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) Macro-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 Food and 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 guerilla marketing. Teamwork emphasized in management of an agribusiness firm through game simulation. Written and oral presentation required.


500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated. Registration Restriction: Major in Agricultural Economics.

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 Methodology in Agricultural Economics (3) 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.

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. (RE) Prerequisite(s): 505 or 503.

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. (RE) Prerequisite(s): 505 or 503.

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

595 Professional Internship (3) Supervised internship experience with appropriate agribusiness firm.

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

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

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 analysis and formulation for beef and dairy cattle, sheep, horses, swine, poultry, laboratory, zoo, and companion animals. Mathematical and computer solutions and applications to formulating complex rations with constraints. 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. Recommended Background: 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. Recommended Background: 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. Recommended Background: 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. Recommended Background: 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.

511 Special Problems in Animal Science (1-4) Repeatability: May be repeated. Maximum 9 hours. Registration Permission: Consent of instructor.

515 Special Topics (1-4) Instructor-initiated course to be offered on topics of current interest. Repeatability: May be repeated. Maximum 9 hours. Registration Permission: Consent of instructor.


523 Advanced Mammalian Reproduction (3) Current topics and new frontiers in reproductive biology. (DE) Prerequisite(s): 320.

525 Research Ethics for the Life Sciences (1) (See Plant Sciences 525.)

530 Animal Nutrition and Metabolism (4) Comparative digestive physiology, digestion, absorption and metabolism of nutrients in ruminant and non-ruminant species. Concepts and methodologies of animal growth and nutrient requirements; relationships, availability and deficiencies of nutrients. Recommended Background: 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.

536 Ecology of Grazing Land Systems (3) (See Plant Sciences 536.)

550 Immuno-pathophysiology (3) Cellular and systemic immune responses to infectious disease and stress that influence whole animal systems. (DE) Prerequisite(s): 520. Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

556 Physiology of Hormones (3) (See Biochemistry and Cellular and Molecular Biology 552.)

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 577.) 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.
Overview of career opportunities in various domains of applied anthropology.

Methods and techniques cultural anthropologists use in fieldwork.

Conceptual and practical exploration of ethnographic research.

Introduction to principles, practice and methodological approaches to the study of human/environmental interactions.

Examination of the organization and dynamics of complex societies and systems within modern states. The relationship between actors (individuals) and structures. The evolution and diffusion of symbols, rituals, and ideologies in producing and reproducing power relations and social organization. The examination of the human skeleton.

Recent advances and concepts, research techniques, current problems.

Recent advances and concepts, research techniques, current problems.

Recent advances and concepts, research techniques, current problems.

Recent advances and concepts, research techniques, current problems.

Recent advances and concepts, research techniques, current problems.

Repeatability: May be repeated. Maximum 6 hours.

Repeatability: May be repeated. Maximum 6 hours.

Repeatability: May be repeated. Maximum 6 hours.

Repeatability: May be repeated. Maximum 2 hours.

Anthropology (122)

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.

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.

Folklore in Anthropology (3) Introduction to anthropological study of folklore, including folklore and folklore materials from various tribal, peasant, and complex societies.

(DE) Prerequisite(s): 130 or consent of instructor.

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 cases.

(DE) Prerequisite(s): 130 or consent of instructor.

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.

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.

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.

Ethnographic Research (3) Conceptual and practical exploration of methods and techniques cultural anthropologists use in fieldwork.

(DE) Prerequisite(s): 130 or consent of instructor.
500 Thesis (1-15)  
Grading Restriction: P/NP grading only.  
Repeatability: May be repeated.

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

502 Registration for Use of Facilities (1-15)  
Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: 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.  
Repeatability: May be repeated. Maximum 9 hours.  
Registration Permission: Consent of instructor.

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.  
Repeatability: May be repeated. Maximum 6 hours.

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

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

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

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

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

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

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

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.

581 Forensic Anthropology (3)  
(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.  
Repeatability: May be repeated. Maximum 9 hours.  
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)  
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 Advanced Graduate Research (1-8)  
Independent investigation of special problems in anthropology by advanced graduate students.  
Repeatability: May be repeated. Maximum 12 hours.  
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.  
Repeatability: May be repeated. Maximum 6 hours.

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

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

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

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.

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.
fundamental design principles, page layout, image manipulation and typographic presentation design within the profession of architecture. Addresses ideas, and theories in architecture.

528 Topics in Architectural History and Theory (3)
Historic topics, primary texts, history, theory, urban issues, technology and professional practice.

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

525 Special Topics in Architecture (1-3)
Student- or instructor-initiated course.

536 Presentation Design II (3)
Advanced techniques and understanding of graphic presentation design within the profession of architecture. Addresses document design, layout and binding, image manipulation and typography, employing computer software applications. Conducted through lectures, assigned projects, assigned readings, labs, exams and/or critiques. (DE) Prerequisite: 535. 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.

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)
In-depth investigations analyzing tectonic influences and traditions in forming architectural form, space and structure. Design of building; coordination of material assembly, environmental control, structure, acoustics and lighting. (DE) Prerequisite(s): 571.

573 Architectural Design Studio: Urban Context (6)
Investigations analyzing cultural, physical, and environmental influences and precedents of community on architectural form, space and structure. Design of projects: civic realm of urban forms and spaces. (DE) Prerequisite(s): 572.

580 Thesis Preparation (3)

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): Enrollment is limited to Master of Architecture students. Registration Permission: Consent of instructor.

591 Foreign Study (1-9)
Registration Permission(s): Consent of instructor and approval of graduate program in architecture.

592 Off-Campus Study (1-9)
Registration Permission(s): Consent of instructor and approval of graduate program in architecture.

593 Independent Study (1-9)
Registration Permission(s): Consent of instructor and approval of graduate program in architecture.
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, mounting and framing, shipping and storage. (Same as Anthropology 482.)
(De) 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.
(De) 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.

503 Theory and Practice of Art Fundamentals (1) Required for all GTA's. Surveys art theory and practice as it relates to teaching art foundations. Practical instruction, professional development, and pedagogy will be introduced in the form of lectures, group discussions, readings and project development.

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(s): May not be applied toward degree requirements.
Comment(s): Enrollment is limited to students who are not GTAs.
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 with an emphasis on the development of individual direction. Repeatability: May be repeated. Maximum 16 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 18 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 courses to be 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 (Art Design/Graphic 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. Concludes 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 20 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.

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 and 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.
   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 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 the 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 the 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 Velázquez.

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-Saharan 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, the Caribbean and the 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.

470 African-American Art (3) Traces the artistic and social legacy of African-American art from the eighteenth-century to the present day. Specifically, this class will focus on the ways in which artists used creativity to confront, deny, or complicate understandings of racial identity and racism. Examines broad scope of artistic production including painting, sculpture, photography, multi-media, fiction writing, and video art. (Same as Africana Studies 470.)

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

473 19th-Century American Art (3) Examines painting, sculpture, and print culture from the Revolutionary War to the turn of the 20th-century.

474 Theory of 20th-Century Art in Europe and America (3) Addresses the theoretical framework for the modern movement. Emphasis on analyzing and discussing individual works of art in light of contemporary writings by artists and theorists. (DE) Prerequisite(s): 172 and 173 or consent of instructor.


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 many 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.

493 Studies in Art History (3) Concentration in individually selected area.
   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 12 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 12 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.

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 Painting (138)

413 Painting IV (6) Advanced painting stressing individual concepts and personal expression with varied media.
   Repeatability: May be repeated. Maximum 12 hours.
   (DE) Prerequisite(s): 313.

415 Watercolor IV (6) Advanced painting with water-based media on paper stressing individual concepts and personal approaches.
   Repeatability: May be repeated. Maximum 12 hours.
   (DE) Prerequisite(s): 315.

419 Special Topics in Drawing and Painting (3) Student- or instructor-initiated course offered at convenience of department to enhance and expand the painting, drawing, and watercolor curriculum.
   Repeatability: May be repeated. Maximum 12 hours.
   Registration Permission: Consent of instructor.

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

514 Graduate Painting 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(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: Not repeatable. May be taken once for 2-6 hours.

462 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: Not repeatable. May be taken once for 2-6 hours.

463 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: Not repeatable. May be taken once for 2-6 hours.

465 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: Not repeatable. May be taken once for 2-6 hours.

466 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: Not repeatable. May be taken once for 2-6 hours.

561 Printmaking I (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods, and monoprint.
   Repeatability: Not repeatable. May be taken once for 2-6 hours.
   (DE) Prerequisite(s): 561.

562 Printmaking II (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.
   (DE) Prerequisite(s): 561 and 562.

563 Printmaking III (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.
   (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 15 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. 
Recommended Background: 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. 
Recommended Background: 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.

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.

Asian Languages (144)
431 Readings in Chinese Literature (3) (Same as Chinese 431.) 
Registration Permission: Consent of instructor.

451 Readings in Pre-Modern Japanese Literature (3) (Same as Japanese 451.) 
Registration Permission: Consent of instructor.

452 Readings in Modern Japanese Literature (3) (Same as Japanese 452.) 
Recommended Background: 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 9 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): 320 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.

476 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 and 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): 306.

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

510 Clinical Education Seminar in Audiology (1) Seminar provides a forum for deliberation on issues impacting audiology practice in a variety of clinical and educational settings to help the graduate student clinician transition to their independent practice roles. 
Repeatability: May be repeated. Maximum 6 hours. 
(DE) Corequisite(s): 512 or 515.

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 neurological 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 neurological cognitive-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.

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.

531 Seminar on Stuttering (3) Current significant research in stuttering.

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.

535 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-4)
Repeatability: May be repeated. Maximum 15 hours. Recommended Background: 100 hours clinical experience. Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval. Registration Permission: Consent of instructor.

538 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4)
Repeatability: May be repeated. Maximum 15 hours. Comment(s): Enrollment for fewer than 2 hours must have prior departmental approval.

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

540 Structural Speech Disorders (3) Etiology, diagnosis and clinical management of craniofacial and resonance disorders.

541 Pediatric Oromotor Disorders (3) Evaluation, diagnosis, and treatment of pediatric oromotor disabilities that affect normal acquisition of feeding and pre-speech skills.

542 Hearing Disorders (3) Effects of heredity, development/aging, diseases, and physical agents on hearing.

543 Amplification Technology (3) Description of hearing aid circuits, components and performance characteristics. Electroacoustical and real ear analysis of hearing aids. Coupler material and geometry effects. Practical experience in troubleshooting, repair, and construction of hearing aids.


545 Sound Measurement Techniques and Hearing Conservation (2) Techniques of measurement and analysis of sound; hearing conservation in schools and industry. Registration Permission: Consent of instructor.

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

547 Special Problems in Audiology (1-3)
Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 473 or equivalent. Registration Permission: Consent of instructor.

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

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

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

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

561 Child Language Disorders (3) Current literature on assessment and intervention techniques for young language learners.

563 Language Disorders: Birth to Three (3) Overview of family-focused, interdisciplinary intervention process. Assessment/treatment of infants, toddlers, and preschoolers. Description of disabilities and resulting communication disorders.

573 Pediatric Audiology for Education Professionals (3) Basic principles in the identification and management of hearing loss in infants and children; social and psychological concomitants of auditory disorder; genetic hearing loss and other high-risk types of impairment related to hearing; educational alternatives and state and federal guidelines.

574 Pediatric Audiology for Audiology Majors (3) Theoretical and practical considerations in evaluation and treatment of hearing loss in infants and children. Audiological intervention in case management of hearing-impaired child; amplification, educational alternatives, and state and federal guidelines.

576 Physiologic Assessment of the Auditory System I (4) Otoacoustic emissions, electrocochleography, and auditory brainstem responses. Anatomical origins, principles, and applications. Use of these responses in evaluation of auditory function and determination of site-of-lesion. Contact hour distribution: 3 hours lecture and 1 hour lab. (DE) Prerequisite(s): 507 and 546 or consent of instructor.

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

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

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

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

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

585 Cochlear Implants (3) Overview of cochlear implants, focusing on theory of auditory stimulation and cochlear implant systems; candidacy, surgical preparation, and follow-up/outcome measures; the rehabilitation process; and cochlear implant case presentations. (DE) Prerequisite(s): 576, 574, and 583 or consent of instructor.

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

591 Foreign Study (1-15)
Repeatability: May be repeated. Maximum 30 hours.
592 Off-Campus Study (1-15)
Repeatability: May be repeated. Maximum 30 hours.

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

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

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

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

601 Experimental Phonetics (3) Acoustical and perceptual analyses of speech production and overall oral communication.
Registration Permission: Consent of instructor.

602 Psychoacoustics (3) Auditory perception and reception of acoustic stimuli.
(DE) Prerequisite(s): 507 or consent of instructor.

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

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

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

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): 518 and 526.

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

656 Directed Research (1-4) Participation in ongoing or non-dissertational 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, 584, and 594 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, 584, and 594 or consent of instructor.

Aviation Systems (169)

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 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): 518.

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

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

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

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

510 Special Topics in Aviation Systems (3) Current problems.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.
Credit Restriction: Maximum of 12 hours may be applied toward degree requirements.

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.
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, seating arrangements, obstacle 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.

517 Systems Flight Testing (3) Civil airworthiness requirements for development and certification of large fixed wing transport category aircraft. FAA regulatory and advisory information is explained and applications are made to systems flight test planning and execution. Flight test examples are provided and major aircraft systems to include hydraulic propulsion, electrical, avionics, autopilot, pneumatic, and ice protection.

518 Aviation systems: an overview (3) Introduction to aviation systems and the discipline of flight test engineering. Topics: aviation fundamentals, basic airmanship, aerospace mathematics and physics, basic aerodynamics, performance, and stability and control, flight test instrumentation and data acquisition, flight test fundamentals, and flight test data analysis and reporting. Course structure will be weekly classroom academics with 3 flight labs during the semester. Course is designed for full-time attendance during the semester and will not be offered as a distance learning course.

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. 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.

550 Project in Aviation Systems (3) Repeatability: May be repeated. Maximum 15 hours. 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 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.

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.

Contact Hour Distribution: Laboratory and lecture.

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

404 Plant Molecular Biology (3) Introduction to current research approaches and methodologies in plant developmental biology and molecular genetics.

Contact Hour Distribution: Laboratory and lecture.

(DE) Prerequisite(s): Biology 240.

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

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

(DE) Prerequisite(s): Biology 140.

471 Biophysical Chemistry (3) Physicochemical principles with applications to biological systems. Thermodynamics; chemical equilibrium; solution 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.

510 Computational Structural Biochemistry (1) Introduction to computational tools, internet resources and databases for biological research to analyze and model protein structures and to study protein-ligand interactions.

(DE) Corequisite(s): 511. Registration Permission: Consent of instructor.

511 Advanced Protein Chemistry and Cellular Biology (3) Cellular structure and function at molecular and supramolecular level in progress; protein structure and function; membrane structure and function; bioenergetics and membrane proteins.

(DE) Corequisite(s): 510. Recommended Background: 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 adhesion.

(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; spectroscopy; microscopy; nucleic acid purification and analysis; protein assays; enzyme purification; electrophoresis; 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.

522 Advanced Plant Physiology I (3) Plant biochemistry and metabolism: respiration, photosynthesis, carbon partitioning, and biosynthesis of specialized plant products: terpenoids, alkaloids, phenolics and plant growth regulators. (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 (3) 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 organismal action of hormones in invertebrate and vertebrate animals. (Same as Animal Science 556.) Recommended Background: 402, 440 or equivalent courses. 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.


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.


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)

409 Cell Tissue and Engineering (3) Mammalian cell culture. Effects of mechanical forces on cells. Tissue engineering of cardiovascular and orthopedic devices. (DE) Prerequisite(s): Biochemistry and Cellular and Molecular Biology 230 or Biology 140.

430 Biomedical Engineering Laboratory (3) Experience with the 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): 345 and Electrical and Computer Engineering 300.


474 Biomaterials (3) (See Materials Science and Engineering 474.)

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.
COURSES OF INSTRUCTION

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: Not may 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 Biotransport Processes (3) Cellular transport and electrical properties from a combined biological, physical, and engineering point of view. Matter transport across cellular membranes involving diffusion, osmosis, coupled solute and solvent transport, carrier-mediated transport, and ion transport. Homeostatic mechanisms involved in maintaining cellular solute concentrations, volume, and potential. Electrically inexorable and excitable cells, lumped parameter and distributed-parameter cell models, linear electric properties of cells, and voltage gated ion channels. (DE) 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.) (DE) Prerequisite(s): Mechanical Engineering 231.

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

538 Ultrasonic Methods and Bioinstrumentation (3) Basic ultrasound principles and techniques, applications of ultrasonic imaging configurations for static and dynamic real-time imaging principles. Doppler physics, Doppler spectral analysis, image quality, image artifacts, clinical safety and measurement techniques, and quality control. Registration Permission: Consent of instructor.

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

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

547 Modern Linear Controls (3) (See Mechanical Engineering 547.)

548 Optimization Techniques in Biomedical Engineering (3) Current techniques in optimization. Emphasis on applying optimization techniques to problems in biomedical imaging. Registration Permission: Consent of instructor.

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. (DE) 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 555.) (DE) 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.)

574 Multidimensional Medical Image Analysis (3) Applied mathematical and physical principles for different medical imaging modalities, image formation, reconstruction, enhancement and filtering, representation and analysis, registration and camera calibration models, shape and texture, transforms, features extraction, segmentation, clustering, introduction to pattern recognition and classification based on non-parametric techniques, parametric techniques, and neural networks models, 2D matching, introduction to biometrics, application in medical image segmentation, classification, and computerized medical diagnosis of diseases. (DE) Prerequisite(s): 572, and Electrical and Computer Engineering 472.

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

578 Advanced Biomaterials: Biological Applications of Nanomaterials (3) (See Materials Science and Engineering 578.)

582 Micro-electromechanical Systems in Biomedical Engineering (3) Examines physical principles, design techniques, fabrication techniques, and testing technologies needed for the modern biomedical engineer working in the microfabrication field in miniaturized environments. This is a hands-on hardware and software course that includes some laboratory experiments and use of MEMS design software. Registration Permission: Consent of instructor.

587 Dynamic Modeling and Simulation (3) (See Mechanical Engineering 587.)

588 Cell and Tissue-Biomaterials Interaction (3) (See Materials Science and Engineering 588.)

590 Selected Biomedical Engineering Problems (2-6) Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 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 UTMSI. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 20 hours.

599 Special Topics in Biomedical Engineering (1-3) Repeatability: May be repeated. Maximum 12 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. Repeatability: May be repeated. Maximum 9 hours. Registration Permission: Consent of instructor.

611 Fields, Forces and Flows in Cells and Tissues (3) Applications of equilibrium and non-equilibrium thermodynamics to rate processes and forces in cells and tissues. Fields in heterogeneous media, electrical double layers, and electromechanical forces in physiological systems. Fluid and solid continuum mechanics of porous hydrated biological tissues. Electrophoretic, electrorotational flows, and diffusion-reaction. Electromechanical and physicochemical interactions in biomaterials and cells. Case studies in membrane transport, electrode interfaces, electrical, mechanical, and chemical transduction in tissues. Cardiovascular, orthopedic and other clinical examples. (DE) 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.) (DE) Prerequisite(s): 531.

632 Biomechanics Design (3) Design of an implant, orthopaedic mechanical device, orthopaedic instrument or a rehabilitation device for a sponsoring orthopaedic company. The design project will include patent searches, literature searches and a final report. (DE) Prerequisite(s): 531.

647 Non Linear Control Systems (3) (See Mechanical Engineering 647.)

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

674 Neuro-Fuzzy Pattern Recognition in Medicine (3) Pattern recognition and computer vision fundamentals, human vision system, principles of image formation and human perception, camera models, sampling and quantization and image transforms. Applications of neuro-fuzzy systems in medicine. (DE) Prerequisite(s): 574.
682 Biological Applications of Micro and Nanoscale Systems (3) Emerging techniques in biological and biomedical research on the micro and nanoscale. Biomaterials, soft lithography, nanomedicine, microfluidic principles, sensor principles and microsensors, microactuators and drug delivery, polymerase chain reactions, and DNA microarrays. (DE) Prerequisite(s): 582.

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 bioprocess systems. Contact Hour Distribution: 2 hours and 1 lab. Recommended Background: Rigid-body dynamics, mechanics of materials. 416 Hydrology (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 bioreactions; practical aspects of bioprocess engineering and process development. Contact Hour Distribution: 2 hours and 1 lab. Recommended Background: Thermodynamics, heat and mass transfer.

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 defined by differential equations, systems of linear equations, linearization, moving boundary problems, and series solutions to solve mathematical expressions. (RE) Prerequisite(s): 519.

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, Disposal 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.

543 Instrumentation and Measurement (3) Modern instrumentation techniques. Static and dynamic response of instrumentation; signal conditioning; temperature, moisture, optical radiation, displacement, strain, pressure, velocity, acceleration, and flow measurements; digital data acquisition and control. (Same as Environmental Engineering 543.) Contact Hour Distribution: 2 hours and 1 lab. (DE) Prerequisite(s): 451 or coursework in electronics and computer circuits.

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

562 Selected Topics in Natural Resource Engineering (3) Topics in engineering for the characterization, conservation, and protection of soil, water, and air resources in spite of human activities such as off-road vehicle use, agriculture, mining, construction and land development, or waste application. Repeatability: May be repeated. Maximum 12 hours.

572 Selected Topics in Machinery, Control, and Instrumentation Systems (3) Topics in the engineering of machinery, sensors, and data collection and analysis systems, and the use of these systems in ways that enhance productivity, increase efficiency, boost economic return, and protect environmental resources. Repeatability: May be repeated. Maximum 12 hours.

582 Selected Topics in Processing (3) Topics in the engineering of biological and physical processes and of biological systems, from the production of raw materials through to high-demand value-added products. Repeatability: May be repeated. Maximum 12 hours.

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

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

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

619 Mathematical Modeling for Engineers (3) Describes physical and mathematical 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.

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)

412 Surveying (3) Measurement of landforms using radar, remote imagery, satellite real-time kinematics, and laser-based surveying instruments. Survey methods and mapping using GIS. Precision landform measurement of distances, angles, and areas; differential and profile leveling; topographic surveying and mapping, area computation. Contact Hour Distribution: 1 hour and one 3-hour lab. Recommended background: college mathematics and computer literacy.

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 analyses, 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.
COURSES OF INSTRUCTION

442 Agricultural Waste Management and Pollution Control (3) Waste renewal 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/IN/P credit only.
Registration Requirement(s): Master of Science – biosystems engineering technology 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: Two 2-hour labs.
Credit Restriction: Students cannot receive credit for both 414 and 514.
Registration Restriction(s): Minimum student level – graduate.

532 On-Site Domestic Wastewater Treatment, Disposal, 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.

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): Requires admission to the MBA program or consent of the MBA Program Director.

511 MBA Core I (3) Essential skills of manager: basic information technology skills, team building, 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 of the MBA Program Director.


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

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.

521 Business Core for Master of Accountancy I (3) Topics in business having relevance to Master of Accountancy students. Topics vary to reflect current needs of the accounting profession. Sequence (521-522-523) culminates with a business simulation.

522 Business Core for Master of Accountancy II (3) Topics in business having relevance to Master of Accountancy students. Topics vary to reflect current needs of the accounting profession. Sequence (521-522-523) culminates with a business simulation.

523 Business Core for Master of Accountancy III (3) Topics in business having relevance to Master of Accountancy students. Topics vary to reflect current needs of the accounting profession. Sequence (521-522-523) culminates with a business simulation.


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(s): 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.

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

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.

Comment(s): Available only by prearrangement with supervising faculty member. May require approval of Director of the MBA program.

591 International Travel (2) MBA students' international trip experience. Will familiarize student with the complexities of doing business internationally through experiential learning.

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 Director 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 Department 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.

596 Global Business Strategies (3) The strategic challenges of globalization; globalization strategies of multi-national corporations; the circumstances in which venturing overseas makes sense, and when it may not be a wise strategy; essential strategic and organizational challenges encountered by international managers (e.g., building competitive advantage in international markets, balancing benefits of global integration against the need to respond to local differences. Managing joint ventures and strategic alliances including the growing trend of offshore outsourcing). Also examines how international differences in social and legal conditions affect strategic choices.

(DE) Prerequisite(s): 513.

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. Recommended Background: MBA core.

Registration Permission: Consent of instructor.

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.

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 including human-machine-interfaces. Workstations with modern industrial equipment, provide an interactive graphics, and visualization environment.

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/NC only. Repeatability: May be repeated.

501 Graduate Seminar (1) Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 20 hours. 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)


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 of 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.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/INP 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 dynamics calculations; applications to complex materials and energy-relevant and biological systems. (DE) Prerequisite(s): 532.

632 Nonequilibrium Thermodynamics (3) Unified treatment of non-equilibrium thermodynamics from the perspective of a general mathematical framework, applicable at all levels of system description from microscopic to macroscopic. Statistical and continuum mechanical descriptions of irreversible thermodynamic systems, with applications to complex fluids, are emphasized. (DE) Prerequisite(s): 531 and 532.

633 Multiscale Materials Modeling (3) Development of multiscale simulation strategies for engineering of advanced micro-and-nano structured materials via integration of essential information from different scales, i.e., molecular, mesoscopic and continuum. (DE) Prerequisite(s): 505, 531, and 547.

Registration Permission: Consent of instructor.

647 Advanced Transport Phenomena (3) Derivation and solution of coupled mass, momentum and energy evolution equations; application to complex materials and energy-relevant and biological systems. (DE) Prerequisite(s): 547 and 548.

652 Sustainable Energy Production (3) Emerging technologies in energy capture, including photovoltaic cells and bio-based fuels and in energy production, including fuel cells. Study of fundamental mechanisms. Comparative analysis of the alternatives, including current technical barriers to commercialization. (DE) Prerequisite(s): 505.

661 Advanced Topics in Process Dynamics and Control (3) Multiloop and multivariable control, model predictive control, process identification and monitoring, plantwide control, etc. Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 505.

662 Chaos and Engineering Applications (3) Chaos and nonlinear dynamics analysis of time series for understanding, development, design and control of complex engineering systems; systems with continuous multi-scale temporal and spatial variations; review of standard analysis techniques; applications to bubble formation, distillation, fluidization, combustion, fermentation, patterns (nonwoven fabrics, nanotubes), molecular-self organization, cardiac control, and bioinformatics. (DE) Prerequisite(s): 505. Recommended Background: Programming.

671 Advanced Biomolecular Engineering (3) Current science and technology at the interface of engineering and biology, focusing at the molecular level. Topics include enzyme-based sensors, molecular-level engineering for bio-based energy production, genetic engineering for protein expression in non-native hosts, modeling of metabolic networks and gene expression. (DE) Prerequisite(s): 575. Recommended Background: Working knowledge of undergraduate level biochemistry and cellular biology; graduate chemical engineering core coursework.

Registration Permission: Consent of instructor.

672 Computational Bioinformatics (3) Modeling and analysis of DNA/RNA and protein sequences. Topics include STR and SNP DNA measurement data for human identification; dynamic programming; distance measures, clusters, and link analysis and discovery; clustering algorithms; data mining using SVD method; dynamic indexing of data collections using clustering; probability theory; Bayesian and maximum likelihood estimation; entropy as a measure of information content and inductive inference; parallel computation. Applications to biological molecules will be studied. (DE) Prerequisite(s): Statistics 505 and 507. Recommended Background: Programming skills.

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 equilibria; 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 and 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, and 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. Maximum 14 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.

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 qualitative chemical analysis.
Recommended Background: 2 semesters of physical chemistry.

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena.
Recommended Background: 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.
Recommended Background: 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.
Recommended Background: 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.
Recommended Background: 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 inorgan ic compounds.
Recommended Background: 1 semester of inorganic chemistry.

533 Chemistry of the Transition Metals (3) Theoretical and experimental foundations of modern coordination, organometallic, and bio-inorganic chemistry of transition metals; transition metal mediated catalysis, materials chemistry, isobologram theory, kinetics and mechanism of reactions of transition metals, and applications in organic synthesis.
Recommended Background: 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.
Recommended Background: 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 Applications of Organic Reactions (3) Applications of organic reactions to directed synthesis targets including bio-organic substrates, natural products, medicinal agents, and other molecules of practical or theoretical interest.
(De) Prerequisite(s): 550.

Recommended Background: 2 semesters of organic chemistry.

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.
Credit Restriction: May not be used toward degree requirements.

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.
Recommended Background: 2 semesters of physical chemistry.

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

511 Survey of Research in Child Development (3) Developmental processes; principles and practice of electroanalytical techniques in quantitative chemical analysis and applied to study of chemical systems.

510 Analytical Spectrometry (3) Principles and practice of optical and mass spectrometric techniques in qualitative chemical analysis.
Recommended Background: 2 semesters of physical chemistry.

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena.
Recommended Background: 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.
Recommended Background: 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.
Recommended Background: 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.
Recommended Background: 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.
Recommended Background: 1 semester of inorganic chemistry.

533 Chemistry of the Transition Metals (3) Theoretical and experimental foundations of modern coordination, organometallic, and bio-inorganic chemistry of transition metals; transition metal mediated catalysis, materials chemistry, isobologram theory, kinetics and mechanism of reactions of transition metals, and applications in organic synthesis.
Recommended Background: 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.
Recommended Background: 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 Applications of Organic Reactions (3) Applications of organic reactions to directed synthesis targets including bio-organic substrates, natural products, medicinal agents, and other molecules of practical or theoretical interest.
(De) Prerequisite(s): 550.

Recommended Background: 2 semesters of organic chemistry.

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.
Credit Restriction: May not be used toward degree requirements.

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.
Recommended Background: 2 semesters of physical chemistry.

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory.
Recommended Background: 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.
(DE) Prerequisite(s): 510 or consent of instructor.

515 Children in Contemporary Society (3) Theory and research on environmental and developmental issues in contemporary society, family life, 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 framework and research methodologies on play. Developmental perspective on play.

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

Recommended Background: 6 hours of graduate coursework in child and family studies.

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.

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 (4) Programs in family life education, including family sexuality, family resource management, 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 Theories of Family Therapy (3) Exploration of classic and contemporary theoretical approaches in family therapy. Emphasis given to application of concepts and methods from these approaches to family situations. (Same as Counselor Education 566.)

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

Recommended Background: 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.
Repeatability: Not repeatable. May be taken once for 1-2 hours.
(DE) Corequisite(s): 575.
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.

Chinese (249)
431 Readings in Chinese Literature (3) (See Asian Languages 431.)

Cinema Studies (251)
400 Special Topics (3)
Repeatability: May be repeated. Maximum 6 hours.

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

422 Topics in Italian Cinema (3) (See Italian 422.)

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 (3) (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)
Repeatability: May be repeated. Maximum 6 hours.

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

Civil Engineering (254)
416 Hydrology (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, columns with combined axial loads and bending, and footings. Design for torsion.
(DE) Prerequisite(s): 471.

485 Principles of Hydrogeology (3) (See Geology 485.)

490 Water Resources Engineering (3) Application of hydrologic/hydraulic principles for development of water resource project design and management of water resources. Assessment of environmental impacts to surface water and groundwater. Regulatory framework for water supply and water quality.
(DE) Prerequisite(s): 390 and 395 or 416.

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 Urban Systems: Engineering and Management (3) Various urban systems usually under responsibility of city manager and/or city engineer: streets, lighting, water, sewerage, refuse collection. Personnel management, finance, planning and public relations.
Comment(s): Graduate standing or consent of instructor required.

521 Pavement Design (3) Empirical and theoretical based methods of pavement design and analysis, strengthening existing pavements, pavement distress and estimation design alternatives.
(DE) Prerequisite(s): 321 and 330.

522 Mix Design for Asphaltic and Portland-Cement Concrete (3) Aggregate properties and tests, asphalt binder properties and tests, mix design methods for asphaltic mixtures, hot-mix asphalt (HMA) mixture production and construction, Portland-cement concrete (PCC) mix design, additives and admixtures for PCC, special types of PCC, PCC production and construction.
(DE) Prerequisite(s): 321.

525 Pavement Materials Characterization (3) Material modeling, laboratory and in-situ characterization of unbound granular, stabilized base, hot-mix asphalt mixtures, Portland cement concrete, and other paving materials; performance prediction for flexible and rigid pavements.
(DE) Prerequisite(s): 321 and 330.

(DE) Prerequisite(s): 330.

531 Soil Stabilization (3) Mechanical stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils with admixtures, waterproofing and modifying soils and admixtures. Reinforced earth and stabilization with geosynthetics.
(DE) Prerequisite(s): 330.

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

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

(DE) Prerequisite(s): 435.

538 Finite Element Applications in Geotechnical Engineering (3) Application of finite element method to typical problems in geotechnical engineering. Confined and unconfined flow through porous media; two-dimensional stress and strain; two-dimensional elements; representation of nonlinear soil behavior with elastic and elastic-plastic models. Taught concurrently with 561.
Credit Restriction: Students may not receive credit for both 538 and 561.
Recommended Background: Coursework in soil behavior and matrix computation.

539 Geotechnology Seminar (1) Seminar topics in geotechnical and geological engineering. Research contributions and case histories by graduate students and engineers and scientists from surrounding community.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 10 hours.
Comment(s): Enrollment limited to students with graduate standing.
Registration Permission: Consent of advisor.

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 engineering. 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 macroscopic 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 control devices including signing and markings.
(DE) Prerequisite(s): 551.

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

554 Public Transit Planning and Operations (3) Characteristics of transit modes – conventional, informal, and paratransit; operational design of transit services: route planning and scheduling; cost analysis; traveler behavior; performance evaluation; data collection methods; organization and financing.
Comments: Graduate standing or consent of instructor required.

555 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 other community features. Use of planning process to establish existing travel patterns, modeling of demand, proposing alternatives and evaluation. (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 intercity and urban service; characteristics of individual modes and strategies for their coordination; functional design and operation of transportation terminals including seaports and air cargo terminals; safety and security issues.
Comment(s): Minimum student level – senior.

561 Finite Element Applications in Structural Engineering (3) Application of finite element method to typical problems in structural engineering. Truss, beam and plate elements; two-dimensional stress and strain; two-dimensional elements; representation of nonlinear material behavior with elastic and elastic-plastic models. Taught concurrently with 538.
Credit Restriction: Students may not receive credit for both 561 and 538.
Recommended Background: Structural analysis and matrix computation course.

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

563 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.

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.

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. Maximum 9 hours.
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.

691 Special Topics in Civil Engineering (3) Selected advanced problems of current interest.
Repeatability: May be repeated. Maximum 6 hours.
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, and 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, and 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.
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 process 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. Comment(s): Admission to a degree program in Communication and Information required.

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. Emphasis 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 interpretivistic traditions. Integrative study of the role of theory, various theoretical traditions and methods within interpretivistic communication and information research. Emphasis 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 Communication and Information Professional Development Seminar (1-3) Seminar examining the role and scope of communication and information teaching, research and other professional development topics. 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.

643 Qualitative Research (3) Theory and application of qualitative research methods to communication and information research. Theoretical considerations underlying symbolic interactionism as translated into research strategies of participant observation, life history, interviewing, archival analysis, and case studies. (DE) Prerequisite: 615. Registration Permission: Consent of instructor.

644 Quantitative Research (3) Discussion of issues and best practices in quantitative research, including measurement, sampling, and research design strategies. Focus on techniques and uses of survey, content analysis, experimental designs, and secondary analysis. Assessment of reliability and validity. Use of data analysis for hypothesis testing and inference. (DE) Prerequisites: 610. Registration Permission: Consent of instructor.

651 Contemporary Issues in Science, Technology, Engineering, and Medical Communication and Information (3) Integrative approach to the role of communication and information in the study of STEM topics. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 610 and 615. Registration Permission: Consent of instructor.

653 Contemporary Issues in Law, Policy, and Ethics in Communication and Information (3) Integrative approach to law, policy, and ethics in communication and information topics. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 610 and 615. Registration Permission: Consent of instructor.
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 6 hours.
Credit Restriction: May not be used toward degree requirements.

508 Graduate Research Participation (3) Advanced research techniques while conducting individual biomedical research projects under supervision of faculty.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

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)
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, Pathobiology, Large Animal Clinical Sciences, and Small Animal Clinical Sciences. 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.

504 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 disease frequency, disease monitoring and control in human and animal populations, field investigations, animal health economics and production.
Registration Permission: Consent of instructor.

505 Laboratory Animal Care and Use (2) Review of basic laboratory animal care and use as prerequisite to conducting research using animal subjects. Compliance issues and techniques.
506 Experimental Animal Surgery (3) Competence in performing hu-
mance surgical modifications of experimental animals. Techniques of
anesthesia. Drug administration and postoperative care.
Contact Hour Distribution: 1 hour and 2 labs.
Recommended Background: Coursework in embryology, parasitology, and phys-
ology and consent of instructor.

507 Zoonoses for the Public Health Practitioner (3) Course deals with
zoonotic agents which have been selected because of their importance
to public health practitioners and to illustrate how such agents can be
prevented and controlled.
Recommended Background: Public health, veterinary medicine, nursing courses
or students in these programs.
Comment(s): Graduate or professional veterinary students at UTK and person-
nel employed by the Tennessee Department of Health and enrolled in the Ap-
plied Epidemiology Certificate Program.

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

561 Pharmacology (4) Basic principles of pharmacokinetic and pharma-
codynamic theory and data modeling. The student will learn the physiolog-
ic processes that dictate the absorption, distribution and elimination of
drugs. The course includes a hands-on module where the student will learn
how to analyze pharmacokinetic data including noncompartmental and
compartmental data analysis, population and physiology-based models, as
well as principles of pharmacokinetic-pharmacodynamic integration.
Registration Permission: Consent of instructor.

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

602 Surgical Pathology (1-2)
Examination of biopsy specimens and in-
terpretation 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.

606 Clinical Epidemiology (3) Theory and principles of design imple-
mentation 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 An-
imals (3) Advanced study of virus diseases important to domestic ani-
mals: 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.

609 Mechanisms of Disease (3) Advanced topics in pathobiology and
mechanisms of disease: pathophysiology, cellular degeneration, inflam-
mation, immunopathology, hypercoagulability, hemorrhage, hypotension. Principal biochemical and
physiologic responses of various cells, tissues, and organs to injury and
other metabolic derangements. Selected contemporary topics from cur-
rent literature and textbooks.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

610 Advanced Topics in Comparative and Experimental Medicine (1-
3) Specialized in-depth experience in various disciplines. Current and fu-
ture research methodology, recent advanced in instrumentation in analyt-
technical 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.
Comment(s): DVM or equivalent degree.

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.
Comment(s): DVM or equivalent degree.

615 GIS and Geographical Epidemiology (3) Principles and applications
of Geographical Information Systems (GIS) and geographical epidemiology
in human and animal health research and practice. Exposure to a wide
range of spatial analysis techniques useful in the investigation of human and
animal disease problems as well as vector dynamics. The knowledge
 gained is useful in guiding disease prevention and control strategies.
Recommended Background: Biological sciences including (but not limited to)
veterinary medicine, public health, epidemiology, parasitology, ecology, ento-
mology, and environmental health. Prior introductory statistics and/or epide-
imology training.

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 (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.
Recommended Background: Completion of core curriculum or consent of in-
structor.

430 Advanced Topics in Hardware Systems (3) Topics such as archi-
tecture, parallel processors, microprogramming, networks, and commu-
ications. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
Recommended Background: Completion of core curriculum or consent of in-
structor.

460 Advanced Topics in Software Systems (3) Topics such as operat-
ings systems, compilers, parallel computation, software engineering, data-
base systems, and programming languages. Emphasis on faculty re-
search.
Repeatability: May be repeated. Maximum 9 hours.
Recommended Background: Completion of core curriculum or consent of in-
structor.

470 Advanced Topics in Scientific Computation (3) Topics such as nu-
merical methods, supercomputers and computer modeling and simul-
ation of physical systems. Emphasis on faculty research.
Repeatability: May be repeated. Maximum 9 hours.
Recommended Background: Completion of core curriculum or consent of in-
structor.

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.
Recommended Background: Completion of core curriculum or consent of in-
structor.

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.

501 Project in Lieu of Thesis (3) Capstone course taken under supervi-
sion of student's major professor and master's committee. Individual proj-
exting literature survey, development of some algorithms, software,
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 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.

Recommended Background: 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.

Recommended Background: 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.

Recommended Background: 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.

Recommended Background: 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 I (3) (See Mathematics 571.)

572 Numerical Mathematics II (3) (See Mathematics 572.)

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

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.

Recommended Background: Numerical linear algebra course.

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

Recommended Background: 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.

Recommended Background: 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) 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 Skills for Counseling (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. Maximum 9 hours.

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 Orientation to Counseling and Ethics (3) Orientation to the counseling profession and professional practice issues in school and mental health counseling and related fields: education, research, standards of practice, credentialing, and policy.

Registration Restriction(s): Master of Science – counseling major/mental health counseling or school counseling concentration.
Registration Permission: Consent of instructor.

550 Foundations in School Counseling (3) Professional school counselor roles, introduction to the ASCA National Model, and professional issues related to school counseling.

Registration Restriction(s): Master of Science – counseling major.
Registration Permission: Consent of instructor.

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.

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 557.)

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with individual clients. (Same as Psychology 559.)
Repeatability: May be repeated. Maximum 9 hours.

(De) Prerequisite(s): 480, 551, 550 or 556, and 554.
Comment(s): Admission to school counseling or mental health counseling program required.
Registration Permission: Consent of instructor.
556 Mental Health Counseling and Related Professional Issues (3) Mental health counseling and related professional issues such as managed care, addictions, and program development.
  Registration Restriction(s): Master of Science – counseling major/mental health counseling concentration.
  Registration Permission: Consent of instructor.

558 Internship in School Counseling (1-6) Supervised post-practicum experience at school setting approved by the academic unit.
  Grading Restriction: Satisfactory/No Credit grading only.
  Registration Restriction(s): Master of Science – counseling major/school counseling concentration.
  Registration Permission: Consent of instructor.

559 Internship in Mental Health Counseling (1-6) Supervised post-practicum experience at a mental health counseling setting approved by the academic unit.
  Grading Restriction: Satisfactory/No Credit grading only.
  Registration Restriction(s): Master of Science – counseling major/mental health counseling concentration.
  Registration Permission: Consent of instructor.

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): 555.

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 Theories of Family Therapy (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: 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: 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.

680 Advanced Theory and Practice of Career Counseling (3) Extensive study of the current status of career development and of career counseling theory, research, and practice.
  (DE) Prerequisite(s): 552.

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

Cultural Studies in Education (271)

504 Teachers, School, and Society (3) Critical interdisciplinary examination of selected policies and assumptions about education in America with a focus on teachers, students, and the relationship between schools and the broader society.


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 philosophic approach to lives and writing 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 constructivist thinking; confronting power and addressing educational implications. (Same as Women’s Studies 548.)

549 Topics in International Education (3) Historical, philosophic, and sociological foundations; selected nations and their cultures.
  Repeatability: May be repeated. Maximum 9 hours.

550 Multicultural Education (3) Introduction to history, varieties, theory and practice of multiculturalism and multicultural education. Addresses the promotion and critique of multicultural education and related concepts in theory and educational practice.
560 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research proposals. Overview of qualitative research methods: ethnography, case study, historiography, biography, oral and life history. Critical reading and evaluation of qualitative research studies. (Same as Educational Psychology 555.)

590 Cultural Studies Seminar (2) Two-semester sequence (fall and spring); ongoing discussion about cultural studies: popular culture, interdisciplinary work, social justice issues. Presentations, videos, readings. 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 and 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.

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 Methods of Historical Research (3) Introduction to theories, methods, and resources for conducting historical research. Repeatability: May be repeated. Maximum 6 hours.


661 Advanced Qualitative Research in Education (3) Implementing and writing qualitative studies in educational settings. Qualitative data collection, analysis, and report writing. (Same as Educational Psychology 661.) (DE) Prerequisite(s): 560. Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

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-8. 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.

593 Independent Study (1-3)
Grading: 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.

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.

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.

426 Plant-Animal Interactions (3) Introduction to the evolutionary and ecological aspects of interactions between plants and animals, including herbivory, pollination, and seed dispersal. Emphasis is on historical development of the field, discussions of primary literature, design of experiments, and writing. (DE) Prerequisite(s): 330 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.

460 Evolution (3) Principles, facts, and theories regarding biological evolution. Concepts, processes, and product in development of organic diversity. Historical development of ideas concerning biological evolution. (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 physio-chemical 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/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 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 16 hours. Credit Restriction: Only 4 hours can be applied towards a graduate degree in ecology and evolutionary biology.

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. 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.

543 Aquatic Insects (3) Taxonomy and biology of aquatic insects; immature forms. Contact Hour Distribution: 2 hours and 1 lab. Registration Permission: Consent of instructor.

546 Evolutionary 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.

557 Quaternary Ecology (3) Perturbation, process, and pattern within Quaternary ecosystems; climatic change and vegetational response during last 2.5 million years. Registration Permission: Consent of instructor.

560 Biometry (3) Statistical applications in biological research. Recommended Background: Statistics course or consent of instructor.

575 Ecological Genetics (3) Genetics of natural populations, using both single-locus and quantitative genetic approaches. Recommended Background: Genetics 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 I (3) (See Mathematics 581.)

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

583 Zoogeography (3) Processes determining geographic distribution of animals and distribution and composition of animal communities. Recommended Background: 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. Recommended Background: 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 biology. 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 I (3) (See Mathematics 681.)

682 Advanced Mathematical Ecology II (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 nontariff 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, and 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/Non-P 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.

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.

579 Environmental Policy Research Workshop (1) Multidisciplinary analysis of advanced topics in environmental policy. Student participation. Major writing requirement.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

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

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.
Recommended Background: Introductory statistics 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.
Recommended Background: Introductory statistics course.

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

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.

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.


672 Public Finance: Taxation and Intergovernmental Relations (3) Theory of taxation; tax incidence and tax efficiency; policy analysis of U.S. tax structure at federal, state, and local levels. Theory of fiscal federalism and intergovernmental relations.

677 Environmental and Natural Resource Economics (3) Alternative paradigms for allocating and valuing environmental resources. Exploration of issues related to market failure and differences between renewable and nonrenewable resources.

678 Economics of Environmental Policy (3) Topics in environmental policy analysis. Consideration of alternative policy instruments, defining policy objectives and role of risk in decision-making process.

682 Advanced Topics in Cross-Section Econometrics (3) Models with limited dependent variables, panel data analysis, nonparametric estimation, selection models and duration models.
(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 Workshops (3) Advanced topics in economics. Student participation. 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. 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.

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.
Recommended Background: Program prerequisites.
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.

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 teach the prelingually hearing impaired student. Practice in preparation of developmentally appropriate reading materials. Methods which assist in integrating hearing impaired students in regular reading curricula and materials.

579 Special Topics (1-3) 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 the 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.)

523 Administration of Special Services (3) Legal, programmatic, and ethical responsibilities of educational administrators in design and implementation of special service programs within school settings. Special learner characteristics, program categories, service delivery models, and legal/ethical frameworks. Inclusion and full service delivery.

529 Politics and Public Relations in Education (3) School/community relations in political context of modern, complex society. Administrator and supervisory competencies: political, social, ethnic, cultural, and racial environments in which schools operate.

533 Program Evaluation in Education (3) (See Educational Psychology 533.)

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 Statistics in Applied Fields (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.

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)

596 Seminar in School Leadership, K-12 (3) On-site study of quality school processes throughout region.

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.)

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.

612 Development of and Current Issues in Educational Administration (3) Introduction to the area of educational administration. Focusing on the development of educational administration, school leadership preparation programs as well as current reforms, issues and indictments.

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.)

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.)

618 Advanced Qualitative Research in Educational Leadership (3) This qualitative methods seminar explores critical issues in qualitative research at an advanced level. Students explore more fully the areas of interviewing, thematic analysis, the use of theory and theoretical frameworks in qualitative research, and issues of methodological defensibility and analytical rigor (validity and reliability) in qualitative research.

620 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 620.)

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 reception 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 reception sign communication skills. Using language in context is emphasized. Grammatical structures of ASL and cultural implications of the deaf community. (DE) Prerequisite(s): 431 or consent of instructor.

435 Linguistics of American Sign Language (3) Introduction to grammatical and linguistic structures of ASL. Language variations, discourse, bilingualism and language contact also covered in this course. Conducted in ASL.

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.

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

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.

506 Modes of Inquiry (3) Exploration of the nature of scholarly inquiry with emphasis on different approaches to research in education and ways to help students make decisions about how they plan to engage in the community of scholars.

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. Maximum 9 hours.

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.

524 Learning in the Workplace (3) Theories and concepts supporting design and management of learning activities for adults in the workplace.

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 Ethical Issues in Adult Education (3) Ethical issues confronting the field of adult education; development of critical analysis skills by examining ethical decision making processes.

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.

531 Discourse Analysis of Educational Environments (3) Provides an introduction to the broad area of discourse analysis as an approach for understanding naturally occurring language use, particularly in the context of teaching and learning. Covers both the underlying philosophy and specific methods for collecting and analyzing written and spoken discourse.

532 Online Collaborative Learning: Computer-Mediated Communication (3) Investigates how computer-mediated communication tools can most effectively be integrated into teaching and learning, including distance and blended environments. Covers both theory and practice of integrating tools into these environments as well as researching their effectiveness.

533 Program Evaluation in Education (3) Issues and practices in planning and conducting program and curriculum evaluation in a 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 533; Higher Education Administration 533.)
   Registration Permission: Consent of instructor.

534 Historical Development of Educational Psychology (3) Historical development of educational psychology and its influence on research and practice in education.

535 Types of Teaching and Learning (3) Theory and practice related to three types of teaching and learning in classroom environments.


555 Introduction to Qualitative Research in Education (3) (See Cultural Studies in Education 560.)

661 Advanced Qualitative Research in Education (3) (See Cultural Studies in Education 661.)

659 Internship in Educational Psychology (3) Supervised employment in unit approved educational psychology internship sites.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 12 hours.

572 Cognitive Education: Models and Approaches (3) Models and approaches in field of cognitive education: research and theoretical support for research in cognitive education that affect successful implementation.

573 Meeting Needs of Nontraditional and Underachieving Learners (3) Exploration of students’ needs at any age and level of functioning who are not progressing up to their fullest potential. Causes of academic and motivational problems, and approaches to overcome them. Learning to learn, cultural alienation, and personal world view and interaction with effective teaching and learning.

574 Facilitating Group Change (3) Practical issues of group change. Analyses of group and individual experiences in all types of educational settings in relation to systems theory and collaborative learning theory. Needs of individuals and groups involved in change and roles of inside and outside change agents.

577 Statistics in Applied Fields I (3) Applications of descriptive and inferential statistics to problems in applied fields. Use of internet sites and computer programs to analyze data. (Same as Educational Administration 577.)
   Recommended Background: 1 year of college mathematics and an elementary course in statistics or consent of instructor.

581 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.

582 Educational Research Fundamentals (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.

583 Survey Research (3) Introduction to survey (descriptive) research. Survey design and application focused on educational problems. Critical reading of research, methodological development in descriptive and survey areas.

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 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.)
   Grading Restriction: Satisfactory/No Credit grading only.
   Credit Restriction: May not be used to meet the Educational Psychology 600 or Counselor Education 600 requirement.
   Comment(s): Admission to a doctoral program in the Department of Educational Psychology and Counseling is required.
### Courses of Instruction

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>602</td>
<td>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.</td>
</tr>
<tr>
<td>604</td>
<td>Special Topics (1-3) Instructor-initiated courses offered at convenience of unit on topics of interest. Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.</td>
</tr>
<tr>
<td>609</td>
<td>Advanced Seminar in Curriculum and Learning (3) Team-taught interdisciplinary seminar: trends, themes, and issues in curriculum and learning. Reading and discussions based on significant research and scholarly publications.</td>
</tr>
<tr>
<td>620</td>
<td>Seminar in Adult Education (3) Issues in adult education, theories and concepts, philosophical positions, research trends and methodologies. (DE) Prerequisite(s): 522 or equivalent. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>622</td>
<td>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.</td>
</tr>
<tr>
<td>630</td>
<td>Doctoral Seminar in Collaborative Learning (3) Issues, theories, concepts and research in collaborative learning. Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 12 hours. Comment(s): Requires admission to collaborative learning specialization.</td>
</tr>
<tr>
<td>635</td>
<td>Ethical, Legal, and Professional Issues in Psychology (3) (See Psychology 635.)</td>
</tr>
<tr>
<td>640</td>
<td>Seminar in Applied Educational Psychology (2) Issues, theories, concepts and research in applied educational psychology. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 hours. Comment(s): Admission to PhD, education major, applied educational psychology specialization required.</td>
</tr>
<tr>
<td>651</td>
<td>Seminar in Assessment and Evaluation (3) Trends and issues in student/client assessment, personnel evaluation, and program evaluation; and examination of current state, regional, and national assessment and evaluation policies. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>652</td>
<td>Application of Evaluation and Assessment: Principles and Procedures (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): 651.</td>
</tr>
<tr>
<td>653</td>
<td>Designing and Implementing Personnel Evaluation Systems (3) Models and methods of assessing performance of P-12 educators and other professionals. Critique of systems currently in use and design of evaluation systems.</td>
</tr>
<tr>
<td>654</td>
<td>Designing Project Evaluations: Theory and Application (3) Evaluation trends and issues. Theoretical frameworks to design evaluation studies for various educational programs.</td>
</tr>
<tr>
<td>655</td>
<td>Research in Psychoeducational Studies (1) Data analyses, collection, and interpretation. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 9 hours.</td>
</tr>
<tr>
<td>661</td>
<td>Advanced Qualitative Research in Education (3) (See Cultural Studies in Education 661.)</td>
</tr>
<tr>
<td>663</td>
<td>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.</td>
</tr>
<tr>
<td>668</td>
<td>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.</td>
</tr>
<tr>
<td>669</td>
<td>Internship in Educational Psychology (1-6) Supervised employment in unit approved educational psychology internship sites. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>670</td>
<td>Internship in Evaluation (1-3) Experiences in educational evaluation applied to instructional improvement. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 9 hours. Recommended Background: Program prerequisites. Registration Permission: Consent of instructor.</td>
</tr>
<tr>
<td>671</td>
<td>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. Comment(s): Requires admission to doctoral program or consent of instructor.</td>
</tr>
<tr>
<td>673</td>
<td>Collaborative Learning (3) Theories of collaborative learning and research related to facilitating collaborative learning in professional practice settings. (DE) Prerequisite(s): 513 and 617 or consent of instructor.</td>
</tr>
<tr>
<td>677</td>
<td>Statistics in Applied Fields II (3) Applications of parametric and nonparametric statistical inference to problems in applied fields. Use of computer programs and internet sites in analyzing data. (DE) Prerequisite(s): 577.</td>
</tr>
<tr>
<td>693</td>
<td>Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.</td>
</tr>
</tbody>
</table>

### Electrical and Computer Engineering (319)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>415</td>
<td>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. (DE) Prerequisite(s): 316.</td>
</tr>
<tr>
<td>416</td>
<td>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.</td>
</tr>
<tr>
<td>421</td>
<td>Electric Energy Systems (3) Structure and operation of electrical energy grid, load flow, economic loading, planning, control, and reliability. Balanced and unbalanced faults, system protection, and system stability. Includes Level 1 design projects. (DE) Prerequisite(s): 421.</td>
</tr>
<tr>
<td>431</td>
<td>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, sinuosoidal 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.</td>
</tr>
<tr>
<td>432</td>
<td>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.</td>
</tr>
<tr>
<td>433</td>
<td>Introduction to VLSI (3) Investigates the behavior of microelectronic devices in digital circuits and helps the students develop an understanding of the relationship between the device physics and the device static and dynamic characteristics. Includes laboratory assignments which are designed to give advanced undergraduate students a working knowledge of CMOS digital integrated circuit technology, circuit design methodologies, including simulation and physical layout of CMOS digital circuit structures. (DE) Prerequisite(s): 335.</td>
</tr>
<tr>
<td>441</td>
<td>Digital Communication (3) Quantization and pulse code modulation, binary and M-ary signaling, spectra of line codes, link budget analysis, binary communication in the presence of noise, matched filtering and equalization, bandpass digital transmission, introduction to multiple access techniques. Includes Level 1 design projects. (DE) Prerequisite(s): 342.</td>
</tr>
</tbody>
</table>
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.
(DE) Prerequisite(s): 441.

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, design for interference, 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, and 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.

455 Embedded Systems Design (3) Design and development of embedded systems for data acquisition and special-purpose computing systems, such as power interfacing, serial/parallel communications and bus systems. Assembly language programming, software architecture, and machine architecture of microcontrollers. Includes Level 1 design projects which require laboratory work.
(DE) Prerequisite(s): 355.

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.
Recommended Background: 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. Recommended Background: Completion of all junior electrical and computer engineering courses or consent of instructor.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated. 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 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 Random Process Theory for Engineers (3) Probability and random variables as approached by set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis as applied to response of systems to random signals.

505 Digital Signal Processing I (3) Discrete-time signals and systems, sampling, fast Fourier transform (FFT) and fast convolution, design of FIR filters and IIR filters.

506 Digital Signal Processing II (3) Filter properties in the Z and Fourier transform domains, structures for digital filters, sampling and reconstruction, hardware implementation of digital filters.

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

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

511 Linear Systems Theory (3) State space models of linear dynamical systems, linear algebra, state transition map, matrix exponential, controllability, observability, realization theory, and stability theory.
(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.

517 Reinforcement Learning in Artificial Intelligence (3) Principles and methods for reinforcement learning and sequential stochastic control: Markov decision problems; dynamic programming; temporal difference learning; design considerations for hardware and software.
Registration Permission: Consent of instructor.

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 machines.

525 Alternative Energy Sources (3) Energy outlook, interconnection issues of distributed energy resources, efficiency of power production, electric energy conversion and storage. Photovoltaics, fuel cells, wind turbines, microturbines.

531 Advanced Analog Electronics I (3) Physical operation of modern electronic devices; semiconductor devices; diodes, bipolar transistors, J-FETs, and MOS-FETs. Small-signal equivalent circuits and noise models of active devices. Project laboratory.
(DE) Prerequisite(s): 431 and 432 or consent of instructor.

(DE) Prerequisite(s): 531.

533 Advanced MOS Concepts and VLSI Design (3) Physics of MOS capacitors and transistors, derivation of V-I relation expressing sub-threshold, threshold, and saturation region behavior; short-channel effects in scaled-down transistors; scaling laws; VLSI fabrication technologies; silicon-on-insulator technology; design and layout of digital integrated circuits. Includes laboratory assignments emphasizing computer aids in VLSI design; schematic capture, circuit simulation, and layout of custom integrated circuits.
Registration Permission: Consent of instructor.
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.


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 realization 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 in the discussion from the application layer down to the physical layer. An emphasis is given on protocol design and performance analysis. Other topics include ad-hoc networking, network security and network simulation. Assignments that require hands-on networking and programming skills will be issued in order to solve concrete problems.

554 Computer Security and Forensics (3) Application of the principles of computer forensic analysis to modern security problems. Covers industry standards and guidelines for the forensic examination and analysis of audit data, disk drives, and computer programs. Provides guidelines for establishing and maintaining a forensic laboratory capability. Registration Permission: Consent of instructor.

555 Embedded Systems (3) Design principles, analysis methods and case studies of microprocessor-based and timing-critical embedded systems, such as sensor and actuator networks, multimedia devices and avionics. Topics include real-time operating systems, single- and multiprocessor scheduling, multi-processor scheduling, distributed systems, quality of service, resource management, end-to-end processor utilization control, embedded middleware, power-aware computing, energy management, and fault-tolerance. (DE) Prerequisite(s): 455. Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

556 Wireless Sensor Networks (3) Principles and design approaches of wireless sensor networks. Topics include operating systems and programming languages, physical network properties, Media Access Control protocols, geographical routing, data aggregation, real-time communication, query processing, power management, sensing coverage, and applications. (DE) Prerequisite(s): 455. Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

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, instruction set organization, RISC (Reduced Instruction Set Computers), and CISC (Complex Instruction Set Computers), implementation issues, technology trends, architecture modeling and simulation.

558 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.

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 and 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. Comment(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. (DE) Prerequisite(s): 565 or consent of instructor.

571 Pattern Recognition (3) Decision-theoretic and structural approaches to pattern recognition. Deterministic and statistical decision rules, feature extraction and representation, syntactic and semantic methods. (DE) Prerequisite(s): 471 or consent of instructor.

572 Digital Image Processing (3) Spatial and transform processing of images. Neighborhood operators, image enhancement, restoration, and coding. Segmentation techniques. Image representation and description. (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 non-linear 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.

575 High Performance Computer Modeling and Visualization (3) Application of high performance computer modeling to assess and visualize the impact of smoke and heat transfer to buildings, electronic equipment, and human survivability. In-depth fire hazard analysis case studies. Advanced topics include software performance analysis and parallel processing. Registration Permission: Consent of instructor.

589 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.

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-systems theory, and advanced-design methods. Repeatability: May be repeated. Maximum 6 hours. (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-systems theory, and advanced-design methods. Repeatability: May be repeated. Maximum 6 hours. (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, VSCF 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, electromechanical 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): 504 or consent of instructor.

644 Coding and Information Theory (3) Structure of algebraic and probabilistic codes; linear codes, convolutional codes, error-correcting codes, decoding methods. Identification schemes: deterministic, stochastic, and hierarchical methods.

(DE) Prerequisite(s): 542, 461 and 462, or 563, 564, or consent of instructor.

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.

657 Advanced Computer Architecture and Design (3) Advanced computer architecture issues including topics such as superscalar architectures, parallel algorithms, principles of parallelism detection and vectorizing compilers, interconnection networks, SIMD/MIMD machines, processor synchronization, shared and distributed memory, data coherence, multiprocessors, multicomputers, datalink machines, special purpose processors.

(DE) Prerequisite(s): 557.

658 Computer and Telecommunications Systems Performance Evaluation (3) Introduction to the basic tools of computer and communications systems analysis and evaluation. Deterministic and stochastic modeling concepts are presented. Queuing theory and discrete event (DES) simulation methods are studied with application to a variety of examples drawn from the computer and communications performance evaluation literature. A standard DES language is used in modeling and simulation studies. Topics of current interest such as computer input/output models, mass memory, bus models, and communications network models are discussed. A modeling project is typically required.

659 Digital Systems Verification (3) Three critical issues for robust digital systems are design errors, manufacturing faults, and failures during operation. This course covers digital system verification, testing, and reliability for both timing and logic, in order to prepare students to deal with these in real designs. Verification will cover formal verification for logic and timing, and contrast with simulation. Methods for generating test vectors, scan testing, and built-in self test will be covered. MTBF will be calculated for several small systems with emphasis on models and their limitations.

(DE) Prerequisite(s): 551 and 557.

663 Advanced Plasma Physics I (3) Basic concepts of high temperature plasma physics. Magnetohydrodynamics and kinetic descriptions of plasma, plasma transport, plasma waves, equilibrium, and stability.

(DE) Prerequisite(s): 541, 542 and 481, 482 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): 671.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning and navigation.

(DE) Prerequisite(s): 672.

691 Advanced Graduate Seminar (1) Research in department.

Grading: Satisfactory/No Credit or letter grade.

Repeatability: May be repeated. Maximum 6 hours.

692 Special Topics (1-3) Advanced topics of current interest to PhD students in electrical engineering.

Repeatability: May be repeated. Maximum 9 hours.

Elementary Education (322)

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 of language development in children.

Recommended Background: An elementary school language arts course or consent of instructor.

505 Elementary and Middle School Teaching Methods II (3) Applied methods of teaching reading, language arts, science, social studies and mathematics: accommodation strategies for students with diverse needs.

(DE) Corequisite(s): 575. Recommended Background: Course in elementary and middle school teaching methods.

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).

Recommended Background: Course in language arts 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.

Recommended Background: 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 3 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.

Recommended Background: 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.

Recommended Background: Research course.

560 Research in Elementary Education (3) Analysis of research in elementary education with application to classroom teaching.

Recommended Background: Research course.

565 Advanced Studies in Early Childhood Education (3) Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 6 hours.

Recommended Background: 2 graduate courses in early childhood education.

Registration Permission: Consent of instructor.

561 Advanced Studies in Elementary School Language Arts (3) Selected issues in elementary school language arts.

Recommended Background: Graduate course in elementary school language arts or consent of instructor.

Engineering Management (328)

500 Thesis (1-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

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): 537 or 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.

595 Special Topics in Engineering Management (3) Problems and topics relevant to current issues in the field.

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

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

691 Advanced Topics in Engineering Management (3) Forum to study advanced topics individually or in groups.

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

Engineering Science (335)

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 Permission: Consent of instructor.

(DE) Prerequisite(s): 552.

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, extremum, finite element/finite volume/discrete implementation, 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 661; Mechanical Engineering 651.)

(DE) Prerequisite(s): 552.

652 Advanced Computational Fluid Dynamics Practice (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.

657 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/structural mechanics. Repeatability: May be repeated. Maximum 20 hours. Comment(s): For departmental thesis students only.

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

671 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 671.)

681 Advanced Topics in Engineering Mechanics (3) Advanced problems in mechanics, group or individually. Repeatability: May be repeated. Maximum 6 hours. 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 a selection of literary works from the Old and Middle English period, as well as some continental texts; most will be read in modern English translation, and no preliminary knowledge of Middle English is required. (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.)

403 Introduction to Middle English (3) Survey of the language and literature of England from the 12th through the 15th centuries. Reading of prose works and shorter poetry will be done in Middle English with special attention paid to grammar, style, dialect, and language change. The class will explore the culture of medieval England through critical essays, histories, and supplementary texts in translation.

404 Shakespeare I: Early Plays (3) Shakespeare’s dramatic achievements 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, and 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.
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. Maximum 6 hours.

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 Brownings; prose by Carlyle, Newman, and Mill.

419 Later Victorian Literature (3) May include poetry by the Pre-Raphaelites, Arnold, Hopkins, and Hardy; prose by Arnold, Ruskin, and Carroll; plays by Gilbert and Wilde.

420 The 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 Lanyer, Elizabeth Cary, Aphra Behn, Frances Burney, Mary Wollstonecraft, Mary Shelley, George Eliot, Virginia Woolf, and Doris Lessing. (Same as Women's Studies 422.) 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, revolutionary, and early national works.

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

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

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

435 American Novel before 1900 (3) Traces the development of the American novel from the late 18th century to the early 19th centuries. Includes such writers as Rowson, Brown, Cooper, Hawthorne, Melville, Stowe, James, Twain, and Dreiser.

436 Modern American Novel (3) Authors such as Faulkner, Steinbeck, Welty.

439 Southern Literature (3) Southern writing from colonial period into the 20th-century, including frontier humorists, local color writers, and the 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 genre, authors, or theories from 1645 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.)


452 Modern Drama (3) Survey of British, American, and international drama from 1880 to the end of World War II. Includes such playwrights as Ibsen, Chekhov, Shaw, Synge, O’Neill, Glaspell, Treadwell, Hughes, Pirandello, Brecht, and Wilder. (Same as Comparative Literature 452.)

453 Contemporary Drama (3) Survey of British, American, and international drama since World War II. Includes such playwrights as Williams, Miller, Beckett, Durrenmatt, Stoppard, Churchill, Shepard, Mamet, Strangen, Wilson, Friel, Mposanya, Highway, and Kushner.

454 20th-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 Fiction/Narrative (3) Formal, literary-historical, and thematic movements in post-World War II British and American fiction and international fiction in translation. Focus on postmodern novels and short stories written after 1945, but readings may include some newly influential narrative forms such as the graphic novel, hypertext and digital fiction and the nonfiction novel.

459 Contemporary Poetry (3) Formal, cultural, and thematic movements in poetry published since 1950. Includes such writers as Lowell, Brooks, Ginsberg, Plath, Larkin, Ashbery, Heaney, Baraka, and Walcott.

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.

464 Advanced Fiction Writing (3) Development of skills acquired in basic fiction-writing course. (DE) Prerequisite(s): 365 or consent of instructor.

466 Writing, Layout, and Production of Technical Documents (3) Principles of design for desktop publishing. Production of various documents to be incorporated into a professional portfolio. (DE) Prerequisite(s): 360 or consent of instructor.

470 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.

471 Sociolinguistics (3) Language in relation to societies. Theoretical and empirical study of language variation in individuals (style-shifting) and among social, cultural, and national/international groups. (Same as Linguistics 471.) Recommended Background: 371 or 372 or Linguistics 200 or consent of instructor.

472 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.

474 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.) Recommended Background: Second year of foreign language or consent of instructor.

476 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; sociocultural factors; and implications for second/foreign language instruction. (Same as Linguistics 476.)

477 Pedagogical Grammar for ESL Teachers (3) Aspects of English syntax and morphology presenting difficulties for non-native learners of English. Basic and complex sentence structures; noun and article system; and verb tense, aspect, modality, and complementation. (Same as Linguistics 477.)

479 Literary Criticism (3) Historical survey of major works of literary criticism.


481 Studies in Folklore (3) Topics vary. Repeatability: May be repeated if topic differs. Maximum 6 hours.
672 Studies in 20th-Century Literature (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.

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.

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 nar-ration, description, exposition, and argumentation; writing process and marking of student papers.

509 Teaching Fiction in the Secondary School (3) Teaching novels and short stories.

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.

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.

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 612, may not enroll in 512.

(DE) Prerequisite(s): 313 or consent of instructor.

Comment(s): Master’s students only.

513 Fungal Epidemiology and Disease Control (2) Quantitative epidemiology and propogule dispersal of fungal plant pathogens; disease assessment strategies and modes of action of fungicides. (Same as Plant Sciences 513.)

Registration Restriction(s): Not open to PhD students.

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.

Recommended Background: 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: 6 hours of biology.

521 Plant Virology (2) 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 (3) 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.

(DE) Prerequisite(s): 321 or basic entomology course.

541 Seminar (1-2) Review in oral or poster form of literature and current research in entomology or plant pathology, or report on student’s thesis research; critique and analysis of presentation effectiveness. Presentations on current topics by outside speakers.

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 enzyme (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, histochemistry 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 (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.

552 Insect Morphology (3) Identification of insect structures and relevance of structures to insect development, survival, physiology, and classification.

Contact Hour Distribution: 2 hours lecture and 1 lab.

Registration Restriction: Students cannot receive credit for both 552 and 652.

555 Basal Hexapods (2) Comprehensive study of the five primitively wingless groups of hexapods, including evolution, biology, behavior, and taxonomy. Methods of preservation, photomicrography, and videography; collection and field trips required.

560 Advanced Integrated Pest Management (2) Practical applications of the ecological principles and concepts of pest management as related by practitioners and experts; field trips required.

Contact Hour Distribution: 2 hours lecture.

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, apiculture, medical and veterinary entomology, insect biodiversity, and insect pathology.

Repeatability: May be repeated. Maximum 12 hours.

603 Research Planning (1-15) Preliminary research and investigation of dissertation research topic.

Repeatability: May be repeated. Maximum 15 hours.

Grading Restriction: Satisfactory/No Credit grading only.

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.

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.
613 Fungal Epidemiology and Disease Control (2) Quantitative epidemiology and propagule dispersal of fungal plant pathogens; disease assessment strategies and modes of action of fungicides.
Contact Hour Distribution: 2 hours and 2 labs weekly for 7 weeks.
Registration Restriction(s): Minimum student level – doctoral.

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.
Recommended Background: Introductory plant physiology and plant pathology or consent of instructor.
Comment(s): PhD students only.

628 History of Phytopathology (1) Study of how plant diseases have impacted human history and of the people who pioneered the science of plant pathology.
Contact Hour Distribution: 3 hours for five weeks.

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.
Recommended Background: 12 hours biological science and 8 hours chemistry.
Registration Permission: Consent of instructor.

652 Insect Morphology (3) Identification of insect structures and relevance of structures to insect development, survival, physiology, and classification.
Contact Hour Distribution: 2 hours lecture and 1 lab.
Credit Restriction: Students cannot receive credit for 552 and 652.
Registration Restriction(s): Minimum student level - doctoral.

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; aequous 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.

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 (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) 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 Nutrient Cycling in Managed Ecosystems (3) Principles of nutrient cycling and soil exchange processes affecting nutrient availability to plants; management of soil nutrients to optimize crop growth; environmental implications of nutrient management; effects of both traditional and non-traditional nutrient amendments; and constraints to measuring plant-available nutrients in the soil.
Recommended Background: Soil fertility course.

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 Methods of Soil Physical Analysis (3) Principles of water, gas, heat, and solute movement in soil/water systems; application of appropriate models for the description of these processes; methods for characterizing hydraulic and chemical transport properties of soil; applications of the science of soil physics to solution of contemporary problems in water conservation, prevention of surface/ground water contamination, and management of plant water status.
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.

544 Environmental Soil Physics (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.
Credit Restriction: Students cannot receive credit for both 444 and 544.
Recommended Background: General soils and physics.
Registration Restriction(s): Minimum student level – graduate.

593 Special Problems in Environmental 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 8 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 (3) Topics of current significance; scientific literature.
(RE) Prerequisite(s): 513.

614 Advanced Topics in Soil Biology and Biochemistry (3) Topics of current significance; scientific literature.
(RE) Prerequisite(s): 516.

615 Advanced Topics in Soil Physics, Genesis, and Morphology (3) 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 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 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.

511 Environmental Chemistry (3) A fundamental and quantitative treatment of the chemical processes that govern the formation, fate, and treatment of pollutants in natural and engineered systems. Chemical thermodynamics of pollutants; atmospheric reaction pathways; phase equilibria; aqueous solution equilibria; reduction-oxidation chemistry.

(DE) Prerequisite(s): Chemistry 130.

512 Environmental Transport and Kinetics (3) Engineering principals that govern the transport, fate, and treatment of pollutants in natural and engineered systems. Material balance equations; convection and dispersion; diffusion and mass transfer; interfacial phenomena; chemical kinetics; reactor design and modeling.

(DE) Prerequisite(s): Chemistry 130, Civil Engineering 390, Mathematics 231 and 241.

513 Environmental Microbiology (3) Fundamental aspects of microbiology governing environmental and engineered applications emphasizing bioenergetics, enzyme and microbial kinetics, metabolic diversity, microbial ecology and biochemical cycling.

Comments: Graduate standing in science or engineering or consent of instructor 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 hydraulic; HEC-1; HEC-2; floodway encroachment; flood hazard zone and damage potential determinations; case 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 selection and design of treatment 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 multilayered aquifer systems. Modeling of complex ground water systems that will include: the development and implementation of conceptual, analytical and numerical models. Numerical approaches to the solution of PDEs that describe flow through porous media: boundary conditions, stability, existence and uniqueness. (Same as Geology 535.)

(DE) Prerequisite(s): 485 or Geology 485 or consent of instructor.

543 Instrumentation and Measurement (3) (See Biosystems Engineering 543.)

550 Advanced Applications in Water and Waste Treatment (3) Theory and design applications of physiochemical and biological processes for the treatment of drinking water, municipal and industrial wastewaters, and contaminated groundwater.

(DE) Prerequisite(s): Civil Engineering 380.

(DE) Corequisite(s): 512 and 513.

558 Solid and Hazardous Waste Management (3) Magnitude and characteristics of solid and hazardous waste problems; collection systems; design and treatment and disposal systems; landfills, incineration, stabilization, composting, and remediation technologies; remedial investigations and feasibility studies; industrial solid and hazardous waste treatment; current and future regulations.

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

574 Air Pollution Engineering and Control (3) Introduction to the fundamentals of air pollution, light scattering and visibility reduction, air quality laws and regulations, estimating concentrations from emission factors, theory and design of settling chambers, cyclone separators, wet collectors, fabric filters, electrostatic precipitator and control methods for gaseous air pollutants.

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

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. Maximum 9 hours.

650 Environmental Engineering Laboratory (3) Experimental measurements of water quality and advanced laboratory investigation of water/waste treatment and environmental restoration processes. Emphasis is placed on research methods, experimental design, and application of laboratory data to field scale solutions.

Contact Hour Distribution: 1-hour lecture and one 4-hour lab.

(DE) Prerequisite(s): 511, 512, 513.

653 Pollutant Fate Modeling and Risk Assessment (3) Application of scientific principles concerning movement and fate of chemicals at interfaces of air, water, and earthen solids in environment. Methods of assessing risk posed by presence of those chemicals.

(DE) Prerequisite(s): 574.

671 Advanced Concepts of Air Pollution Engineering (3) Multidisciplinary approach to the principles and chemistry of incineration, adsorption theory and design of adsorbers in transient state, absorption theory and column design, applications and chemistry of non-thermal plasma, computational design and optimization of air pollution control facilities.

(DE) Prerequisite(s): 574.

672 Air Pollution Dispersion Modeling (3) Diffusion of air pollution in the atmosphere; application of USEPA computer models for atmospheric dispersion from industrial, area, mobile sources, and spills; evaluation of meteorological data and comparison of model predictions to ambient measurements; new source review and permitting requirements.

(DE) Prerequisite(s): 574.

691 Special Topics in Environmental Engineering (3) Selected advanced problems of current interest.

Repeatability: May be repeated. Maximum 6 hours.

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.

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).

523 Biomechanics (3) Biomechanical principles and applications to analyses of human movements. Quantitative analysis of human movements.

533 Exercise Physiology (3) Physiology of human performance: acute and chronic effects of exercise on metabolic, cardiac, pulmonary, and skeletal systems.

541 Special Topics (1-3) Advanced study in selected areas of exercise science.

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.


569 Clinical Exercise Physiology (3) Cardiac structure and function, interpretation of 12-lead electrocardiograms, exercise considerations for cardiac and pulmonary patient.

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.

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

593 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade.

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

601 Research Seminar (1) Research topics in different aspects of exercise science, sport psychology, and sport sociology. (Same as Sport Studies 601.)

622 Directed Independent Research (3-6) Grading Restriction: Satisfactory/No Credit or letter grade.

623 Advanced Topics in Obesity (1-4) (Same as Animal Science 623.)

633 Advanced Methods and Instrumentation in Biomechanics (3) Focus on methods and instrumentation commonly used in biomechanics. Provides practical experience and theoretical foundations for selected topics in two-/three-dimensional kinematics, anthropometric models and parameters, force measurements and force platform, pressure distribution measurements, two-dimensional/three-dimensional kinetics, muscle electrical activity and electromyography, and other related methods.

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.)

661 Seminar in Exercise and Applied Physiology (1-3) Selected topics in exercise and environmental physiology.

664 Research Participation in Exercise Science (1-6) Participation in research with faculty member whose interests coincide with those of student.

681 Practicum (1-3) Intern experience in areas of major interest.

693 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade.

Finance (349)

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.

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.

512 Problems in Financial Management (3) Readings and cases that apply finance theory to real-world investment, financing, and asset management problems.

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.


571 International Finance (3) Issues in international finance, focusing on international financial markets, as well as multinational companies and how they operate in multiple levels of business activities within multiple countries.

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 real estate and availability of funds for real estate lending. Effects of government intervention (taxation, subsidization, and regulation) in both real estate and mortgage markets.

593 Independent Study (3) Directed research and study.

Comment(s): For doctoral students. Others must obtain consent of instructor.

Recommended Background: Basic biomechanics course 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.
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.
(DE) Prerequisite(s): 641.
Registration Permission: Consent of instructor.


Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.

501 Seminar (1) Individual reports and discussion on topics from current literature.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 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.

515 Advanced Food Chemistry (3) 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.

(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): 420 and 429.

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 hour 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.


Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.

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Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 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.

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Registration Permission: Consent of instructor for non-majors.

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(DE) Prerequisite(s): 320 and 340 or consent of instructor.


Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Consent of instructor.

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Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.

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Repeatability: May be repeated. Maximum 15 hours.
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Repeatability: May be repeated. Maximum 15 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.
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. Repeatability: May be repeated. Maximum 9 hours. 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. Recommended Background: Completion or near completion of foreign language hours for certification. Comment(s): Requires admission to teacher education.

466 Assessment and Evaluation (3) Highlights the implementation of authentic assessment, specifically, portfolio assessment for ESL students in K-12 settings. Focuses on designing appropriate tools for various assessment purposes. Specific types and different forms of assessment are examined based on their effectiveness and meaningfulness. Required for Tennessee (PreK-12) licensure. Comment(s): Requires admission to teacher education or consent of instructor.

476 Teaching English as a Second Language (3) Examines ESL pedagogy, practices, research, and instructional strategies that accommodate students at all levels of ESL/EFL settings. Required for Tennessee (PreK-12) licensure. Comment(s): Requires admission to teacher education or consent of instructor.

555 Foreign Language in the Elementary Schools Practicum (3) Experiences designing, implementing and assessing second language instruction in elementary school setting. (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.

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, trends and issues in English as a second language. (DE) Prerequisite(s): 578 or consent of instructor.

Forestry (396)

422 Forest and Wildland Resource Policy (3) Policy formulation and 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.
Forestry, Wildlife and Fisheries (398)

416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildland 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 (3) Identification and analyses of issues regarding forestry, wildlife, fisheries and wildland 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: Students cannot earn credit for Forestry, Wildlife and Fisheries 420 and 520.

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.

592 Off-Campus Research (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.


Registration Permission: Consent of instructor.

603 Research Planning (1-15) Preliminary research and investigation of dissertation research topic.

Repeatability: May be repeated. Maximum 21 hours.

610 Interdisciplinary Analysis of Natural Resource Problems (2) Selected issues in natural resources and natural resource management at regional, national, or international level. Development of interdisciplinary approach to addressing problems: evaluating current state of knowledge, developing alternative actions to address problems, and identifying criteria for evaluation of alternatives.

612 Seminar in Natural Resources (1) Current issues and developments in natural resources. All natural resource doctoral students must complete 612 twice during their program of study.

Repeatability: May be repeated. Maximum 2 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 the writers from Lyon and members of the Pléiade.

(DE) Prerequisite(s): 300-level literature course.

412 French Literature of the 17th-Century (3) Masterpieces of 17th-century French literature. (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.

414 French Literature of the 19th-Century (3) French Romanticism and its counter movements – Realism, Parnassianism, and Naturalism. (DE) Prerequisite(s): 300-level literature course.

415 French Literature of the 20th-Century (3) Evolution of 20th-century French literature. (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 Romance Languages.

(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.)

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 arts. (DE) Prerequisite(s): 300-level literature course.

432 Contemporary French Culture (3) Current French cultural issues placed in historical perspective with a comparative emphasis.

(DE) Prerequisite(s): 351 or 352.

500 Thesis (1-15)

Grading Restriction: P/NP 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.

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. (Same as German 515; Spanish 515.)
### Courses of Instruction

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>519</td>
<td>Bibliography and Methods of Research</td>
<td>3</td>
<td>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.</td>
</tr>
<tr>
<td>520</td>
<td>French and Francophone Film</td>
<td>3</td>
<td>French and Francophone culture through film.</td>
</tr>
<tr>
<td>530</td>
<td>French and Francophone Theater</td>
<td>3</td>
<td>Changing approaches to French and Francophone Theater.</td>
</tr>
<tr>
<td>540</td>
<td>French Literature and Culture I</td>
<td>3</td>
<td>Literary and cultural heritage of French Middle Ages.</td>
</tr>
<tr>
<td>550</td>
<td>French Literature and Culture II</td>
<td>3</td>
<td>Literary and cultural heritage of 16th- and 17th-century France.</td>
</tr>
<tr>
<td>560</td>
<td>French Literature and Culture III</td>
<td>3</td>
<td>Literary and cultural heritage of 18th- and 19th-century France.</td>
</tr>
<tr>
<td>570</td>
<td>French and Francophone Literature and Culture I</td>
<td>3</td>
<td>Literary and cultural heritage of France and other Francophone countries from the first part of 20th-century.</td>
</tr>
<tr>
<td>573</td>
<td>French and Francophone Literature and Culture II</td>
<td>3</td>
<td>Literary and cultural heritage of France and other Francophone countries from the late 20th-century to present.</td>
</tr>
<tr>
<td>580</td>
<td>Critical Moments in French and Francophone Studies, or Linguistics</td>
<td>3</td>
<td>Contribution of France and Francophone world to evolution of literature, society, and ideas. Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>584</td>
<td>Modern Theory and Criticism</td>
<td>3</td>
<td>Survey of 20th-century critical theory, including psychoanalysis, Marxism, structuralism, and more. Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>591</td>
<td>Foreign Study (1-15)</td>
<td></td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
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<tr>
<td>592</td>
<td>Off-Campus Study (1-15)</td>
<td></td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
</tr>
<tr>
<td>593</td>
<td>Independent Study (1-15)</td>
<td></td>
<td>Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 15 hours.</td>
</tr>
<tr>
<td>594</td>
<td>French Directed Readings (3)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>595</td>
<td>French Directed Readings (3)</td>
<td>3</td>
<td></td>
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<tr>
<td>600</td>
<td>Doctoral Research and Dissertation (3-15)</td>
<td></td>
<td>Repeatability: May be repeated.</td>
</tr>
<tr>
<td>610</td>
<td>Doctoral Seminar in French and Francophone Studies, or Linguistics (3)</td>
<td>3</td>
<td>Content varies. Repeatability: May be repeated with consent of department. Maximum 12 hours.</td>
</tr>
</tbody>
</table>

**Geography (415)**

<table>
<thead>
<tr>
<th>Course Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>410</td>
<td>Global Positioning Systems and Geographic Data</td>
<td>3</td>
<td>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.</td>
</tr>
<tr>
<td>411</td>
<td>Introduction to Geographic Information Science</td>
<td>3</td>
<td>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.</td>
</tr>
<tr>
<td>412</td>
<td>Advanced Cartography Techniques</td>
<td>3</td>
<td>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.</td>
</tr>
<tr>
<td>413</td>
<td>Remote Sensing: Types and Applications</td>
<td>4</td>
<td>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): 132.</td>
</tr>
<tr>
<td>414</td>
<td>Spatial Databases and Data Management</td>
<td>3</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 10 hours. Credit Restriction: A maximum of 4 hours may be applied toward the MS. A maximum of 4 hours may be applied toward the PhD.

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 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): 411 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. Registration Permission: Consent of instructor.

518 GIS Project Management (3) Interactions between management, technical, and application aspects of Geographic Information Systems project through simulated environment of real-world GIS sites. (DE) Prerequisite(s): 411 or consent of instructor.

519 Graduate Practicum in Cartography/Remote Sensing/GIS (2-6) 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.

522 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. (DE) Prerequisite(s): 435 or consent of instructor.

536 Topics in Watershed Dynamics (3) Trends, problems and methods in study of watershed processes. Repeatability: May be repeated with consent of instructor. Maximum 6 hours. Registration Permission: Consent of instructor.

540 Topics in Urban/Economic Geography (3) Analysis of research on urban systems, internal morphology, urban problems, urban spatial behavior, and regional economic development. Repeatability: May be repeated with consent of instructor. Maximum 9 hours. (DE) Prerequisite(s): 340 or 441.

541 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) Graduating 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) Graduating 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) Graduating 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.

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.

613 Seminar in Natural Hazards (3) Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.

623 Seminar in Dendrochronology (3) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 432 or consent of instructor.

633 Seminar in Physical Geography (3) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 533 or consent of instructor.

634 Seminar in Climatology (3) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 534 and 532 or consent of instructor.

635 Seminar in Biogeography (3) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 535 or consent of instructor.

641 Seminar in Urban/Economic Geography (3) Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 541 or consent of instructor.

643 Seminar in Rural Geography (3) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 443 or consent of instructor.

649 Seminar in Geography of Transportation (3) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 549 or consent of instructor.

663 Seminar in Geography of the American South (3) Repeatability: 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 hours lecture. Recommended Background: Introductory geology and calculus or consent of instructor.

410 Mineral Science (3) Crystal chemistry of the rock-forming minerals. Interaction of electromagnetic radiation and crystalline solids. Optical properties of minerals, visible and infrared spectroscopy, and X-ray diffraction. Laboratory exercises emphasize thin section and X-ray diffractometer methods of mineralogy. Contact Hour Distribution: 2 lectures and one 2-hour lab. Recommended Background: Mineralogy or consent of instructor.

440 Field Geology (5) Summer field course for advanced undergraduate and first-year graduate students in geology. Taught off-campus and requires the full time of the student. The 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 a week 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 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 will be covered. 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 or structural geology or consent of instructor.

473 Principles of Near-Surface Geophysics (3) Basics of several standard near-surface geophysical techniques (for example, seismic reflection, electromagnetic induction, electrical resistivity, magnetics, and EM), using state-of-the-art field equipment to develop the skills necessary to process and interpret data. Includes a significant field component. Recommended Background: Introductory calculus.

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.) Contact Hour Distribution: Introductory calculus, physics, and geology.

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

525 Data Analysis for Geoscientists (3) Overview of datasets, data analysis, and statistical methods as applicable to earth sciences. Recommended Background: Introductory geology and introductory calculus.

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 hours lecture and one 2-hour lab. Recommended Background: Advanced mineralogy or consent of instructor.

533 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 remote sensing, light scattering models, instrumentation for remote sensing, calibration and atmospheric removal, multi- and hyperspectral image cube analysis, and ground-truthing techniques. Emphasis on working directly with remote sensing data to solve geologic problems. 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; biotic 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: Mineralogy, geochemistry and sedimentology and stratigraphy or consent of instructor.

561 Organic Geochemistry (3) Fundamentals of organic geochemistry; primary production, diagenesis, and preservation of organic matter in the sedimentary record; 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, biogeochemistry, 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 spectroscopy 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.
575 Tectonics (4) Evolution of Earth’s lithosphere in context of plate tectonics theory. Formation of continents through comparative anatomy of mountain belts, including Appalachians, Alps, Urals, Caledonians, Cordillera, Andes, and Himalayas.
Contact Hour Distribution: 3 hours lecture and 1 seminar.
Recommendaed Background: Structural geology course.
Registration Permission: Consent of instructor.

580 Planetary Science (3) Broad survey in planetary science. Emphasis on fundamental physical principles, quantitative problem solving, and canonical derivations in planetary science. Topics include orbital dynamics, heating and energy transport, atmospheric physics and chemistry, planetary surface processes, planetary interiors, origin and evolution of the solar system, and extrasolar planets.
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.
Credit Restriction: Only 3 hours may be applied to the geology major.
Registration Permission: Consent of instructor.

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 completion of graduate coursework requirements.
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.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

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) 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.

680 Seminar in Planetary Science (3) 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.

695 Seminar in Planetary Sciences (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.
Registration Permission: Consent of instructor.

419 German Fairy Tales and Literary Fantasies (3) Examination of how and why forms of literary fantasies ranging from apocalyptic dreams to enchanted visions have changed over the centuries. Strong interdisciplinary component, tracing interconnections between philosophy, psychology, religion and literary history, as well as exploring the relationship between binary, musical and artistic representations of specific themes.
Recommended Background: 6 hours of courses covering German history, excluding 331 and 332.

420 Selected Topics in German Literature from 1750 to the Present (3)
Recommended Background: 6 hours of 300-level courses, excluding 331 and 332.

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, and Proto-Indo-European, and other proto-languages. (Same as French 426; Linguistics 426; Russian 426; Spanish 426.)
Recommended Background: 6 hours of upper-division foreign language courses, excluding courses in translation or graduate reading courses.

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.
Recommended Background: 6 hours of courses covering German culture, excluding 331 and 332.

432 German Creative Thinking: Interdisciplinary Dialogues (3) Interdisciplinary connections between German literature and art, music, philosophy, theatrical praxis, psychology, dance, anthropology, history, and the sciences. Comparative analyses of literary and non-fictional texts, films, and other media.
Recommended Background: 6 hours of courses covering German culture, excluding 331 and 332.

433 Nation, Race, and Ethnicity (3) Examination of cultural constructions of nation, race, and ethnicity and how they have challenged each other and developed in German-speaking countries since the 18th 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.
Recommended Background: 6 hours of courses covering German culture, excluding 331 and 332.

434 Extraordinary Wo(Men)-Outcasts, Rebels, Martyrs and Saints (3) Examination of German texts and visual media that have challenged mainstream thinking throughout the centuries. Strong interdisciplinary component focusing on literary and artistic forms that depict struggles involving religion, politics and gender.
Recommended Background: 6 hours of courses covering German culture, excluding 331 and 332.
435 Structure of the German Language (3) Contrastive English-German segmental and suprasegmental phonemes, contrastive English-German linguistic structures, selected topics in advanced German grammar and syntactic analysis. (Same as Linguistics 435.)

Recommended Background: 6 hours of upper-division German language courses, excluding courses in translation and graduate reading courses.

436 History of the German Language (3) Development of the 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.)

Recommended Background: 6 hours of upper-division German language courses, excluding courses in translation and graduate reading courses.

485 Business German (3) German used in fields of business, government, administration, and economics.

Recommended Background: 6 hours of upper-division German, excluding courses in translation and 331 and 332.

494 German Community Service Practicum (1) Supervised by the director of the lower-division German program. Students either assist German classes at local schools or perform supervised service with local institutions that promote awareness of German culture among the general public.

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.

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.

515 Technology Enhanced Language Learning (3) (See French 515.)

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 9 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 Language and Literature (3) 1890-1945 (3) Content varies.

Repeatability: May be repeated. Maximum 6 hours.

556 Modern German Language and Literature (3) 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) Repeatability: May be repeated. Maximum 9 hours.

562 Directed Readings in German Language and Literature (3) 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)

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)

Repeatability: May be repeated. Maximum 18 hours.

632 Seminar in German and Germanic Philology (3)

Repeatability: May be repeated. Maximum 18 hours.

Global Studies (440)

482 Special Topics in Global Cinema (3) (See Modern 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. (Same as Safety 406.)

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.

435 Substance Use and Abuse (3) Drug and alcohol abuse problems and suspected causes. Pharmacology of drugs and effects on society. Strategies for intervention and education.

465 Aging and Health (3) Aging process in a health perspective as it relates to health promotion and wellness of the aged.

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.

520 Sex Education and Human Sexuality (3) Advanced in-depth discussion of educational and health counseling theory, techniques, materials used in school, community, or health care facility.

530 Health Promotion and Health Education Program Development (3) Theories and principles of health promotion program development; methodology, marketing, public relations. Health education as vehicle for health promotion.

540 Evaluation in Health Promotion and Health Education (3) Evaluation principles and methodologies as related to health promotion products, processes and programs. Construction of instruments for use in assessing health education outcomes.

570 Special Topics (1-3) For graduate students, in-service teachers and other health professionals. Health/wellness or health promotion issues.

Repeatability: May be repeated. Maximum 12 hours.

585 Seminar in Gerontology (1) Scope of gerontology as discipline and as related to other academic and professional disciplines. Speakers both internal and external to the University of Tennessee, Knoxville. (Same as Counseling Education 585; Educational Psychology 585; Exercise Science 585; Nursing 585; Public Health 585; Social Work 585; Sociology 585.)

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 3 hours.

Registration Permission: Consent of instructor.

590 Research Methods in Health (3) Basic research techniques in variety of health settings. Development of research skills and problem identification for research topic. (Same as Public Health 590; Safety 592.)

593 Directed Independent Studies (1-3) Individual identification and study of health/wellness or health promotion problem/issue. Specific proposal must be presented to instructor before registration.

Repeatability: May be repeated. Maximum 12 hours.
Higher Education Administration (461)

455 Seminar in Student Leadership (1) Topics to be assigned. Designed to develop knowledge and skills in leadership roles for resident assistants, student government leaders, student activities, and other student organizations. Grading Restriction: P/NP only. Repeatability: May be repeated. Maximum 12 hours.

500 Thesis (1-15) Grading Restriction: P/NP only. 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. May not be used toward degree requirements. 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.

513 Administrative and Organizational Theory (3) (See Educational Administration 513.)

514 Leadership Themes in Literature (3) Review and analysis of selected literature works – novels, biographies, poetry, plays, essays, personal letters and speeches; history – for lessons that enhance understanding of leadership role, values, and effectiveness.

516 Research Methods (3) (See Educational Administration 516.)

533 Program Evaluation in Education (3) (See Educational Psychology 533.)

534 Program Evaluation in Education (3) (See Curriculum, Educational Research, and Evaluation 534.)

536 Policy Issues in Higher Education Quality Assurance (3) Exploration of historic and contemporary approaches to definition and demonstration of quality in education and examination of contemporary policy issues related to quality assurance.

537 Student Assessment in Higher Education (3) Outcome assessment in American higher education: origins of assessment policies, rationales for assessment policy and practice, constructs and outcomes typically assessed, methods for conducting assessment, and uses of assessment data. Philosophies, priorities, and values, recent assessment efforts in higher education.

542 The College Student and the Court (3) Legal precedent affecting student personnel services in public higher education. Student discipline, housing, dress, organizations, activities fees, tuition and related federal regulations.

543 American Higher Education in Transition (3) History, philosophy, purposes, functions, organizations and programs in American higher education.

570 Student Affairs Administration in Higher Education: Theory and Practice (3) Historical, philosophical and organizational perspective. Functional areas comprising field and major issues.
History (462)

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

501 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 Foundations of Graduate Study in History (3) Assumptions and methods of historians. Required of all candidates for advanced degrees.

511 Teaching World History (3) Methodology, conceptualization, historiography, text book selection and syllabus construction to prepare students to teach courses in world history.

513 Teaching United States History (3) Methodology, conceptualization, historiography, text book selection and syllabus construction to prepare students to teach courses in U.S. history.

515 Introduction to American History to 1840s (3) Survey of major themes, methodologies, and interpretations in early American historiography.

516 Introduction to American History, 1840s – present (3) Survey of major themes, methodologies, and interpretations in modern American historiography.

521 MA Readings (3) Directed readings in preparation for MA examinations.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Open only to master's candidates in history.

529 Topics in Late-Antique/Early-Medieval History (3) Reading seminar: European history, c. 200-600 CE. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

530 Topics in Medieval History (3) Reading Seminar: European history, c. 600-1400 CE. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

Repeatability: May be repeated. Maximum 15 hours.

532 Topics in Modern Europe (3) Reading seminar: movements and trends multinational in focus. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

533 Topics in European National History (3) Reading seminar: international topics; usually British, Russian, German, or French. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

541 Topics in Early American History (3) Reading seminar. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

542 Topics in 19th-Century United States (3) Reading seminar. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

543 Topics in 20th-Century United States (3) Reading seminar. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

544 Topics in U.S. Environmental History (3) Reading seminar. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

551 Topics in the History of Foreign Relations (3) Reading seminar. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

552 Topics in Military History (3) Reading seminar: military history, military operations, social impact of war, and naval strategy in foreign policy.
Repeatability: May be repeated. Maximum 15 hours.

555 Topics in United States Social and Economic History (3) Reading seminar. Social or economic history of European nations. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

556 Topics in European Social and Economic History (3) Reading seminar. Social or economic history of European nations. Focus varies.
Repeatability: May be repeated. Maximum 15 hours.

557 Topics in Cultural and Intellectual History (3) Reading seminar. 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 Meeting Planning, Special Events, and Convention Management (3) Management techniques used in the execution of meetings, marketing, conventions, and special events. Emphasis on integration of management principles and strategic planning.

(DE) Prerequisite(s): 210, 211, and 390 or consent of instructor.

500 Thesis (1-15)
Grading Restriction: P/INP 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 service industry. Implications of trends and their managerial and strategic applications in service 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. Maximum 6 hours.
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. Maximum 3 hours.

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

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

614 Trends and Issues in Hospitality and Tourism (3) Examination of contemporary issues in hospitality and tourism.

615 Literature and Thought in Hospitality and Tourism (3) Evaluation of hospitality and tourism management literature with emphasis upon research literature, development of scholarly thought, and identification of potential areas of further study.

Human Resource Development (529)

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.

503 Problems in Lieu of Thesis (3)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

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.

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

602 Designing Effective Organizations (3) Survey of major topics and perspectives in organization theory and design including consideration of organizations as complex systems. Organizational environments, structure, culture, decision-making, organizational learning and change. (Same as Management 621.)
Registration Permission: Consent of instructor.

603 Seminar in Macro Organizational Behavior (3) Study of current theory and research in organizational behavior focused at the macro level. Attention to behavioral choice and decision making in organizations. (Same as Management 622.)
Registration Permission: Consent of instructor.

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 ergonomic 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.
Human Resource Management (530)

503 Problems in Lieu of Thesis (1-3) Company project. Preliminary investigation of significant strategic human resource management-related issue (new initiative or significant organizational change to enhance organizational effectiveness) in a sponsoring organization. Work within company under guidance of faculty to develop proposal that defines issue and scope of project. Proposal to be approved by company and faculty. 
Repeatability: May be repeated. Maximum 3 hours.
(DE) Prerequisite(s): 556. 
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

530 Employment Law and Labor Relations (3) Examination of the current legal environment of human resource management as it applies to effective workplace relations between the employer and employees, employment discrimination, labor relations, employee rights, and collective bargaining processes.
(DE) Prerequisite(s): Management 521.
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

535 Applied Training and Development (3) Examination of the strategies and techniques of training systems, including needs assessment, motivation to learn, transfer of training, evaluation, and performance improvement as such systems satisfy both organization needs and personal career goals.
(DE) Prerequisite(s): Management 521.
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

540 Staffing (3) Examination of the processes and practices that facilitate effective human resource management planning, recruitment, and placement of employees in relation to the organization’s present and future needs.
(DE) Prerequisite(s): Management 521.
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

545 Compensation and Benefits (3) Examination of the development and implementation of reward systems in order to achieve strategic organizational objectives. Reward systems include compensation, benefits, legal compliance, and cost containment policies as they apply in both the U.S. and international business environments.
(DE) Prerequisite(s): Management 521.
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

555 Strategic Human Resource Management (3) Examination of the role of human resource management in creating and sustaining competitive advantage. Contemporary issues such as globalization, outsourcing, workforce diversity, mergers and acquisitions, downsizing, and occupational health, safety, and security are explored in terms of their strategic value.
(DE) Prerequisite(s): Management 521.
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

592 Internship (3) The organizational experience provides additional human resource knowledge and assists the student in research and career advancement.

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.
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 prearrangement 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.

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: 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 – 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): 306 and 402.

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.

Recommended Background: 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.

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 affecting manufacturing system design. Case studies and team projects. (Same as Mechanical Engineering 508.)

Registration Permission: Consent of instructor.

514 Advanced Information Systems Analysis and Design (3) Systems analysis and 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; relationship between statistical process control techniques and classical statistical tools; parameter estimation; hypothesis testing; goodness-of-fit tests; 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 uncertainties; inequivalence; using non-probabilistic techniques; capital financing and project allocation; evaluating involving equipment replacement, investor-owned utilities, and public works projects; probabilistic risk analysis including computer simulation and decision trees; multi-attribute decision analysis; and other advanced topics.

(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 manned 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.

521 Advanced Human Factors Engineering Methodology (3) Advanced methodologies used in human factors engineering. Observation 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, nonlinear, multivariable functions; search techniques; decision making under uncertainty; game theory; and dynamic programming.

(DE) Prerequisite(s): 301 or Engineering Management 537.

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 realism, reliability 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 seminar 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.

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 if topic differs. Maximum 6 hours.

Registration Permission: Consent of instructor.

592 Special Topics in Industrial Engineering (1-3) Individual or group research projects.

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

Registration Permission: Consent of instructor.
593 Special Topics in Industrial Engineering (1-3) Individual or group research projects. Repeatability: May be repeated if topic differs. Maximum 6 hours. Registration Permission: Consent of instructor.

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; artificial intelligence in complex decision analyses. (DE) Prerequisite(s): 518 and 523.

602 Nonlinear Optimization (3) (See Management Science 651.)

605 Probabilistic Methods in Engineering Systems (3) Application of probabilistic methods to selected problems in engineering systems. (DE) Prerequisite(s): 516.


651 Advanced Topics in Industrial Engineering (3) Forum to study individually or in groups. Repeatability: May be repeated if topic differs. Maximum 6 hours. Comment(s): Requires graduate standing. Registration Permission: Consent of instructor.

652 Advanced Topics in Industrial Engineering (3) Forum to study individually or in groups. Repeatability: May be repeated if topic differs. Maximum 6 hours. Comment(s): Requires graduate standing. Registration Permission: Consent of instructor.

653 Advanced Topics in Industrial Engineering (3) Forum to study individually or in groups. Repeatability: May be repeated if topic differs. Maximum 6 hours. 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): 549. Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

549 Enterprise Applications, Security and Controls (3) Examines the use and audit of enterprise information systems used to achieve strategic and operational advantage, support managerial decision making, and achieve operational control. Application database design, data security and control issues are also examined. Registration Permission: 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 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.

510 Information Environment (3) Generation, production, management, dissemination, and use of information. Roles of information in society, information seeking and user behavior, information industry, economics of information products and services, technological and organizational change, information professions, and issues.

520 Information Representation and Organization (3) The structure and organization of intellectual content regardless of format. Emphasis on how content is created, exchanged, and stored so it can be found. Includes standards and best practice for describing and characterizing intellectual content.

521 Cataloging and Classification (3) Basic library-oriented cataloging and classification techniques, tools, and supporting operations. Descriptive cataloging, choice and form of non-subject entries, subject heading work, general classification, authority control, bibliographic utilities, online library catalogs.

523 Abstracting and Indexing (3) Philosophies, standards, and procedures for manual and automatic document indexing, back-of-the-book indexing, vocabulary control, thesaurus construction, and abstracting.

530 Information Access and Retrieval (3) Information access, retrieval, and use. Information seeking, user interfaces, information services and tools. Database structure, search engines, query logic, and evaluation of retrieval system performance.

531 Sources and Services for the Social Sciences (3) Information sources in political science, sociology, psychology, geography, history, anthropology, business, and education.

532 Sources and Services for Science and Engineering (3) Information sources in engineering, physical and life sciences.

533 Sources and Services for the Humanities (3) Information sources in philosophy, religion, fine arts, performing arts, literature and language. Organization and management of regional collections.

534 Government Information Sources (3) Selection, acquisition, organization, and utilization of government information in variety of formats from legislative, judicial and executive branches of federal, state, local, and international government and intergovernmental agencies.

535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, e.g., non-bibliographic formula and structure databases, contents-page/full-text databases, patents; document delivery alternatives, evaluation, and testing.

536 The Information Society (3) Competing theoretical positions and definitions regarding the existence and importance of the information society; historical evolution and selected key contributors of information society theories; issues of globalization including critical perspectives of economic, social, political, and cultural aspects.

537 Information Industry (3) Issues and trends concerning information industry: products and services. Standards, enabling technologies, choice of distribution media, entrepreneurial opportunities. Legal, ethical, and quality concerns.

538 Economics of Information (3) Costing and pricing of information; value of information and value added services; cost-benefit analysis and tradeoffs; policy issues related to economic aspects of information exchange and transfer.

539 Information Policy (3) Role of government in creation and exchange of information; review of key national and international policy areas relevant to information creation, production, and distribution; development of information policy for organizations.

540 Research Methods for Information Professionals (3) Research methods in a variety of information environments; primary and secondary research, research project design; research results interpretation; analysis of published research; techniques supporting research process.

550 Management of Information Organizations (3) Supervisory and management concepts, strategies, and techniques applicable to information professionals working in libraries, archives, records management, and other information organizations.

551 School Library Media Centers (3) Planning, implementing, and evaluating school library programs. Curricular involvement, role of technology, site-based management, relationships with district and state services.
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.
Recommended Background: Completion of core and pertinent advanced courses relevant to student’s practicum design.
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, and access and retrieval. Research opportunities and methods. Relationship to and interaction with other disciplines.

680 Information Science Theory (3) Intensive study of theories of information including the definitions of information, information sciences, and information technology. Focus on the intersection of theory and information representation, retrieval, and transfer; theories of human behavior, organizational behavior and information; standards and technologies for information processing and distribution, bibliometrics and infometrics; exploration of relationships with theories of other disciplines.

Instructional Technology (569)

521 Computer Applications in Education (3) Use and integration of technology in educational settings to support teaching and learning.
Recommended Background: Basic computer operations or consent of instructor.

566 Administering Instructional Media Programs (3) Leadership roles and responsibilities of professional media administrator in variety of organizational settings.

569 Media and Technology Production Techniques (3) Workshop strategy; basic photography, audio production, multi and single camera TV production, basic digital video editing, and other media/technology techniques important for improving communication in variety of presentation or instructional settings.

570 Instructional Systems Design (3) Application of theory and research of instructional systems design to solve instructional problems in educational settings.

571 Desktop Publishing for Educators (3) Use of computer-based desktop publishing and graphics software and related hardware in designing and producing instructional and informational products.

573 Introduction of 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.
Registration Permission: 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.

678 Seminar in Instructional Technology (1) Readings and discussions based on current literature, research, theories and practices in instructional technology.
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, Health, and Cultural Studies (572)

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.

518 Educational Specialist Research and Thesis (3)
Grading Restriction: P/NP only.
Repeatability: May be repeated. Maximum 9 hours.

531 Independent Study (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 12 hours.

549 Supervised Readings (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 12 hours.

595 Special Topics (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 12 hours.

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

601 Foundations of Research, Scholarship and Doctoral Study (3) Introduction to PhD program concentrations in ITES: research requirements, meaning of scholarship in academe and issues/problems in education.
Comment(s): Admission to a PhD program in ITHCS 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.
Registration Permission: Consent of instructor.

693 Independent Study (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 9 hours.

694 Supervised Readings (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 9 hours.

695 Special Topics (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 9 hours.

Italian (584)

401 Dante and Medieval Culture (3) Introduction to the significance of this great Italian writer. (Same as Medieval Studies 401.)
(DE) Prerequisite(s): 212 or consent of instructor.

402 Petrarch and Boccaccio (3) (Same as Medieval Studies 402.)
(DE) Prerequisite(s): 212 or consent of instructor.

403 Literature of the Rinascimento (3) From Pulci to Tasso, Quattrocento and Cinquecento.
(DE) Prerequisite(s): 212 or consent of instructor.

409 Directed Readings (3)

411 Aspects of Modern Literature and Culture (3) Representative works of modern literature and culture.

412 Advanced Literary Reading and Conversation (3) Representative works of contemporary literature and culture.
422 Topics in Italian Cinema (3) Examination of Italian cinema from 1930 to the present focusing on feature films, documentaries and, depending on the topic of the course, on literary works in light of political, cultural, and social contexts. Films are shown in Italian with English subtitles. (Same as Cinema Studies 422.)
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Open to non-majors. Majors will read texts and write papers in Italian.

510 Readings in Italian Literature (3) Topics vary. Repeatability: May be repeated. 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)
Repeatability: May be repeated. Maximum 15 hours.

Japanese (589)

451 Readings in Pre-Modern Japanese Literature (3) (See Asian Languages 451.)
452 Readings in Modern Japanese Literature (3) (See Asian Languages 452.)

Journalism and Electronic Media (592)

412 Opinion Writing (3) Analysis of editorial positions and practices. Writing editorialials/columns for newspapers, magazines, corporate publications, and electronic media (radio, television, cable, Internet), with emphasis upon study and use of rhetorical devices and logic. Registration Permission: Consent of instructor.

414 Magazine and Feature Writing (3) Techniques of writing features and in-depth articles for mass circulation and specialized magazines or newspapers. Organizing and presenting material with attention to problems in areas such as business, science, agriculture, and the humanities. (DE) Prerequisite(s): 203 or consent of instructor.

415 Magazine Industry Workshop (3) Introduction to the magazine industry including management, design, writing and editing, and interactivity. Analysis of print and electronic format magazines. Planning new products for the marketplace. (DE) Prerequisite(s): 414 or consent of instructor.

430 Public Affairs Reporting (3) Reporting (including database reporting) and writing about courts, government and public agencies. Event and issue-oriented journalism of politics and public affairs. (DE) Prerequisite(s): 315.

433 Editing and Layout for Print/Web (3) Editing and layout for newspapers, magazines, and online publishing. (DE) Prerequisite(s): 203 or consent of instructor.

450 Writing About Science and Medicine (3) Writing workshop to analyze exemplary pieces of successful science writing and write series of articles for general public based on scientific journals, news conferences, technical meetings and interviews. (Same as Information Sciences 450.)
Registration Permission: Consent of instructor.

451 Environmental Writing (3) Writing for news media (including the Internet) on such environmental issues as sprawl, forests, air pollution, energy, and invasive species. Students hear presentations from and interview experts in environmental science and reporting. Exemplary environmental writing is analyzed. Registration Permission: Consent of instructor.

456 Science Writing as Literature (3) Survey of important science writing for the general public across the spectrum of science, engineering, and medicine. Works by authors such as Arthur C. Clarke, Stephen J. Gould, and Richard Selzer will be analyzed for literary qualities in a quest to understand why some science writing succeeds.

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. Regulatory, 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. 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 topics and hours by advisor required.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated.
Comment(s): Admission to a degree program in Communication and Information required.

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 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.

511 Environmental 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.

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.)


(DE) Prerequisite(s): 544.

591 International Study (1-9) Individual or group study abroad. Academic research, field investigation, and/or studio experiences. Determination of credit based on particular international experience. Repeatability: May be repeated. Maximum 12 hours. Registration Permission(s): Consent of instructor and approval of graduate program in landscape architecture.

592 Off-Campus Study (1-9) Individual or group study in the United States. Academic research, field investigation, and/or studio experiences. Determination of credit based on particular off-campus experience. Repeatability: May be repeated. Maximum 12 hours. Registration Permission(s): Consent of instructor and approval of graduate program in landscape architecture.

593 Independent Study in Landscape Architecture (1-9) Independent study on an issue of mutual interest between the student and faculty member. Repeatability: May be repeated. Maximum 15 hours. Registration Permission(s): Consent of instructor and approval of graduate program in landscape architecture.

Latin American Studies (600)

430 Contemporary Brazilian Studies (3) (See Portuguese 430.)

432 Topics in the Literature and Culture of Portuguese-speaking World (3) (See Portuguese 432.)

456 Latin American Government and Politics I (3) (See Political Science 456.)

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 to 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 IV (Fundamental principles of American constitutional law, federalism, reparation 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.

(DE) Prerequisite(s): 520 for students electing concentration in advocacy.

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.

(DE) Prerequisite(s): 818.

821 Administrative Law (3) Administrative agency decision-making processes and judicial review of administrative decisions: procedural standards for informal and formal administrative adjudication and rule-making (attention to federal Administrative Procedure Act); constitutional due process standards in administrative settings; and availability, scope and timing of judicial review of agency actions.

822 Legislation (3) Interpretation and drafting of statutes, legislative process, and legislative power; comparison of judicial views on legislative process with both realities of legislative process and applicable constitutional principles.


827 Business Associations (4) Legal problems associated with the formation, operation, and dissolution of unincorporated and incorporated business firms; legal rights of duties of firm participants (principals and agents; partners, joint venturers, limited partners, limited liability partners, and members and managers of limited liability companies; and corporate shareholders, directors, and officers) and others with whom those participants interact in connection with the firm’s business.

828 Corporate Finance (3) Legal issues arising in conjunction with the purchase, sale, and repurchase of securities in capital formation and investment transactions, including: private and public debt, equity, and convertible securities offerings; dividends and other shareholder distributions; and mergers and acquisitions.

(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 anti-fraud provisions; periodic reporting and other disclosure requirements; the regulation of proxy solicitations, tender offers, and securities transactions involving officers, directors, and other insiders; and the regulation of stock markets and professional service providers in the securities industry.

(DE) Prerequisite or (DE) Corequisite: 827.
833 Representing Enterprises (3-5) Capstone course for concentration in business transactions. Simulated business transactions and completion of major planning drafting project. Transactions vary: formation of new business, acquisition of existing business, development of real estate project, various financing transactions and corporate reorganization.

Repeatability: Not repeatable. May be taken once for 3-5 hours.
(DE) Prerequisite(s): 818, 826, 827, 840, 842, 940, and 972.
Recommended Background: Completion of all courses for concentration in business transactions.

Comment(s): Up to two of the prerequisites may be taken as corequisites.

834 Antitrust (3) Federal antitrust laws; monopolization, price-fixing, group boycotts, and anticompetitive practices generally; government enforcement techniques and private treble damage suits.

840 Commercial Law (4) Basic coverage of most significant provisions of Uniform Commercial Code: security interests in personal property (Art. 9 of U.C.C. and relevant Bankruptcy Code provisions); commercial paper, including checks, notes and other negotiable instruments (Arts. 3 and 4 of U.C.C.); sales of goods, including coverage of portions of Art. 2 of U.C.C. not covered in Contracts.

842 Contract Drafting Seminar (2) Practical fundamentals of drafting contracts of different types.

843 Debtor-Creditor Law (3) Basic elements of federal bankruptcy law: claims, property of estate, automatic stay, trustee’s avoidance powers, assumption and rejection of contracts, priority of distributions, and distinction between liquidation and rehabilitation. Enforcing judgments outside of bankruptcy.

844 Business Reorganizations and Workouts (3) An examination of reorganization under chapter 11 of the United States Bankruptcy Code; from petition date to confirmation of a plan of reorganization as well as coverage of the use of extensions, compositions, workouts and other non-bankruptcy methods of adjusting the rights or parties to business transactions. Although not required as prerequisites, an understanding of the subject matter of Commercial Law and especially Debtor/Creditor law is strongly recommended. The course satisfies the expository writing requirement.

847 Advanced Constitutional Law (2-3) Advanced study of issues in American constitutional law. Specific course offerings vary. Subjects include: constitutional structure of American governmental institutions, federalism, separation of governmental powers: relationship between legislative and executive branches, relationship among states and between states and federal government, and constitutional amendment process; state constitutional law, Tennessee constitution and differences between state and federal constitutional law; Bill of Rights and 14th Amendment to Constitution: constitutional rights as protected by Bill of Rights and 14th Amendment.

Repeatability: May be repeated if topic differs. Maximum 9 hours.
(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 proceedings 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 allocate 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.

Repeatability: Not repeatable. May be taken once for 2-3 hours.

895 Labor Relations Law (3) Political, social and economic influences in development of federal labor relations laws; employee rights of self-organization; union and employer unfair labor practices; strikes, lockouts, boycotts, and collective bargaining processes; enforcement of collective agreements; individual rights of employees; federal preemption and state regulation.

896 Law of the Workplace (3) Explores federal and state regulation of the employment relationship. Focuses on state common-law doctrines, particularly the employment “at-will” doctrine and its erosion through contract (e.g., employee handbooks), tort (e.g., fraud and defamation), and public policy claims. Addresses limits on employee conduct, including non-compete agreements and trade secret protections; laws dealing with whistleblowers, retaliation, and workplace privacy; and constitutional protections of employees’ free speech and free association rights. Considers federal legislation on minimum wage and overtime, family and medical leave, and ERISA.

897 Employment Discrimination Law (3) Surveys the major federal statutes dealing with discrimination in employment, including the Civil Rights Act of 1964, the Equal Pay Act, the Age Discrimination in Employment Act, and the Americans with Disabilities Act. Considers discrimination based on an employee’s status (e.g., race, sex, sexual orientation, religion, age, and disability), sexual harassment, reverse discrimination, and affirmative action. Examines state law; aspects of practice in this area, particularly administrative requirements for pursuing discrimination litigation.
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 resolution, initiating and defending claims, conducting factual investigations, and presenting evidence.

Credit Restriction: May not receive credit for both 905 and 946 or both 905 and 947.

(DE) Prerequisite(s): 920.

Comment(s): Third-year standing required.

908 Mediation Clinic (3) Mediation process, theory, strategy, tactics and skills through readings, simulations, and service as mediators in general sessions court and other settings: mediation ethics, relationship of mediation to other dispute resolution methods, roles of attorneys in mediation, and writing of mediation agreements.

(DE) Prerequisite(s): 914 or participation in ABA Representation in Mediation Competition or substantial prior mediation training demonstrated to the satisfaction of the instructor.

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 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 jurors; opening and closing arguments. Written work: pleadings, motions, interrogatories or memoranda.

(DE) Prerequisite(s): 813 (except students in advocacy concentration).

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.

(DE) Prerequisite(s): 920.

923 Complex Litigation (3) Advanced civil procedure course dealing with the special problems that arise in litigation involving multiple claims and multiple parties – permissive and compulsory joinder; intervention; disposition of duplicative or related litigation; class actions; discovery in large cases; judicial control of complex litigation; res judicata and collateral estoppel problems.

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.

Comment(s): Not open to students who have taken 904 or 905.

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.

Comment(s): Not open to students who have taken 927.

935 Gratuitous Transfers (3) Gifts; will substitutes; nature, creation, termination and modification of trusts; intestate succession; execution, revocation, probate and contest of wills; statutory protections against disinheritance and introduction to powers of appointment; basic problems of will construction, powers of attorney, and planning for disability and death.

937 Estate Planning Seminar (2) Estate planning problems: relationship to estate planning of law and practice of fiduciary administration, insurance, property, wills, future interests, trusts, corporations, and partnerships. Required drafting of estate plans and implementing documents.

(DE) Prerequisite(s): 935 and 973.

Recommended Background: Intellectual property course.

Comment(s): Limited enrollment.

940 Land Finance Law (3) Financing devices: mortgages, deeds of trust and land contracts; problems of priorities; transfer of secured interests when debt assumed or taken subject to security interest; default, exercise of right to redemption; mechanics lien and materialmen's liens; bankruptcy and mechanics lien laws.

943 Land Use Law (3) Private land use controls: nuisance, easements, real covenants, equitable servitude and home owner associations; public land use controls: zoning, subdivision controls, eminent domain, and regulatory takings.

946 Business Law Clinic (6) Supervised fieldwork assuming substantial responsibility for representing clients with various business and transactional matters. Exploration and development of fundamental professional skills involved in practicing business and transactional law. Interviewing and counseling clients, negotiating with other attorneys and parties, planning, negotiating and documenting transactions and dispute resolutions, conducting factual investigations and legal audits of businesses, and monitoring and ensuring compliance with federal, state and local statutes, rules and regulations.

Credit Restriction: Students may not receive credit for both 946 and 905.

947 Prosecution Externship (6) Supervised fieldwork required to be admitted to practice as prosecutor and to assume substantial responsibility for prosecution in one of criminal cases in state or federal courts. Classes on Tennessee or federal criminal law and procedure and prosecution function. Under direct supervision of full-time, experienced prosecutor and other professional prosecutors in office. Assist in investigation of crimes, interview and preparation of witnesses, drafting of relevant documents, negotiation and formal presentation of guilty pleas, presentation of cases to grand jury, and representation of government in preliminary hearings and felony trials.

Credit Restriction: Students may not receive credit for both 947 and 905.

(DE) Prerequisite(s): 813, 920, and either 854 or 855.

Comment(s): Third-year standing required.

Registration Permission: Consent of instructor.

949 Judicial Externship (4) Supervised fieldwork in selected state and federal trial and appellate courts. Students identify legal issues in pending cases, conduct legal research, prepare legal memoranda, and perform other judicial clerk duties under the direction of the assigned judge. Course is designed to refine the student's research and writing skills to enhance the student's appreciation of the application of bodies of law already learned; to familiarize the student with court procedures, judicial decision-making, and the deliberative process; and to permit the student to observe and evaluate the style and demeanor of judges and lawyers in order to contemplate the development of their own professional style. Students are required to maintain a daily work log and weekly activities journal and to attend and participate in orientation and classroom component.

Grading Restriction(s): Satisfactory/No Credit grading only.

Registration Permission: Consent of instructor.

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 and procedural aspects of infringement actions, 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, enabling description, novelty, and non-obviousness; infringement; ownership and licensing; and remedies. Emphasizes essential legal principles, useful as background for non-patent lawyers and as a foundation for patent lawyers.

Recommended Background: Intellectual property course.

Comment(s): Science or engineering background not required.
956 Entertainment Law (3) Role of law and lawyer in entertainment industry. Course content varies. Music industry: music copyright laws; artist/manager relationships; recording contract negotiations; industry labor unions; and performing right organizations.

957 Law, Science and Technology (3) Legal implications of advanced technologies; adaptation of law to challenges posed by new kinds of knowledge and new ways of doing things. Biotechnology, regulation of scientific research, space law, legal issues related to new information technologies, nanotechnologies, and others designated by instructor.

958 Women and The Law (3) Treatment and status of women in American legal system: women as political actors, as family members, as participants in workforce, as targets of violence and as members of legal profession; introduction to current competing approaches to gender justice.

959 Intellectual Property (3) Intellectual property and related interests under federal and state law: patents; trademarks; trade secrets; copyright; right of publicity; unfair competition.

962 Law and Medicine Seminar (2) Effects of legal rules on delivery and quality of medical care nature of physician-patient relationship; unauthorized practice of medicine; medical education, licensing and specialization; hospital staff privileges; medical malpractice liability: standard of care, proof, causation, defenses, and damages; protection of patient autonomy; Consent, informed consent, conception and abortion, choice of treatment, and death and dying; control of communicable diseases; organ transplantation and medical resource allocation.

963 Health Care Law and Regulation (3) Surveys legal issues confronting the American health care system, considering federal and state law. Topics include quality control; licensing and accreditation; access to health care, including private health insurance, managed care, Medicare, Medicaid, and emergency health care; privacy regulations; relationships between health care entities and physicians; fraud and abuse regulations; antitrust considerations; and research restrictions. Satisfies expository writing requirement if student elects to write a paper.

964 Health Care Policy (2) Considers ethical perspectives on health care policy, relating to decisions both on individual patient care and on systemic resource allocation. Considers basic theories of bioethics, including how these ethical perspectives may inform analysis of current issues in health care law and policy and how they are expressed in the national policy debate. Topics include organizing and financing health care, quality and accountability in health care, equality and discrimination in access to health care, privacy issues raised by new technology, legal and ethical issues in managed care, and tort reform. Satisfies the perspectives requirement.

965 Community Development (3) Considers legal issues faced by under-represented constituencies. Students work on law-related field projects under lawyer supervision, collaborating with organizations that serve or advocate for the under-represented in and around Knoxville. Projects may include classroom talks, and the creation, development or production of law-related written materials, skits, interactive workshops, videos, or Web pages. Satisfies the perspectives requirement.

966 Community Legal Education (3) Considers how to advance the law-related education of under-represented constituencies. Under lawyer supervision, students work on law-related education projects for the under-represented in and around Knoxville. Projects may include classroom talks, and the creation, development or production of law-related written materials, skits, interactive workshops, videos, or Web pages. Satisfies the perspectives requirement.

967 Media Impact on Justice (3) Explores the impact that the media has on the perception and reality of justice in the United States, including its impact on courts, counsel, legislatures, and executive branches.

972 Income Taxation of Business Organizations (3) Survey and comparative analysis of federal patterns of income taxation of partnerships, subchapter C corporations, subchapter S corporations, and limited liability companies; introduction to transactional analysis and business planning. Required written exercises: drafting of portions of partnership agreements, opinions, memoranda, and legal memoranda.

973 Wealth Transfer Taxation (3) Taxation of gratuitous transfers of wealth during life (gift tax) and at death (estate tax) and of generation skipping transfers.

975 Tax Theory (3) Method and purposes of governmental revenue collection through examination of economic and political theory; comparative analysis of various actual and proposed patterns of taxation: income tax, consumption tax, sales tax, and value-added tax. Required preparation of expository essay on aspect of tax theory chosen by student.

978 Transactional Tax Planning (3) Advanced study of taxation of business organizations and related business acquisitions, tax planning for financially troubled entities, and review of recent transactions involving cutting-edge tax planning and shaping changes in law.

980 Insurance (3) Types of insurance: life, property, health, accident and liability insurance; regulation of insurance industry; interpretation of insurance contracts; insurer's interest requirement; conditions, warranties and representations; coverage and exclusions; duties of agents; excess liability; subrogation; and bad faith actions against insurers. Liability insurance defense problems: duty to defend, notice and cooperation issues, and conflicts of interest.

985 Workers' Compensation (3) Workers' Compensation system for compensating victims of work-related accidents and diseases; requirements for covered employer-employee relationship; accidental injuries or occupational diseases arising out of and in course of employment; causation; nature of medical, disability, and death benefits; exclusiveness of compensation remedy against employer and co-employees; and rights and liabilities of non-employees: administrative and procedural aspects of Workers' Compensation practice; and various law reform measures.

990 Issues in the Law (3) Selected topics.

991 Issues in the Law Seminar (2) Selected topics.

992 Field Placement (1-4) Supervised fieldwork, overseen by full-time faculty, in professional placement selected by student and faculty and structured to maximize the experiential learning of the participating student. Students are required to submit a weekly journal describing and analyzing the experience, and to meet regularly with the supervising faculty member.

993 Directed Research (1-2) Independent research and writing under direct supervision of faculty member. Proposals must be approved by the supervising faculty member and by the dean or the dean's designee.

994 Independent Study (1-4) Independent study under direct supervision of faculty member. Proposals must be approved by the supervising faculty member and by the dean or the dean's designee.

995 Field Placement (1-4) Supervised fieldwork, overseen by full-time faculty, in professional placement selected by student and faculty and structured to maximize the experiential learning of the participating student. Students are required to submit a weekly journal describing and analyzing the experience, and to meet regularly with the supervising faculty member.

996 Law Review (1) Performance of duties as staff member or editor of the Law Review. Responsibilities vary each semester: writing of case synopsis, writing of article, and/or performing other assigned duties related to operation. Members of Transactions who are not on senior editorial board receive one hour of credit for successfully completing two consecutive semesters of service. Members of senior editorial board receive two hours of credit for each full year of satisfactory service.

997 Tax Theory (3) Method and purposes of governmental revenue collection through examination of economic and political theory; comparative analysis of various actual and proposed patterns of taxation: income tax, consumption tax, sales tax, and value-added tax. Required preparation of expository essay on aspect of tax theory chosen by student.


997 Moot Court (1) Participation as member of faculty-supervised inter-scholastic moot court competition. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 4 hours.

998 Planning and Drafting Project (1) Preparation and completion of planning and drafting project under faculty supervision in conjunction with substantive courses when such planning and drafting option is provided by course instructor. Repeatability: May be repeated. Maximum 4 hours.

Life Sciences (621)

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 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 15 hours.

510 Special Topics in Life Sciences (1-3) Specializations in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethnology; 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. Grading Restriction: Satisfactory/No Credit grading only.

516 Introduction to Genome Science and Technology II (1) Science and ethics of practice of science. Grading 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. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 hours.

541 Colloquium (1) Invited speakers. Topics announced in advance. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 12 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.

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

615 Journal Club in Genome Science and Technology (1) Reading and discussion based on current literature. Grading 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 linguistic thought from the Hebrews and Greeks through modern times. Readings from Boas, Sapir, Bloomfield, and others. Recommended Background: 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.)

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 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.

520 Integrated Logistics Management (3) Focus on logistics as a value-adding process that achieves time and place synchronization of demand with operational fulfillment. Emphasis placed on challenges related to providing logistical support for procurement, manufacturing and marketing-distribution.

(DE) Prerequisite(s): Business Administration 513. Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

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: 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.

624 Managing the Strategy Process (3) Managers at the apex of an organization; the roles and processes undertaken to form strategic direction. Who is involved, their strategic actions, processes, decision making over time, and performance/strategic outcomes.

Registration Permission: Consent of instructor.

Management (625)

440 Organizational Psychology (3) (See Psychology 440.)

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.

521 Foundations of Human Resource Management (3) Examination of the theoretical foundations, historical development, and contemporary practice of human resource management (HRM). Core human resource management areas are surveyed, including employment law, employee rights and employer responsibilities, job analysis, job design, measurement of individual differences, performance management, career development, training, and employee/management relationships.

545 Organizational Behavior and Development (3) Examination of individual group and organizational issues that affect and shape organizations. Topics include individual differences, motivation, communication, decision making, leadership, power, organizational structure and design, and change.

551 Management of New Ventures (3) Integration of various functional disciplines and their application to general management of ventures formed both within larger corporations and independently. Preparation of a venture plan, case analysis.

571 International Management (3) Analysis of environment of international business firms and impact of internal and external factors on managerial decisions.

593 Directed Independent Study (1-3) Topic of mutual interest. Available only by prearrangement with supervising faculty member.

Grading: Satisfactory/No Credit or letter grade.

Repeatability: May be repeated. Maximum 6 hours.

595 Selected Topics in Current Management Issues (3) In-depth consideration of current issues. Managerial impact of emerging topics.

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.

621 Designing Effective Organizations (3) (See Human Resource Development 602.)

622 Seminar in Macro Organizational Behavior (3) (See Human Resource Development 603.)

623 Overview of Strategic Management (3) Survey of research and theory focusing on the interrelationship among strategy, structure, and performance at the organizational and industry levels. Business strategy, corporate strategy, governance, performance, environmental and industry forces, resource-based views of the firm.

Registration Permission: Consent of instructor.

624 Managing the Strategy Process (3) Managers at the apex of an organization; the roles and processes undertaken to form strategic direction. Who is involved, their strategic actions, processes, decision making over time, and performance/strategic outcomes.

Registration Permission: Consent of instructor.

625 Contemporary and Global Issues in Strategic Management (3) Political, economic, legal, and technological sectors of the global environment. Social responsibility and ethics, the role of culture, cross-cultural communications, negotiations, and decision-making.

Registration Permission: Consent of instructor.

626 Special Topics (1-3) Recent developments in management.

Repeatability: May be repeated: Maximum 6 hours.

Registration Permission: Consent of instructor.

Management Science (627)

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.

526 Advanced Applications of Systems Modeling and Simulation (3) (See Industrial Engineering 526.)

531 Mathematical Programming (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis, linear-fractional, piecewise-linear, separable and integer programming, transportation linear programming.

Recommended Background: Fundamentals of matrix algebra course.

532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory.

(DE) Prerequisite(s): Statistics 563 and mathematical analysis course or consent of instructor.

533 Computational Mathematical Programming (3) Computational aspects of mathematical programming models, in particular for large systems.

(DE) Prerequisite(s): 531 and proficiency in computer language.

534 Management Science Methods in Business (3) Application of methods from 531, 532, and 533 to real world problems in business/industry.

551 Leveraging Information Through Descriptive and Prescriptive Modeling (3) Concepts and tools for emulating business operations (descriptive modeling) and for determining optimal operational or tactical strategies (prescriptive modeling). Visualization, optimization, and simulation concepts reinforced through hands-on experience with technologies: geographic information systems (GIS), spreadsheet-based models, simulation packages, and supply chain optimization software.

593 Management Science Problems (1-6) Directed study on subject of mutual interest.

Repeatability: May be repeated. Maximum 9 hours.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Repeatability: May be repeated.

631 Integer Programming (3) Theoretical and computational aspects of linear programming with integer variables, branch and bound, cutting plane, and group theoretic algorithms.

(DE) Prerequisite(s): 531 or equivalent.

651 Nonlinear Optimization (3) Kuhn-Tucker theory in nonlinear programming, solution procedures for constrained and unconstrained nonlinear programs, search techniques, quadratic programming, duality and sensitivity analysis. (Same as Industrial Engineering 602.)

(DE) Prerequisite(s): 531 or equivalent and proficiency in computer language.

681 Special Topics (3) Repeatability: May be repeated. Maximum 9 hours.

(DE) Prerequisite(s): 531 and 532.

Registration Permission: Consent of instructor.

691 Management Science Seminar (1) Subjects selected from current literature.

Grading Restriction: Satisfactory/No Credit grading only.

692 Management Science Seminar (1) Subjects selected from current literature.

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.

510 Principles of Marketing Management for Non-MBA Students (3) For students from other disciplines interested in obtaining knowledge of marketing discipline at graduate level.

520 Marketing and Customer Value (3) Frameworks, techniques, and processes required for customer relationship management and demand planning in organizations. Twin problems of analyzing markets and customers and translating these analyses into actionable marketing strategies.
(DE) Corequisite(s): Business Administration 513.
Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

536 MBA Global Marketing Communications (3) Strategies and tactics associated with communicating value to customers in an integrated and globally-aware manner. Professional selling, sales force management, advertising, public relations, and promotions management. Global aspects address the opportunities and challenges of managing integrated marketing communications globally. Where the MBA hub course is designed to be more strategic in nature, this course is more tactical and analytically driven upon a solid understanding of marketing strategy and demand/supply integration.
(DE) Prerequisite(s): 520 and Business Administration 513.

557 MBA Global Product and Brand Management (3) Complex, inter-disciplinary nature of product development and product management in a global context. Strategic issues during product life cycle, from idea conception to product development to commercialization to eventual product discontinuation. Cross-national forces that enable firms to design and maintain competitive marketing and supply chain networks across multiple geographic locations. Builds on a solid understanding of marketing strategy and demand/supply integration.
(DE) Prerequisite(s): 520 and Business Administration 513.

593 Independent Study (3) Directed research and study.
Repeatability: May be repeated. Maximum 6 hours.
Recommended Background: 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 frameworks common to business research. Historical and philosophy of science perspectives. (Same as Logistics 611.)

612 Quantitative Research Methods (3) Quantitative research process: problem formulation, Measurement reliability, validity and scale development, Experimental design and analysis, survey design and analysis, sampling, ethical considerations, and international issues in quantitative research. (Same as Logistics 612.)

613 Qualitative Research Methods (3) Examination of qualitative research theoretical foundations and methodologies. Application of qualitative research methods to theory building research. Topics include formulating research questions, designing qualitative research studies, sampling, data generation techniques, data analysis techniques, evaluating qualitative research, and writing qualitative research reports.

614 Contemporary Marketing Thought (3) Representative topics comprising content of marketing knowledge: macromarketing, markets, channels, and 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 frameworks 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.

(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 orthopedic, cardiovascular, and dental surgical implant devices. Corrosion and degradation problems. Material properties of primary importance and tissue response to synthetic materials. (Same as Biomedical Engineering 474).
(DE) Prerequisite(s): 201.

476 Overview of Intermetallic Compounds and Composites (3) Fabrication and processing, Ultraline-grained materials nanotechnology. Thermodynamics and stability. Microstructural characterizations. Mechanical properties, corrosion and oxidation properties. Theoretical modeling. 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. Maximum 6 hours.
Credit Restriction: For MS students, a maximum of 3 hours may be applied to the major. For PhD students with MS, a maximum of 3 hours may be applied to the major. For PhD students directly from BS, a maximum of 6 hours may be applied to the major.
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. Maximum 6 hours.
Credit Restriction: For MS students, a maximum of 3 hours may be applied to the major. For PhD students with MS, a maximum of 3 hours may be applied to the major. For PhD students directly from BS, a maximum of 6 hours may be applied to the major.
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.

525 Welding Metallurgy (3) Welding processes; physical metallurgy of welding; phase transformations; heat flow; residual stresses; theories of hot craking, cold cracking and porosity formation; applications to process utilization.

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.

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, etc., and stress corrosion.

(DE) Prerequisite(s): 470 or consent of instructor.


Recommended Background: Course in mechanical behavior.

540 Basic Polymer Chemistry (3) Synthesis, reactions and degradation of polymers. Molecular characterization: solution methods and spectroscopy.

Recommended Background: 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.

Recommended Background: 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. Support instrumentation includes linear viscoelastic rheometry, capillary viscometry, 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.

553 Nonwovens Science and Technology (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.

Recommended Background: Organic chemistry course or consent of instructor.

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): 360 or equivalent.

572 X-Ray Diffraction (3) Symmetry of crystals, space group theory, reciprocal lattice and application to definition of structures; powder and single crystal X-ray techniques; introduction to crystal structure determination and characterization of orientation; application to inorganic, metallic and polymer structures.

576 Special Topics in Materials Science and Engineering (3) Topics of current significance and interest.

Repeatability: May be repeated. Maximum 6 hours.

Registration Permission: Consent of instructor.

578 Advanced Biomaterials: Biological Applications of Nanomaterials (3) Focuses on the biological/medical uses of nanoscale materials. Includes the following topics: 0-1, 1-100 nm materials and characterization with an emphasis on surface properties; chemical and biological functionalization of nanomaterials and nano-bio interfaces. Biological and biomedical application of nanomaterials. (Same as Biomedical Engineering 578.)

(DE) Prerequisite(s): 474.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.


Registration Permission: Consent of faculty committee.

588 Cell and Tissue-Biomaterials Interaction (3) Study of the fundamental principles involved in materials/cell and tissue interactions. Students will learn the underlying cellular and molecular mechanisms in host response to biomaterials. Emphasis will be placed on the integration of biomaterials/neuronal cells and tissue interactions into the design of neural implants (sensors, scaffolds, and therapeutics delivery modalities, etc.). (Same as Biomedical Engineering 588.)

(DE) Prerequisite(s): 474.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

600 Doctoral Research and Dissertation (3-15)

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

610 Structure and Dynamics of Materials (3) Focuses on understanding how the structure of a material and the dynamics of its constituent atoms determine its behavior. Topics that will be covered include crystal structure, lattice dynamics, and tensor properties as well as experimental methods used to study these areas.

(DE) Prerequisite(s): 511 and 512.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

611 Fundamentals of Thermodynamics, Phase Transformations, and Material Simulations at Small Length Scales (3) Covers fundamentals of thermodynamics of materials at small length scales, particularly as related to the dynamics of phase transformations. Topics will include fundamentals of statistical mechanics, mean-field Landau theory of phase transformations, and dynamics of phase transformations. Basics will be illustrated using various simulation methods, including molecular dynamics, Monte Carlo simulations, and phase-field modeling. Topics will be chosen according to time and student's interests.

(DE) Prerequisite(s): 511.

Comment(s): Prior knowledge may satisfy prerequisites, with 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) Seminar 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 chemistry 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.

644 Optoelectronic Processes in Polymeric Materials (3) This course introduces fundamental molecular orbital and energy band theories and discusses (1) optical and electronic properties of polymeric materials, (2) principles, design and characterization of polymer optoelectronic devices, and (3) applications of laser spectroscopy in polymer characterization. The focus is to understand electron related processes and opto-electronic characterizations 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.

650 Mechanical Behavior of Solids at Elevated Temperatures (3) Metals, ceramics, polymers, and composites will be included. Topics include: temperature effect on stress-strain behavior, anelasticity, damping, creep, creep mechanisms, strengthening at high temperatures, creep rupture, deformation map and engineering application, environmental effects, high-temperature indentation, high temperature plastic forming, superplasticity, creep-fatigue interaction, life prediction. Provides scientific knowledge to face and solve material problems encountered in high temperature applications.

(DE) Prerequisite(s): 511 and 512.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

652 High Performance Fibers (3) Reviews the structure and properties of fibers and fiber formation methods, and discuss the principles of forming high performance fibers. Topics that will be covered include HS HM PE fibers, gel spinning, PVA fibers, HSM fibers from cellulose, Nylon66 & PET, LC Polymers, fiber formation from LCPs, aromatic fibers, flame resistant organic fibers, carbon fibers, inorganic fibers, nanofibers, optical fibers, biodegradable fibers, absorbent fibers, etc.

(DE) Prerequisite(s): 553.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

666 Nanoindentation and Small-Scale Contact Mechanics (3) Basic principles of elastic and plastic contact as they influence the measurement of mechanical properties by load and depth sensing indentation methods. Application of nanoindentation techniques to small scale mechanical characterization of metals, ceramics, and polymers.

(DE) Prerequisite(s): 512.

672 Introduction to Transmission EM and Electron Diffraction (3) Fundamentals of electron scattering, reciprocal space, the Ewald Sphere construction. Basic electron optics, operation of the transmission electron microscope TEM (includes some laboratory sessions) and sample preparation. The kinematic theory of imaging of perfect and imperfect crystals in the TEM. Problems and 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 Topographer, 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.

674 Materials Physics (3) Starts with the description of the electronic states in regular crystals, and extends it to surfaces, interfaces, defects, amorphous and liquid state and strongly correlated electron systems including magnetism. Also, advanced experimental methods to study the electronic states and atomic structure are discussed.

(DE) Prerequisite(s): 511 and 512.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

675 Advanced Structural Analysis (3) Introduces graduate students in materials science, physics, chemistry and biochemistry to modern methods of structural characterization using x-rays and neutrons. After a quick review of the basics, theories and practices necessary to carry out and utilize these advanced techniques will be covered.

(DE) Prerequisite(s): 511 and 512.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

676 Advanced Topics in Materials Science and Engineering (3) Latest developments and/or advanced special topics.

Repeatability: May be repeated. Maximum 9 hours.

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. Maximum 6 hours.

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 classroom.

(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 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.

(DE) Prerequisite(s): 142 or 148 or 152.

411 Mathematical Modeling (3) Construction and analysis of mathematical models used in science and industry. Projects emphasized.

Recommended Background: Courses in differential equations and linear algebra.

421 Combinatorics (3) Introduction to problems of construction and enumeration for discrete structures such as sequences, partitions, graphs, finite fields and geometries, and experimental designs.

(DE) Prerequisite(s): 323.
423 Probability (3) Axiomatic probability, univariate and multivariate distributions, conditional distributions and expectations, moment generating functions, laws of large numbers and central limit theorem. 
(DE) Prerequisite(s): 241 and 323.

424 Stochastic Processes (3) Markov chains, Poisson processes and Brownian motion, Other topics as selected by instructor. 
(DE) Prerequisite(s): 423.

425 Statistics (3) Standard statistical distributions, independence of mean and variance for a Gaussian sample, basic limit theorems; point and interval estimation, tests of statistical hypotheses, Neyman-Pearson theorem; likelihood ratio and other parametric and nonparametric tests. 
(DE) Prerequisite(s): 423.

(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 and 241 or 247.

443 Complex Variables (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.

446 Advanced Calculus II (3) Continuation of 445. 
(DE) Prerequisite(s): 445.

447 Honors: Advanced Calculus I (3) Honors version of 445. 
(DE) Prerequisite(s): 341.

448 Honors: Advanced Calculus II (3) Continuation of 447. 
(DE) Prerequisite(s): 447.

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.

456 Abstract Algebra II (3) Continuation of 455. 
(DE) Prerequisite(s): 455.

457 Honors: Abstract Algebra I (3) Honors version of 455. 
(DE) Prerequisite(s): 351.

458 Honors: Abstract Algebra II (3) Continuation of 457. 
(DE) Prerequisite(s): 457.

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.

462 Differential Geometry (3) Classical differential geometry of curves and surfaces: Frenet frames, first and second fundamental forms, Gauss curvature and mean curvature, geodesics and parallel transport, the Gauss-Bonet theorem, geometry of the hyperbolic plane. 
Recommended Background: Multivariable calculus (241 or 247).

467 Honors: Topology (3) Includes topology of line and plane, separation properties, compactness, connectedness, continuous functions, homeomorphisms, continua, and topological invariants. 
(DE) Prerequisite(s): 300 and 241 or 247.

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. 
(See Computer Science 471.)
Recommended Background: Course in basic numerical methods.

(See Computer Science 472.)
Recommended Background: Course in basic numerical methods and linear algebra.

475 Industrial Mathematics (3) Modeling, analysis, and computation applied to scientific/technical/industrial problems. 
Recommended Background: Course in differential equations and familiarity with an operating system and a programming language.

490 Readings in Mathematics (1-3) Open to superior students. Independence 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.

510 Applied Mathematics Laboratory (1) Computer applications in applied mathematics: software packages for matrix analysis, symbolic algebra, and differential equations. 
Repeatability: May be repeated. Maximum 2 hours. 
(DE Corequisite(s): 511.

511 Methods in Applied Mathematics I (3) Fundamentals and techniques associated with discrete models of physical, engineering and biological systems: difference equations, networks and graphs, optimization, and other topics. 
Recommended Background: Courses in advanced calculus and linear algebra.

512 Methods in Applied Mathematics II (3) Fundamentals and techniques associated with continuous models of physical, engineering, and biological systems: development, solution and qualitative analysis of ordinary and partial differential equations, and calculus of variations. 
(DE) Prerequisite(s): 511.

Recommended Background: Advanced courses in ordinary and partial differential equations and advanced calculus.
514 Mathematical Principles of Fluid Mechanics II (3) Continuation of 513. (DE) Prerequisite(s): 513.

515 Analytical Applied Mathematics I (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.
Recommended Background: Courses in advanced calculus, linear algebra, and either advanced differential equations or 512.

516 Analytical Applied Mathematics II (3) Continuation of 515. (DE) Prerequisite(s): 515.

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 I (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 II (3) Continuation of 521. (DE) Prerequisite(s): 521.

523 Probability I (3) Probability spaces and random variables, expectation, characteristic functions, convergence of random variables.
Recommended Background: One year of advanced calculus and 323.

524 Probability II (3) Continuation of 523. Law of large numbers, central limit theorem, conditional expectation, martingales. Other topics as selected by instructor. (DE) Prerequisite(s): 523.

525 Statistics I (3) Formulation of statistical models, sufficiency; methods of estimation and optimal theory, asymptotic efficiency; the confidence procedure and hypothesis testing, uniformly most powerful tests; Bayesian statistics.
Recommended Background: One year of advanced calculus and 425.

526 Statistics II (3) Continuation of 525. Estimation and tests in general linear models; non-parametric models, rank methods for comparison, robust tests. Other topics as selected by instructor. (DE) Prerequisite(s): 525.

527 Stochastic Modeling (3) Variable topics in probability applied to real world situations. Topics may include queuing theory, branching processes, Monte Carlo simulation, stochastic finance and other topics as selected by instructor.
Recommended Background: One year of advanced calculus and one year of undergraduate probability or mathematical statistics.

529 Seminar in Stochastics (1-3) Repeatability: May be repeated. Maximum 12 hours.

Recommended Background: One year of advanced calculus and undergraduate differential equations.

532 Ordinary Differential Equations II (3) Continuation of 531. The nonlinear theory of differential equations including Liapunov stability, critical point analysis, and Poincare-Bendixson theory. (DE) Prerequisite(s): 531.

534 Calculus of Variations (3) Necessary and sufficient conditions for weak and strong extrema in one-dimensional variation problems; Lagrangian mechanics. Multiple integrals. Basic elements of direct methods.
Recommended Background: At least one senior-level course in differential equations or advanced calculus. Mathematical maturity.

Recommended Background: One year of advanced calculus.


537 Mathematical Principles of Continuum Mechanics I (3) Conservation principles, equations of equilibrium and motion for fluids and elastic solids, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory.
Recommended Background: Courses in advanced calculus and advanced differential equations.

538 Mathematical Principles of Continuum Mechanics II (3) Continuation of 537. (DE) Prerequisite(s): 537.

539 Seminar in Differential Equations (1-3) Repeatability: May be repeated. Maximum 12 hours.

545 Real Analysis (3) Measure theory, Lebesgue integration, Hölder and Minkowski inequalities, Radon-Nikodym theorem, Fubini's theorem.
Recommended Background: One year of advanced calculus.

546 Complex Analysis (3) Holomorphic functions, Cauchy's theorem, Maximum Modulus theorem, Schwarz's lemma, normal families, Riemann mapping theorem.
(DE) Prerequisite(s): 545.

547 Applied Linear Analysis (3) Banach and Hilbert spaces, linear operators and spectral theory, Sobolev spaces, applications. (DE) Prerequisite(s): 545.

549 Seminar in Analysis (1-3) Repeatability: May be repeated. Maximum 12 hours.

551 Modern Algebra I (3) Groups and rings.
Recommended Background: One year of undergraduate abstract algebra.

552 Modern Algebra II (3) Continuation of 551; modules, fields and Galois theory. (DE) Prerequisite(s): 551.

555 Number Theory I (3) Introduction to algebraic number theory.
Recommended Background: One year of undergraduate abstract algebra.

556 Number Theory II (3) Continuation of 555.

559 Seminar in Algebra (1-3) (DE) Prerequisite(s): 556.

561 Topology I (3) Topological spaces and continuous functions, separation axioms, product and quotient topologies, connectedness, compactness, complete metric spaces.
Recommended Background: One year of advanced calculus.

562 Topology II (3) Continuation of 561. Fundamental group and covering spaces. (DE) Prerequisite(s): 561.

Recommended Background: One year of advanced calculus.

568 Riemannian Geometry II (3) Continuation of 567. (DE) Prerequisite(s): 567.

569 Seminar in Topology and Geometry (1-3) Repeatability: May be repeated. Maximum 12 hours.

571 Numerical Mathematics I (3) Direct and iterative methods for linear systems. The algebraic eigenvalue problem and the singular decomposition theorem. Newton and quasi-Newton methods for systems of nonlinear equations. (Same as Computer Science 571.) Recommended Background: Courses in advanced calculus and basic numerical analysis.


574 Finite Element Methods (3) Finite element techniques for solution of boundary and initial-boundary value problems. Variational formulation. Finite dimensional subspaces and their approximating properties; rates of convergence. Computer implementation. (Same as Computer Science 574.) Recommended Background: Courses in partial differential equations, linear algebra and numerical analysis.

576 Linear and Nonlinear Programming (3) Linear programming, the simplex and interior methods. Integer, convex, stochastic and other topics in nonlinear programming. Applications to real world problems.
Recommended Background: Courses in numerical algorithms, linear algebra and advanced calculus.

577 Optimization (3) Mathematical foundations of constrained and unconstrained optimization. Lagrange multipliers, the Farkas lemma, the Kuhn-Tucker-Karush theorem. Analysis of major algorithms and applications to real world problems.
Recommended Background: Courses in numerical algorithms, linear algebra and advanced calculus.
<table>
<thead>
<tr>
<th>COURSES OF INSTRUCTION 255</th>
</tr>
</thead>
<tbody>
<tr>
<td>578 Numerical Methods for Partial Differential Equations (3) Numerical approximation of solutions of partial differential equations including conservation laws and hyperbolic, parabolic, and elliptic problems. Derivation, physical meaning, and implementation of schemes. Recommended Background: A course in partial differential equations or 512 or 515, and familiarity with an operating system and a programming language.</td>
</tr>
<tr>
<td>579 Seminar in Numerical Mathematics (1-3). Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>581 Mathematical Ecology I (3) Deterministic and stochastic models of populations, communities, and ecosystems. (Same as Ecology and Evolutionary Biology 581.) (DE) Prerequisite(s): 431 and 453.</td>
</tr>
<tr>
<td>582 Mathematical Ecology II (3) Continuation of 581. (Same as Ecology and Evolutionary Biology 582.) (DE) Prerequisite(s): 581.</td>
</tr>
<tr>
<td>583 Mathematical Evolutionary Theory (3) Population genetics and evolutionary ecology. (Same as Ecology and Evolutionary Biology 585.)</td>
</tr>
<tr>
<td>585 Optimal Control Theory (3) Deterministic optimal control. Examples involving calculus of variations, optimal trajectories, and engineering control problems. Introduction to stochastic control.</td>
</tr>
<tr>
<td>589 Seminar in Mathematical Ecology (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>590 Seminar in Teaching College Mathematics (1-3) Selected topics in research, theory, and techniques for teaching collegiate mathematics. Repeatability: May be repeated. Maximum 12 hours. Credit Restriction(s): May not be applied toward mathematics major (Master of Science). Registration Permission: Consent of department head.</td>
</tr>
<tr>
<td>593 Independent Study (1-12) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>599 Seminar in Mathematical Presentations (1)</td>
</tr>
<tr>
<td>600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/NP only. Repeatability: May be repeated.</td>
</tr>
<tr>
<td>617 Geometry of Groups (3) Geometry of Lie groups, symmetric spaces and discrete groups. Topics vary. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 561 and 562 or 567 and 568.</td>
</tr>
<tr>
<td>619 Seminar in Applied Mathematics (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>623 Advanced Probability I (3) Selected topics in modern theory of probability and stochastic processes. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 523 and 524.</td>
</tr>
<tr>
<td>624 Advanced Probability II (3) Continuation of 623. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 623.</td>
</tr>
<tr>
<td>629 Seminar in Combinatorics (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>635 Advanced Partial Differential Equations I (3) Selected topics in classical and modern theoretical partial differential equations. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 535 and 536.</td>
</tr>
<tr>
<td>636 Advanced Partial Differential Equations II (3) Continuation of 635. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 535.</td>
</tr>
<tr>
<td>642 Functional Analysis II (3) Continuation of 641. Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 641.</td>
</tr>
<tr>
<td>645 Advanced Analysis I (3) Selected topics in real, complex, or discrete analysis. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 545 and 546.</td>
</tr>
<tr>
<td>646 Advanced Analysis II (3) Continuation of 645. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 645.</td>
</tr>
<tr>
<td>649 Seminar in Analysis (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>651 Advanced Modern Algebra I (3) Selected topics in algebra, algebraic geometry, or number theory. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 551 and 552.</td>
</tr>
<tr>
<td>652 Advanced Modern Algebra II (3) Continuation of 651. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 651.</td>
</tr>
<tr>
<td>659 Seminar in Algebra (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>661 Modern Topology I (3) Selected topics in topology. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 561 and 562.</td>
</tr>
<tr>
<td>662 Modern Topology II (3) Continuation of 661. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 661.</td>
</tr>
<tr>
<td>663 Algebraic Topology I (3) Homology, cohomology and homotopy theories: duality theorems and Hurewicz isomorphism theorem. Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 561 and 562. Recommended Background: One year of abstract algebra.</td>
</tr>
<tr>
<td>664 Algebraic Topology II (3) Continuation of 663. Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 663.</td>
</tr>
<tr>
<td>667 Modern Geometry I (3) Selected topics in Riemannian geometry and geometric analysis. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 561 and 562 or 567 and 568.</td>
</tr>
<tr>
<td>668 Modern Geometry II (3) Continuation of 667. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 667.</td>
</tr>
<tr>
<td>669 Seminar in Topology and Geometry (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>674 Advanced Topics in Numerical Partial Differential Equations II (3) Continuation of 673. Repeatability: May be repeated. Maximum 12 hours. (DE) Prerequisite(s): 673.</td>
</tr>
<tr>
<td>679 Seminar in Numerical Mathematics (1-3) Repeatability: May be repeated. Maximum 12 hours.</td>
</tr>
<tr>
<td>681 Advanced Mathematical Ecology I (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.</td>
</tr>
<tr>
<td>682 Advanced Mathematical Ecology II (3) Continuation of 681. (Same as Ecology and Evolutionary Biology 682.) Repeatability: May be repeated. Maximum 6 hours. (DE) Prerequisite(s): 681.</td>
</tr>
<tr>
<td>Mathematics Education (642) 485 Teaching of 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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>
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.

543 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 such research on development of teachers both pre-service and in-service. Recommended Background: 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. Recommended Background: 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.


475 Thermal Engineering (3) Thermal systems with emphasis on turbo-machinery, heat exchangers, gas-vapor mixtures and psychrometry, and fuels and combustion. Chemical equilibrium and 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/ONP 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 Multidisciplinary Project (1) (See Industrial Engineering 509.)


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): 344 and 511.

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.


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.

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 flow; gas turbine, and rocket motor combustor; furnaces; introduction to supersonic combustion and hypersonic flows. (DE) Prerequisite(s): 525.

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): 344.


530 Foundations of Nanomechanics (3) Fundamental aspects of small-scale mechanics and thermodynamics needed to understand properties and behavior of engineered nanoscale systems. Role of nanomechanics in the contemporary nanotechnology research. Essential practical tools used by engineers and researchers for the analysis and characterization of nanostructures, nanocomposite materials, and complex multiphase phenomena in solids and liquids. (DE) Prerequisite(s): 321 and 331.

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.) Recommended Background: 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.)


541 Fluid Mechanics I (3) Derivation of equations governing flow of inviscid and viscous fluids (conservation of mass, Newton's second law, conservation of energy). Equations of state and constitutive relations. Euler and Navier-Stokes forms and nondimensionalization. Exact solutions and introduction to potential and boundary-layer flows. (Same as Aerospace Engineering 541; Biomedical Engineering 541; Engineering Science 541.) Recommended Background: 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 Modern Linear Controls (3) Multivariable feedback systems; transfer function and state-space techniques; stability of linear systems; optimality and robustness; control system design. (Same as Aerospace Engineering 547; Biomedical Engineering 547.) (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 Vibrations 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. Bending of beams, symmetrical and 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 561.)

562 Computational Fluid-Thermal Systems (3) (See Engineering Science 562.)

563 Computational Solid Mechanics (3) (See Engineering Science 563.)

567 Smart Structures and Materials (3) Constitutive modeling and characteristics of piezoelectric materials, electrostrictive materials, magnetoelectrostrictive materials, shape memory alloys, electrorheological and magneto-rheological fluids, and electroactive polymers. Energy methods for static and dynamic analysis of piezoelectric bimorph and other smart systems. (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), flowpath 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), flowpath 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.

587 Dynamic Modeling and Simulation (3) Modeling and analysis of physical systems. Systems and parameter identification. Mathematical modeling methods and approximations. Digital simulation techniques and practices. Design and control applications. (Same as Biomedical Engineering 587.) (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.

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 the problems option. Registration Permission: Consent of advisor.


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. Maximum 20 hours.

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.


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 researchers 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 Mechanical Systems (3) Advanced theory and applications in control systems, dynamics, mechanics, strength of materials and vibrations. 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.


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. (Same as Aerospace Engineering 647; Biomedical Engineering 647.) (DE) Prerequisite(s): 547 or Electrical and Computer Engineering 512.

651 Advanced Topics in Computational Fluid Dynamics (3) (See Engineering Science 651.)

652 Advanced Computational Fluid Dynamics Practice (3) (See Engineering Science 652.)

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.)
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 Microbial Physiology (3) Examination of concepts in microbial physiology and the structure and function of microbial cells. (DE) Prerequisite(s): 310. (DE) Corequisite(s): Biochemistry and Cellular and Molecular Biology 401.
429 Medical Microbiology Laboratory (2) Laboratory exercises in medically important areas of microbiology including microorganisms, pathogenesis, and immunology. (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 recognition in immune mechanisms; and 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. Emphasis on the 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.

520 Microbial Pathogenesis (3) Broad study of host-pathogen relationships including the biochemical, cellular, genetic, genomic and evolutionary factors which play a role in microbial pathogenesis. Credit Restriction: Students may not receive credit for both 420 and 520.

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.

594 Grant Writing (3) Readings and description of scientific ethics and grant writing.

595 General Seminar (1) Lectures and seminars by invited speakers, faculty, and graduate students.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 18 hours.

596 Laboratory Rotation (3) Familiarization with research areas in department through series of rotations in laboratories of individual faculty members.

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

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.

609 Journal Club in Microbial Genomics (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) (Same as Animal Science 620.)
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.

650 Topics in Microbial and Molecular Genetics (1-3)
Repeatability: May be repeated. Maximum 12 hours.
(DE) 411 or consent of instructor.

660 Topics in Eukaryotic Pathogens (3)
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

670 Advanced Topics in Environmental Microbiology (1-3)
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

680 Foundations in Microbiology (3) Readings and discussions of historically relevant research contributions to microbiology.

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.

512 Teaching a Foreign Language (3) Practical application of methods for teaching and evaluating basic language skills and foreign language skills. Formation and application of 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.

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.

550 Curriculum Development and Evaluation in Music Education (3) Principles of curriculum development applied to music education programs. Formulating objectives; construction of evaluation instruments; survey of appropriate literature.
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.
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.

552 Symphonic Band (1)
  Repeatability: May be repeated. Maximum 12 hours.
  Comment(s): Requires audition or consent of instructor.

553 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)
  Repeatability: 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.
  Registration Permission: Consent of instructor.

511 Lecture Recital (2)
  Repeatability: May be repeated. Maximum 12 hours.
  Registration Permission: Consent of school director.

521 Special Topics in Performance (1-3)
  Repeatability: May be repeated. Maximum 12 hours.
  Registration Permission: Consent of instructor.

540 Secondary Applied Music (1)
  May be taken by music majors desiring applied study on a 2nd or 3rd instrument.
  Repeatability: May be repeated. Maximum 12 hours.
  Comment(s): Requires audition and payment of applied music fee.

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.

560 Orchestral Repertoire (1)
  Intensive weekly master class focused on the performance of standard orchestral repertoire used in most orchestral auditions.
  Repeatability: May be repeated. Maximum 6 hours.
  Registration Permission: Consent of instructor.

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.
  Repeatability: May be repeated. Maximum 12 hours.

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.

430 Piano Literature II (3)
  Middle 19th-century to the present.
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 1 and 2. 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 3 and above. Comment(s): 485 and 495 must be taken in sequence. Registration Permission: Consent of instructor.

520 Piano Literature Seminar (3) Topics vary. Repeatability: May be repeated. Maximum 9 hours.

531 Recital Project (2) Vocal recital. Preparation and accomplishment of full recital for accompanying concentrations only. Registration Permission: Consent of instructor.

540 Advanced Piano Pedagogy (2) Topics vary. Evaluation and study of methods and materials for teaching piano at all levels. Supervised laboratory teaching. Repeatability: May be repeated. Maximum 8 hours. Registration Permission: Consent of instructor.

541 Recital Project (2) Instrumental recital. Preparation and accomplishment of full recital for accompanying concentrations only. Registration Permission: Consent of instructor.

560 Organ Literature Seminar (3) Topics vary. Repeatability: May be repeated. Maximum 6 hours.

Music Performance (713)

403 Flute (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 304 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 304. Registration Permission: Consent of instructor.

404 Flute (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 403 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 403. Registration Permission: Consent of instructor.

405 Oboe (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 306 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 306. Registration Permission: Consent of instructor.

406 Oboe (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 405 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 405. Registration Permission: Consent of instructor.

410 Bassoon (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.

411 Bassoon (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 410 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 410. Registration Permission: Consent of instructor.

415 Clarinet (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 316 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 316. Registration Permission: Consent of instructor.

416 Clarinet (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 415 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 415. Registration Permission: Consent of instructor.

420 Saxophone (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 321 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 321. Registration Permission: Consent of instructor.

421 Saxophone (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 420 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 420. 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): 331 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 331. 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): 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.

436 Trombone (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 436 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 436. Registration Permission: Consent of instructor.

440 Euphonium (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 440 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 440. Registration Permission: Consent of instructor.

441 Euphonium (1-3) Repeatability: May be repeated. Maximum 8 hours. (DE) Prerequisite(s): 441 and Music General 101. Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 441. Registration Permission: Consent of instructor.
445 Tuba (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 445.
Registration Permission: Consent of instructor.

446 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.

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): 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.

466 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.

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.

483 Guitar (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 384 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 384.
Registration Permission: Consent of instructor.

484 Guitar (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 483 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 483.
Registration Permission: Consent of instructor.

486 Harpsichord (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 385.
Registration Permission: Consent of instructor.

489 Organ (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 390 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 390.
Registration Permission: Consent of instructor.

490 Organ (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 489 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 489.
Registration Permission: Consent of instructor.

494 Composition (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 395 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 395.
Registration Permission: Consent of instructor.

495 Composition (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 494 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 494.
Registration Permission: Consent of instructor.

496 Composition with Electronic Media (1-3)
Repeatability: May be repeated. Maximum 8 hours.
(DE) Prerequisite(s): 396 and Music General 101.
Comment(s): Requires audition, registration for ensemble appropriate to degree program, and C or higher in 396.
Registration Permission: Consent of instructor.
499 Improvisation (1-2)
Repeatability: May be repeated. Maximum 4 times.
Credit Restriction(s): May not be used to satisfy applied music requirement.
(DE) Prerequisite(s): Music General 101.
Comment(s): Requires audition and registration for ensemble appropriate to degree program.
Registration Permission: Consent of instructor.

503 Flute (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

505 Oboe (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

510 Bassoon (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

515 Clarinet (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

520 Saxophone (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

525 Horn (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

530 Trumpet (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

535 Trombone (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

540 Euphonium (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

545 Tuba (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

550 Percussion (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

555 Voice (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

560 Violin (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

565 Viola (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

570 Cello (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

572 Electric Bass (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

575 String Bass (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

580 Piano (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

583 Guitar (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

585 Harpsichord (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

590 Organ (1-4)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

594 Composition (1-3)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

595 Composition with Electronic Media (1-3)
Repeatability: May be repeated. Maximum 16 hours.
Comment(s): Requires audition.
Registration Permission: Consent of instructor.

599 Improvisation (1-4)
Repeatability: May be repeated. Maximum 16 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, graphics design, sequencing, and page layout. Study of MIDI protocol as applied to computer music work station 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.
(DE) 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 projects.
(DE) Prerequisite(s): 550.

Music Theory (714)

430 Counterpoint I (3) Study of species counterpoint in modal and tonal styles with emphasis on works of Palestrina and J.S. Bach.
(DE) 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.
(DE) Prerequisite(s): 430 with grade C or higher.

450 Choral Arranging (2) Analysis of scores and writing of arrangements for choruses.
(DE) 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 instructor.
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, Czech, Slavic, British, and American art songs.
Credit Restriction: Graduate credit not available for students in vocal performance.

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.
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.
Comment(s): Available only for graduate students majoring in vocal pedagogy.
Registration Permission: Consent of instructor.

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.

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 of perception and emotions, music, and the 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. 1600 to c. 1750, 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 interpolations, oral and written transmissions.
(DE) Prerequisite(s): 400.
(DE) Corequisite(s): Music General 510.
Registration Permission: Consent of instructor.

545 Music in the Renaissance (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.

550 Music in the Baroque Period (3) The development of classical style from the pre-classic 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, conflations 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.

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.

593 Independent Study (1-15)
Repeatability: May be repeated. Maximum 18 hours.
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): 301.

404 Nuclear Fuel Cycle (3) Topics relative to nuclear fuel cycle including, 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 shielding. May be designated as double ordinate problems and Monte Carlo.

(DE) Prerequisite(s): Physics 232.


(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.) Regulation: Consent of instructor.

484 Introduction to Maintainability Engineering (3) Principles of maintenance and reliability engineering, and maintenance management. Topics include information extraction from machinery measurements, rotating machinery diagnostics, nondestructive testing, life prediction, failure models, lubrication oil analysis, establishing predictive maintenance program, and computerized maintenance management systems. (Same as Chemical Engineering 484; Industrial Engineering 484; Materials Science and Engineering 484; Mechanical Engineering 484.) Regulation: 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: Consent of instructor.

500 Thesis (1-15)

Grading Restriction: P/NP only. Repeatable. Maximum 6 hours.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.

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 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.


543 Selected Topics in Nuclear Criticality Safety (3) Criticality safety computational and experimental methods for enrichment, fabrication, storage, reprocessing, and transport applications; overview of safety practices and regulatory requirements.

(DE) Prerequisite(s): 421 or consent of instructor.

550 Radiation Measurements Laboratory (3) Physics and electronics associated with radiation detection and measurement, methods of data analysis. Applicability of particular detector measurements and fundamentals of radiation detection instrumentation operation.

(DE) Prerequisite(s): 551.


(DE) Corequisite(s): 301.

552 Radiological Assessment and Dosimetry (3) Transport of radionuclides in environment, food chain pathways, internal dosimetry and personnel dosimetry.

(DE) Prerequisite(s): 551 or consent of instructor.

567 Medical Physics I (3) Ionizing radiation use in radiation therapy to control 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: 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.

(DE) Prerequisite(s): 567.


(DE) 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: 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: 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 monitoring and diagnosis 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.

(DE) Prerequisite(s): Statistics 571.

Registration: Consent of instructor.

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 correlation theory. Particular emphasis on solving neutral particle radiation transport problems using the MCNP code system.

Registration: Consent of instructor.

583 Radiation Transport Methods (3) Application of analytic/deterministic solutions of the Boltzmann transport equation to problems in neutral particle transport. Special emphasis is placed on application of the discrete ordinates method (in forward and adjoint) to deep penetration shielding analysis.

(DE) Prerequisite: 406.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.
400 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. Recommended Background: Graduate level statistics course. Registration Restriction(s): Master of Science in Nursing – nursing 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.

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, recent health problems; indications, contraindication, side and interactive effects of commonly prescribed drugs. Recommended Background: Undergraduate pharmacology course or consent of instructor. Comment(s): Open to non-degree students.


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. Registration Restriction(s): Master of Science in Nursing – nursing major.

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. Comment(s): Open to non-degree students.

512 Issues in Advanced Practice Nursing (1) Seminar provides a forum for collaborative deliberation on issues impacting the practice of advanced practice nursing and helps advanced practice nursing student transition to their independent practice roles. Comment(s): Required for all MSN students, except those in Nurse Anesthesia. Registration Restriction: Master of Science in Nursing – nursing major.

513 Advanced Practice Role Seminar (1) Seminar lays the foundation for the socialization of the advanced practice nurse in today’s dynamic and challenging health care environment. Comment(s): Required for masters-entry students. Registration Restriction: Master of Science in Nursing – nursing major.

515 Advanced Pathophysiology for Nursing Practice (3) Advanced physiologic and pathophysiologic concepts, principles, and theories applied to deviations of human systems. Recommended Background: Undergraduate pathophysiology course. Registration Restriction(s): Master of Science in Nursing – nursing major.
516 Advanced Pathophysiology: Neurological/Cardiovascular with Anesthesia Implications (2) Review of anatomy and physiology and integration of pathophysiology involved in administration of anesthesia for patients requiring cardiac care for cardiac surgical procedures, and patients with cardiopulmonary bypass, interventional 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.

(REE) Prerequisite(s): 524 and 525.
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.

(REE) Prerequisite(s): 524 and 525.
(REE) Corequisite(s): 523.
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

518 Advanced Pathophysiology: Obstetrical and Pediatric Pathophysiology with Anesthesia Implications (2) Review of anatomy and physiology with focus on the integration of pathophysiology for obstetrical and pediatric patients requiring anesthetic care.

(REE) Prerequisite(s): 524 and 525.
(REE) 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 psychoactive medications in relation to the use of other psychotherapeutic interventions.

(REE) Prerequisite(s): 525.
Comment(s): Prior knowledge may satisfy prerequisite with 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.

(REE) Prerequisite(s) or (REE) 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 anesthesia administration is based. The focus of this course, developed for students in the 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 varied health care settings serving children.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
(REE) Corequisite(s): 550 or 551.
Registration Restriction(s): Master of Science in Nursing – nursing major.

528 Well Child Care: Assessment of Growth, Development, and Behavior (2) Comprehensive and preventative care for the well child. Appropriate screening tools and relevant development theories. Focus is on the well child ages 0 to 21 years.

(REE) Prerequisite(s): 550 and 527.
Registration Restriction(s): Master of Science in Nursing – nursing major.

529 Clinical Practice: Adult and Older Adult (1-5) Clinical experience in the role of the adult or gerontological nurse practitioner, or adult or gerontological clinical nurse specialist in a variety of health care settings serving the adult and older adult populations.

Contact Hour Distribution: All practicum.
Repeatability: May be repeated. Maximum 18 hours.
(REE) Prerequisite(s): 504 and 505.
(REE) Prerequisite(s): 515.

530 Adult Health Nursing I (2) Advanced nursing practice for health promotion, health assessment, and maintenance of adult clients. Application of theory and research to advanced practice nursing in a variety of settings.

(REE) Prerequisite(s): 504 and 505.
(REE) Prerequisite(s): 515.
(REE) Prerequisite(s) or (REE) Corequisite(s): 507.
Registration Restriction(s): Master of Science in Nursing – nursing major.

531 Adult Health Nursing II (2) Continuation of 530. Emphasis on health restoration and management of advanced practice nursing care to adult clients with complex health problems and their families. Application of theory and research to advanced practice nursing in a variety of settings.

(REE) Prerequisite(s): 530 and 531.
Registration Restriction(s): Master of Science in Nursing – nursing major.


(REE) Prerequisite(s): 533.
(REE) Prerequisite(s): 534.

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.
(REE) 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.
(REE) 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 mobilize 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.
(REE) 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.
(REE) Prerequisite(s): 535.
Registration Restriction(s): Master of Science in Nursing – nursing major.

537 Global Issues in Health Care Delivery During Disaster (3) Examination of topics relevant to health care delivery and international humanitarian assistance in disaster, mass casualty events, and large population emergencies. Topics include ethics; international human rights; interface of culture, politics, and religion; psychological impact on survivors, aid workers, and health professionals; vulnerable populations.

(REE) Prerequisite(s): 504 and 505.
(REE) Prerequisite(s): 507 and 510.
Registration Restriction(s): Master of Science in Nursing – nursing major.

538 Gerontological Nursing I (2) Advanced nursing practice for health promotion, health assessment, and maintenance of older adults. Application of theory and research to advanced practice nursing in a variety of settings.

(REE) Prerequisite(s): 504 and 505.
(REE) Prerequisite(s): 515.

539 Gerontological Nursing II (2) Continuation of 538. Emphasis on health restoration and management of advanced practice nursing care for older adult clients with complex health problems and their families.

Application of theory and research to advanced practice nursing in a variety of settings.

(REE) Prerequisite(s): 538 and 501.
(REE) Prerequisite(s) or (REE) Corequisite(s): 582.
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. 
Repeatability: May be repeated. Maximum 11 hours. 
(RE) Corequisite(s): 545. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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. 
Repeatability: May be repeated. Maximum 11 hours. 
(Re) Prerequisite(s): 545. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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. 
Repeatability: May be repeated. Maximum 11 hours. 
(Re) Prerequisite(s): 546. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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. 
Repeatability: May be repeated. Maximum 11 hours. 
(Re) Prerequisite(s): 547. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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. 
Repeatability: May be repeated. Maximum 11 hours. 
(Re) Prerequisite(s): 548. 
Registration Restriction(s): Master of Science in Nursing – nursing major/nurse anesthesia concentration.

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. 
(Re) Prerequisite(s): 504 and 505. 
(Re) Corequisite(s): 507. 
(DE Corequisite(s): 553 or 527 or 564. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Prerequisite(s): 550 and 501. 
(DE Corequisite(s): 553 or 527 or 564. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Prerequisite(s): 550. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550 or 551. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 551. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Prerequisite(s): 504. 
(DE Prerequisite(s): 505 and 515. 
(DE Prerequisite or (DE) Corequisite(s): 507 and 510. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

561 Mental Health Nursing II (7) Advanced practice nursing in community setting for families and groups with actual and potential mental health problems. 
Contact Hour Distribution: 2 didactic and 5 practicum. 
(Re) Prerequisite(s): 504. 
(DE Prerequisite(s): 505 and 515. 
(DE Prerequisite or (DE) Corequisite(s): 507 and 510. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 551. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550 or 551. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

565 Teaching Practicum (1-6) Individually designed teaching experience in collegiate nursing program or nursing practice setting. Objectives to be developed collaboratively by student and faculty. 
Grading: Satisfactory/No Credit or letter grade. 
Repeatability: May be repeated. Maximum 6 hours. 
(De) Prerequisite or (DE) Corequisite(s): 556. 
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 collegiate nursing students, staff development, and patient education. 
Registration Permission: Consent of instructor.

567 Embryology and Neonatal Pathophysiology for Advanced Neonatal Nursing Practitioner (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. 
(Re) Corequisite(s): 504 and 505. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550. 
Registration Restriction(s): Master of Science in Nursing – nursing major.

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. 
(Re) Corequisite(s): 550. 
Registration Restriction(s): Master of Science in Nursing – nursing major.
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.  
(RE) Prerequisite(s): 504.  
(DE) Prerequisite(s): 505 and 515.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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.  
(RE) Prerequisite(s): 570.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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.  
(RE) Prerequisite(s): 571.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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): 501 and 572.  
(DE) Prerequisite or (DE) Corequisite: 582.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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 experiential 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.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

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.  
Registration Restriction(s): Master of Science in Nursing – nursing major.

592 Nursing Administration: Macroanalysis (2) Exploration, analysis, and application of selected organizational, management, and leadership theories and financial principles to delivery of homeland security nursing services. Structure, functions, organization, behaviors, and adaptive processes of health care organizations.  
(RE) Prerequisite(s): 510.  
(DE) Corequisite(s): 533.  
Comments: This course is for students in the Homeland Security Nursing management track only.  
Registration Restriction: Master of Science in Nursing – nursing major.

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/NP 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 historically relevant 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.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

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.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

606 Nursing Research Seminar (3) Selected topics pertaining to dissertation proposal process, research experience, and defense.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

607 Qualitative Nursing Research (3) Critique and application of qualitative nursing research methods.  
(RE) Prerequisite(s): 603.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

608 Quantitative Nursing Research (3) Critique and application of quantitative nursing research methods.  
(RE) Prerequisite(s): 603.  
Recommended Background: Multivariate statistics course.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

609 Research Practicum (1-3) Supervised individual or group research experience under guidance of faculty.  
Grading: Satisfactory/No Credit or letter grade.  
Repeatability: May be repeated. Maximum 12 hours.  
Registration Permission: Consent of instructor.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

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.

612 Health and Nursing Policy/Planning (3) Policies affecting nursing education and practice; health policies and political processes; interactions between health professionals, consumer groups, and government in health policy development and health planning activities.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

613 Nursing Leadership in Complex Systems (3) Analysis and evaluation of nursing leadership/management in complex professional, academic and health care systems.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

614 Nursing Preceptorship (1-3) Individually-designed practicum, field, or internship experiences in variety of administrative, educational, research, or clinical practice settings.  
Repeatability: May be repeated. Maximum 6 hours.  
(RE) Prerequisite(s): 601.  
Registration Restriction(s): Doctor of Philosophy – nursing major.

Nutrition (726)

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.

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

511 Advances in Carbohydrate, Lipid and Protein Metabolism (4) The physiological impact of dietary carbohydrates, lipids and proteins, with an emphasis on nutritional and hormonal regulation of intermediary metabolism, bioenergetics and gene regulation.  
Recommended Background: Advanced nutrition course.
512 Advances in Vitamin and Mineral Metabolism (3) Advances in the requirements, utilization, metabolism and physiological impact of micro-nutrients with an emphasis on vitamins and minerals in the context of human nutrition.  
Recommended Background: Advanced nutrition course.

513 Community Nutrition I (3) Orientation to community; assessment of nutrition problems, needs, and resources; functional roles of public health nutritionist. Concurrent field experiences.

514 Community Nutrition II (3) Planning, implementation, and evaluation of public health nutrition programs. Concurrent field experiences.  
(DE) Prerequisite(s): 513 or consent of instructor.

515 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 12 hours.  
(DE) Prerequisite(s): 513 and 514.  
Registration Permission: Consent of instructor.

516 Maternal and Child Nutrition (3) Nutrition principles related to growth and development during pregnancy, infancy, and childhood to age 5, high risk conditions.  
Recommended Background: Advanced nutrition course or consent of instructor.

518 Nutrition and Aging (3) Nutritional problems of adults; nutritional requirements, dietary intakes; affects of nutrition on biological aging.  
Recommended Background: Advanced nutrition course or consent of instructor.

522 Nutrition Counseling (2) Individual eating habits and disorders, evaluation strategies for effectiveness of helping process.  
Recommended Background: Nutrition in disease course or consent of instructor.

542 Topics in History of Philosophy (3) One or more figures or movements from antiquity through mid-20th-century.  
Repeatability: May be repeated. Maximum 9 hours.  
Recommended Background: 6 hours of philosophy courses or consent of instructor.

545 Intermediate Formal Logic (3) Metatheory of formal logic and philosophy of logic.  
Registration Permission: Consent of instructor.

544 Topics in Applied Ethics (3) Content may vary.  
Repeatability: May be repeated if content differs. Maximum 9 hours.  
Recommended Background: 6 hours of philosophy courses or consent of instructor.

543 Advanced Business Ethics (3) Advanced topics in business ethics.  
Repeatability: May be repeated if content differs. Maximum 6 hours.  
(DE) Prerequisite(s): One of the following – 241, 242, 243, 244, 245, 246, 340.

545 Advanced Environmental Ethics (3) Advanced topics in environmental ethics.  
Repeatability: May be repeated if content differs. Maximum 6 hours.  
(DE) Prerequisite(s): One of the following – 241, 242, 243, 244, 245, 246, 340.

546 Advanced Bioethics (3) Advanced topics in bioethics.  
Repeatability: May be repeated if content differs. Maximum 6 hours.  
(DE) Prerequisite(s): One of the following – 241, 242, 243, 244, 245, 246, 340.

480 Topics in Metaphysics and Epistemology (3)  
Repeatability: May be repeated if content differs. Maximum 6 hours.  
Recommended Background: 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.  
Credit Restriction: May not be used 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.

524 Topics in 20th-Century Philosophy (3) Intensive critical work on major philosopher or school.  
Repeatability: May be repeated. Maximum 9 hours.

528 Topics in Contemporary 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.

544 Topics in Applied Ethics (3) Content may vary.  
Repeatability: May be repeated if content differs. 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.

560 Topics in the Philosophy of Science (3) Repeatability: May be repeated. Maximum 9 hours.

575 Topics in Metaphysics and Epistemology (3) Repeatability: May be repeated. Maximum 9 hours.

577 Topics in Philosophy of Mind (3) Relation of mental to physical and the role of words in discourse about mental activities, thinking and feeling. Repeatability: May be repeated. Maximum 9 hours.

578 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.

590 Topics in the Philosophy of Science (3) recommended Background: Familiarity with computational methods.

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 Restriction: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 30 hours.

600 Doctoral Research and Dissertation (3-15) Grading Restriction: P/INP only. Repeatability: May be repeated. Maximum 9 hours.

601 Proseminar (3) Topics 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, and coupled electric and magnetic fields, Maxwell’s Equations, and electromagnetic waves and radiation. (DE) Prerequisite(s): 135 or 138 or 232.

432 Electricity and Magnetism (3) Electrostatics, magnetostatics, and coupled electric and magnetic fields, Maxwell’s Equations, and 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/INP 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.

531 Classical Mechanics (3) Variational formulation, Lagrange's and Hamilton's equations, constraints, canonical transformations, Hamilton-Jacobi theory and action-angle variables.

541 Electromagnetic Theory (3) Review of electrostatics, magnetostatistics, and classical-field problems; Maxwell's field equations and their solutions in dielectric and conducting media; electrodynamics and relativity, retarded potentials and gauge transformations, radiation produced by accelerating charges.

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.


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.


572 Mathematical Methods in Physics II (3) Advanced Problems. Topics may vary according to interests of students and instructor. (Same as Mathematics 518.) (DE) Prerequisite(s): 571.

573 Numerical Methods in Physics (3) Numerical methods for solution of physical problems, use of digital computers, analysis of errors. (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.

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): 521 and 541.

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, cosmologies, 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. (DE) Prerequisite(s): 521, 531, and 571.

671 Advanced Solid State Physics (3) Survey of research problems and methods. Topics of current interest. Comment(s): Intended for all graduate students.

672 Advanced Solid State Physics (3) Advanced problems. Comment(s): Intended for students specializing in the field.
Plant Sciences (791)

Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 220, 330, and Environmental and Soil Sciences 210 or consent of instructor.

421 Native Plants in the Landscape (3) Native plants and plant communities as a basis for landscaping and environmental restoration. Weekly lecture coupled with either an outing or service practicum of invasive exotic plant removals or planting of natives. Study and work sites will primarily be demonstration projects of the University of Tennessee Environmental Landscape Design Lab. They include local schoolyard habitats, greenways, wetlands, streambanks, and shorelines.

427 Management and Administration of Public Horticulture Institutions (2) Management of resources in non-profit institutions, support organizations and communities. Theoretical framework and institutional mission; strategic planning and programming; financial accounting and budgeting; development and fund raising; personnel policies; volunteer development; marketing and publicity; legal issues; relationships between staff and governing boards; the use of information technology in management and governance systems; and conservation/preservation roles in community development.
(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, arboreta, historical gardens, 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.

435 Field and Forage Crops (3) Agronomic principles of crop production and management. Crop improvement, cropping systems, tillage, fertilization, pest management, harvest and utilization of major field and forage crops.

436 Plant and Garden Photography (3) 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.
Registration Permission: Consent of instructor.

437 Public Garden Operations and Management (2) An analysis of year-round operations and management of public gardens. Case studies involving the 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.
(DE) Prerequisite(s): 226.

441 Advanced Turfgrass Management (2) Principles and scientific basis of turfgrass culture. Adaptation, ecology, physiology, climatic influences on grass culture. Clipping and water management; design.
Contact Hour Distribution: 1-hour lecture and one 1-hour lab.
(DE) Prerequisite(s): 240.

442 Turf Root-zone Construction (2) Construction and management of root-zones for home lawns, golf courses and athletic fields.
(DE) Prerequisite(s): 240.

446 Horticultural Therapy (3) Introduction to the application of horticulture tosystems for treatment, rehabilitation, and/or training of individuals with disabilities.

448 Horticultural Internet Communication (3) Creation and management of information resources for the internet with a focus on development of visual and oral communications skills through a series of individual and team exercises in writing, graphics, and public speaking.
(DE) Prerequisite(s): Communication Studies 210 or 240.

450 Specialty Landscape Construction (3) Methods of design, materials, and construction techniques for specialized components of the landscape industry. Irrigation systems, outdoor lighting, garden ponds and water features.

451 Plant Tissue Culture (3) (See Entomology and Plant Pathology 451.)

457 Weed Management (2) Principles of weed interference, integrated management, and herbicide selectivity and behavior. Specific recommendations for various crop and non-crop situations.
(DE) Prerequisite(s): Environmental and Soil Sciences 210.

458 Turf Weed Management Lab (1) Laboratory addressing practices and principles presented in 457 from the standpoint of turf.
(DE) Prerequisite(s): Environmental and Soil Sciences 210.

459 Agronomy Weed Management Lab (1) Laboratory addressing practices and principles presented in 457, from the standpoint of agronomy.
(DE) Prerequisite(s): Environmental and Soil Sciences 210.

(RE) Prerequisite(s): 210.
(DE) Prerequisite(s): 226 or 230 or 240.
Registration Restriction: Minimum student level—senior.

475 Professional Issues in Bioenergy (3) Study and discussion of professional issues and practices in the bioenergy field, including economics, policy, engineering, processing, agronomy, biotechnology.

480 Advanced Landscape Design (4) 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.
Contact Hour Distribution: Two 3-hour labs.
(DE) Prerequisite(s): 280 and 380.

485 Computer Aided Landscape Design (3) 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.
Contact Hour Distribution: Two 3-hour labs.
(DE) Prerequisite(s): 280, 380, and Agriculture and Natural Resources 290 or Computer Science 100.

494 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.
(DE) Prerequisite(s): Agriculture and Natural Resources 290 or Computer Science 100.

500 Thesis (1-15)
Grading Restriction: P/NP only.
Repeatability: May be repeated. Maximum 3 hours.
Registration Permission: Consent of instructor.

501 Special Topics in Plant Sciences (1-3) Topics to be assigned. 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 Non-Thesis Project (1-2) Library, field, or laboratory project under supervision of faculty member.
Repeatability: May be repeated. Maximum 4 hours.
Comment(s): For students in non-thesis option only.

504 Seminar (1-5) Presentations and discussion of topics. Repeatability: May be repeated. Maximum 5 hours.

505 Professional Development and Presentation Skills (1) Introduction to style, content and format guidelines for preparing formal presentations to scientific and professional peers. Preparation of abstracts and discussion of strategies and opportunities leading to development of young academic professional acumen.
Comments: Taken the first semester offered after beginning MS (or PhD) studies in plant sciences.

513 Fungal Epidemiology and Disease Control (2) (See Entomology and Plant Pathology 513.)
525 Research Ethics for the Life Sciences (1) How good research conduct and knowing the rules of science can enable success in life science research. Bioethics is not a focus. (Same as Animal Science 525.) Contact Hour Distribution: 1 hour.

530 Integrated Pest Management (3) (See Entomology and Plant Pathology 530.)

532 Environmental Plant Ecophysiology (3) Physiological and ecological principles of plants and the relation of those principles to plant responses to the environment. Water relations, gas exchange, stress physiology, seed biology, plant competition, plant defense. Recommended Background: Plant physiology course.

536 Ecology of Grazing Land Systems (3) Multi-university, field-oriented course. Components and functions of grazing lands and how these vary in different ecoregions; research needs, objectives and techniques in soil-plant-animal research; forage-livestock ecology and systems in grazing lands (cropolis, pasturieland, 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. (Same as Animal Science 536.) Registration Permission: Consent of instructor.

537 Plant Nutrition (3) Effects of plant nutrition on biochemical and physiological processes in plants. (DE) Prerequisite(s): Biochemistry and Cellular and Molecular Biology 321 and Environmental and Soil Sciences 210.

544 Protein Gel Electrophoresis (1) (See Entomology and Plant Pathology 544.)

545 Plant Microtechnique (1) (See Entomology and Plant Pathology 545.)

551 Quantitative Plant Genetics (3) Gene and genotype frequencies, genetic variance, correlation among relatives, estimation of response to selection. Recommended Background: Courses in genetics and statistics.

554 Plant Biotechniques (3) Lectures will discuss recombinant DNA technology, molecular assisted breeding of economically important crops, gene cloning and transformation technologies. Examples will be given of food and ornamental crops, pharmaceuticals, and renewable energy sources produced using biotechnology as well as potential risks of this technology. Labs will include electrophoresis, tissue culture, plasmid preps, genomic DNA preps, PCR, plant transformation, genomic techniques. Contact Hour Distribution: 1-hour lecture and one 3-hour lab. Credit Restriction: Students cannot receive credit for both 544 and 554. (DE) Prerequisite(s): 353 or Biology 240.

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.

569 Teaching Practicum (1-3) Supervised experience in teaching. May involve preparation of lectures and teaching aids, preparation and supervision of laboratory exercises, evaluation of student performance, and for second-year graduate students, responsibility for course delivery. Repeatability: May be repeated. Maximum 12 hours. Registration Permission: Consent of instructor.

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. Repeatability: May be repeated. Maximum 6 hours.

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/NP only. Repeatability: May be repeated.

602 Research Planning (1-9) Preliminary research and investigation of dissertation research topic. Repeatability: May be repeated. Maximum 9 hours. Grading Restriction: Satisfactory/No Credit grading only.

603 Special Topics in Crop Physiology and Ecology (1-3) Microclimateology of agroecosystems, crop dormancy and responses to stress, physiology of yield and reproduction. Interactions between energy and germination 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, polyplody, genetic engineering, interspecific hybridization, linkage, screening methods, genome organization. Repeatability: May be repeated. Maximum 6 hours.

610 Advanced Plant Genomics (2) Journal club format emphasizing active class participation as a mechanism to explore the field of plant genomics. Each student will be required to lead the exploration of specific topics and will present a combination of three lectures and/or journal club discussions on the assigned topic.

633 Plant Metabolism (3) Metabolism of chemical compounds of economic importance in crop production: plant growth regulators, naturally occurring plant metabolites, and herbicides. (DE) Prerequisite(s): Botany 521 or 522 and an organic chemistry or biochemistry course.

643 DNA Analysis (2) (See Entomology and Plant Pathology 643.)

653 Advanced Plant Breeding Genetics (3) Principles and methodologies targeting genetic gain for crop improvement. Concepts of qualitative and quantitative trait improvement. Parental germplasm, hybridization, population formation, inbreeding, genetic variance, heritability, selection methods, molecular genetic markers, genetically engineered crops. (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.

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.

435 Criminal Law and Procedure (3) An overview of substantive and procedural law in the criminal justice field with emphasis on constitutionally questions and public policy issues.

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 and Regulatory Policymaking (3) Legal and political dimensions of rulemaking, enforcement and adjudication by executive agencies.

445 Administration of Justice (3) Administration and processes of justice system, including judicial administration and decision making in trial and appellate courts.

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 situation 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/NP only. Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

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 subfields.

531 Theory of Planning (3) Analysis of nature and objectives of planning process: role of planners and planning function in public decision making.

532 Presidency (3) Systematic examination of the structure, functions and powers of the American presidency as they have evolved from the founding to the present.

533 Congress (3) Formal, empirical and theoretical approaches to and models of the institutional workings of Congress and the behavior of legislators.

535 Public Opinion and Political Socialization (3) Explores the meaning and measurement of public opinion and contemporary research on the topic; including questions of rationality, tolerance, and party identification.

536 Campaigns, Elections, and Voting Behavior (3) Surveys theory and research of American campaigns and elections, with an emphasis on presidential and congressional contests.

537 Political Parties and Interest Groups (3) Theoretical and empirical examination of the structure, functions and operations of political parties and interest groups.

539 State and Local Government and Politics (3) Theoretical and empirical analysis of government, politics, policymaking and public administration at the state and local levels.

540 Courts and Judicial Processes (3) Examination of published research dealing with judicial behavior, judicial policymaking, and courts and political actors.

544 Information Systems and Networks in Planning (3) Use and impact of computer-based information systems and global networks in planning and public management. Development of practical skills in design of planning-related decision support systems, databases, Internet-based tools and geographic information systems (GIS).

545 Planning Research Methods (3) Overall structuring of social science research in planning practice: familiarity with structure of planning literature information sources, decision processes and tools, practice in posing research questions relevant to planning, evaluation methods.

547 Planning Technology (3) Relationships between information technology, society and planning. Overview of other advanced technologies, economic development, and associated social and planning issues.

548 Public Policy Process (3) Theoretical, formal and empirical analysis of the roles, functions and decision-making processes of public policymakers, including legislative, executive and judicial actors.

549 Environmental Policy (3) Overview of contemporary environmental policy and its evolution. Examines the roles of values in the environmental arena. Provides a framework for policy analysis and analytical tools for selection and choosing among policy options.

550 Public Administration (3) Overview of public administration theory and function.

552 Organization Theory (3) Appraisal of major theories of organization and their applicability to public sector.

555 Planning and Transportation (3) (See Civil Engineering 558.)

556 Policy Analysis (3) Strategies and techniques for identification and analysis of public problems and policy solutions.

558 The Politics of Administration (3) Examination of public administration in context of American political system, policy making and political roles of public administrators and agencies.

560 Public Financial Administration (3) Principles and techniques of public finance at state and local levels: budget preparation, execution and audit, risk management, capital planning, major tax structures, economic forecasting, cash management, and debt administration.

562 Public Management (3) Interpersonal and leadership skills, techniques and methods for planning, decision making, and implementation of management strategies in public sector.


566 Ethics, Values, and Morality in Public Administration (3) Moral-ethical-value dilemmas confronting administrators in American political system.

569 Internship in Public Administration (3-9) Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated with consent of department. Maximum 9 hours.

570 Comparative Government and Politics (3) Selected topics in modern governments.

572 The Politics of Development (3) Selected topics dealing with political problems of less developed countries.

574 Area Seminar in Comparative Government and Politics (3) Selected topics in area studies: African, Asia, Latin America, Middle East, Soviet Union and Eastern Europe or Western Europe.

580 International Politics (3) Survey of literature and major aspects of international politics.

581 Fundamentals of Planning (3) History of planning, structure and development of urban areas, operations of contemporary planning, trends and issues.

583 Economic Analysis and Development (3) Basic methods of policy analysis and planning. Planning for economic change in cities and regions. Economic development and planning process.

584 Environmental Planning (3) Role of planners and planning in maintenance of balance between natural and built environment.

585 Planning Methods (4) Preparation of comprehensive plans for urban areas and regions. Development of baseline data and forecasts, formulation of alternative plans and strategies, and development of plan implementation programs.

586 Planning and Property Development (3) Process of urban physical growth and change: functioning of private sector real estate development and its relationship to planning. Partnership roles of public and private sectors in urban development and redevelopment.

587 Legal Aspects of Planning (3) Legal basis for planning and guiding community development. Legal tools of planning.

588 Sustainable Communities (3) Overview of sustainable communities. Project-based coursework in local community.


590 Practicum in Planning (3-6) Repeatability: May be repeated. Maximum 6 hours. 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.

594 College Teaching in Political Science (1) Instructional effectiveness, techniques, organization, materials for teaching political science at college level. Grading Restriction: Satisfactory/No Credit grading only. Registration Permission: Consent of instructor.

595 Readings and Special Problems in Political Science (1-3) Repeatability: May be repeated. Maximum 15 hours. Registration Permission: Consent of instructor.

596 Workshops in Computer Applications (1) Training in software applications to support research and decision-making tasks in public service. Successful completion certifies proficiency of MPA students in use of software applications for personal computer. Grading Restriction: Satisfactory/No Credit grading only.

597 Special Topics in Planning (1-3) Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.

598 Problems in Planning (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 Special Topics in Empirical Theory and Methodology (3) Advanced methods and procedures of analysis in political science. Repeatability: May be repeated with consent of department. Maximum 9 hours.

628 Topics in Political Theory (3) Selected issues and problems in normative political theory. Specific content determined by instructor. Repeatability: May be repeated with consent of instructor. Maximum 9 hours.

639 Special Topics in American Government and Politics (3) Advanced study of selected topics. Repeatability: May be repeated with consent of instructor. Maximum 9 hours.

641 Special Topics in Courts and Judicial Processes (3) Intensive examination of research literature dealing with particular aspects of judicial decision making.

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. Recommended Background: 3 hours at the 300-level in another Romance language.

430 Contemporary Brazilian Studies (3) Current Brazilian cultural, political and racial issues placed in a historical perspective with a comparative emphasis. Topics may vary. (Same as Latin American Studies 430.) Repeatability: May be repeated. Maximum 12 hours. Comment(s): Open to non-majors. Majors will write papers in Portuguese.

432 Topics in the Literature and Culture of the Portuguese-speaking World (3) Examination of the socio-political environment, literary works, and other important cultural practices of the Portuguese-speaking world. Topics may vary. (Same as Latin American Studies 432.) Repeatability: May be repeated. Maximum 12 hours. Recommended Background: 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)


409 Group Facilitation (3) Study of theory and technique through supervised experience in small groups. Repeatability: May be repeated. Maximum 6 hours. Recommended Background: 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): 365 or Mathematics 115 or Statistics 201 or graduate standing.

415 Psychology of Religion (3) History of the 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.)

435 Multicultural Psychology (3) Issues of race, ethnicity, socioeconomic status, gender, spirituality, sexual orientation, and ability level as related to the theory, research, and practice of psychology will be examined. Focus will be on increasing personal self-awareness and knowledge of multicultural issues.

440 Organizational Psychology (3) Social-psychological analysis of organizations, emphasizing role-theory and systems theory. (Same as Management 440.)


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.

470 Theories of Personality (3) Major theories of human personality and their development.

475 Adolescent Development (3) Theoretical perspectives and empirical research findings pertinent to adolescent development.

480 Theories of Learning (3) Classical and current approaches to learning and cognition.

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.

489 Supervised Research (1-9) Repeatability: May be repeated. Maximum 12 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.

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.

508 Readings and Special Issues in Psychology (1-3) Repeatability: May be repeated. Maximum 9 hours.

509 Research Practicum (1-3) Required of first-year graduate students in psychology.

510 Topics in Psychology (3) Intensive examination of selected issues in psychology.

511 Developmental Psychology (3) Normal processes of human socialization: physical, cognitive, and emotional development from conception through infancy, childhood, and adolescence.

512 Life-Span Development (3) Theories and research concerning normal human development throughout life, adulthood and old age.

513 Foundations of Psychology: Biological Factors, Perception, Learning, Thinking, Motivation (3) Intensive survey.

515 Colloquium in Experimental Psychology (1) Research and practical issues in experimental psychology.

521 Analysis of Variance for Social Sciences (3) Analysis of variance and statistical theory; application within social science framework. Contrasts among means, trend analysis, analysis of covariance, analysis of factorial designs, and multivariate approaches to analysis of within subjects data.

522 Multiple Regression for Social Sciences (3) Complexities of regression analyses and theory: application within social science framework. Bivariate correlation and regression, multiple regression, analysis of variable sets, interactions among continuous predictors, reducing collinearity between main effects and application of multiple regression to testing procedures of mediation and moderation.

524 Brain and Behavioral Development (3) Survey of experience-dependent changes in brain and behavior development.

525 Psychopharmacology (3) Effects of psychoactive drugs on mood and behavior, emphasizing the mechanisms of drug action on neurotransmitter systems. Topics include the relationship between behavior and endogenous neurochemical activity, therapeutic agents used to treat mental disorders, and drugs of abuse.

527 Behavioral Neuroscience (3) Advanced analysis of functional neural systems involved in the regulation of behavior.

528 College Teaching in Psychology (3) Concepts, techniques, and materials for teaching psychology at college and/or university level. Supervised practice.

530 Psychology of Attitudes (3) Survey of core topics on attitude formation, change, and measurement; roles of automatic and controlled processes, affect, cognition, and behavior in a variety of attitude domains.

543 Cognitive Science (3) Theories and research.

545 Advanced Animal Behavior (3) (See Ecology and Evolutionary Biology 545.)

546 Evolutionary Psychology (3) Advanced analysis of the ecological and evolutionary bases of behavior. (Same as Ecology and Evolutionary Biology 546.)

547 Conceptual Foundations of Evolution and Behavior (3) Critical evaluation of seminal writings on theory and methods in comparative analysis of behavior. (Same as Ecology and Evolutionary Biology 547.)

550 Social Psychology (3) Survey of theory and research concerning interpersonal interaction and individual behavior in social context.

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.

(DE) Prerequisite(s): 555.
555 Psychometrics (3) Basic concepts: factor analysis, scaling, test theories, probability models and their applications, computerized adaptive testing and other topics.

Repeatable: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): Statistics 537 and 538.

558 Interviewing and Observation (3) Sensitizing students to own feelings and beliefs and to feelings of interviewee, and analysis of language content, style, and body language. Exploration of various important aspects of interviewee’s life.

(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.

Repeatable: May be repeated. Maximum 6 hours.
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: Personality, Cognition and Affect (3) Survey of current theoretical and empirical literature on the determinants of individual differences including cognitive (e.g., self-efficacy, schemas, attributions) and affective (e.g., information-processing, emotion regulation, inhibition of emotion) processes.

Comment(s): Admission to clinical psychology concentration or consent of instructor required.

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.

579 Practicum in Individual Assessment, Counseling (3) Basic application of individually-administered, standardized assessment instruments: administration, scoring, and integrated interpretation. Supervision in adult evaluation, and referral/treatment planning. Instruments include WAIS; Stanford-Binet; MMPI, PAI, MCMI.

(DE) Prerequisite(s): 667 and 668.
Recommended Background: Formal tests and measurement or equivalent course.

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 (1-9)

Grading Restriction: Satisfactory/No Credit grading only.
Repeatable: 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.

(DE) Prerequisite(s): 571 or 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.

(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.

607 Seminar in Applied Psychometrics (3)
Repeatable: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 555 and 557.
Registration Permission: Consent of instructor.

610 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.
(DE) Prerequisite(s): 543.
Registration Permission: Consent of instructor.

623 Seminar in Methods of Naturalistic Research (3)
Repeatable: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 546 or consent of instructor.

625 Advanced Study in Personality (3) Theory, research and conceptual analysis of studies with application to education and counseling. (Same as Counselor Education 625.)

635 Ethical, Legal, and Professional Issues Psychology (3) Research, human services, teaching, and public policy. (Same as Counselor Education 635; Educational Psychology 635.)
Grading Restriction: Satisfactory/No Credit grading only.
Comment(s): Admission to doctoral program in psychology or consent of instructor required.

661 Seminar in Neuropsychology (3) Theory, research, and evaluation of neural bases of brain/behavior relationships, common syndromes and their behavioral and cognitive manifestations (e.g., neurodevelopmental syndromes, lifespan issues, etc.).

(DE) Prerequisite(s): 461 and 534.
Repeatable: May be repeated. Maximum 12 hours.

667 Assessment in Counseling Psychology I (3) Use and interpretation of measures commonly used in the practice of counseling psychology, including measures of cognitive ability, vocational, and personality assessment.

(DE) Prerequisite(s): 445 and Counselor Education 525.

668 Assessment in Counseling Psychology II (3) Advanced use and interpretation of measures commonly used in the practice of counseling psychology, including measures of cognitive ability, psychopathology, and personality.

(DE) Prerequisite(s): 667.

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.

(DE) Prerequisite(s): 670.
Comment(s): Admission to doctoral concentration in clinical psychology or consent of instructor required.
672 Psychological Dysfunction (3) Classification methods in psychopathology and use of the DSM for differential diagnosis and treatment options appropriate for counseling psychology and other mental health professionals.
(DE) Prerequisite(s): 431.
Recommended Background: Courses in abnormal psychology and personality theories.

673 Laboratory in Psychotherapy (2)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 60 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.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 445 or equivalent and 569.
Comment(s): Admission to doctoral concentration in counseling psychology required.
Registration Permission: Consent of instructor.

675 Advanced Theory and Practice in Group Counseling (3) Theories and supervised practice.
(DE) Prerequisite(s): 567.
Registration Permission: Consent of instructor.

676 Field Placement in Counseling Psychology (3) Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
(DE) Prerequisite(s): 674 or consent of instructor.

677 Internship in Counseling Psychology (1-6) Supervised employment in departmentally approved counseling psychology internship sites.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Admission to the doctoral concentration in counseling psychology required.
Registration Permission: Consent of instructor.

678 TheorY and Practice of Counseling Supervision (3) Theory and practice of supervision in counseling.
Grading Restriction: Satisfactory/No Credit grading only.
(DE) Prerequisite(s): 674 or consent of instructor.

679 Seminar in Behavioral Medicine (3) Current research and theory concerning relationships between behavior and health.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

695 Field Placement in Clinical Psychology (3) Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 60 hours.
Comment(s): Admission to the doctoral concentration in clinical psychology required.
Registration Permission: Consent of instructor.

696 Advanced Psychology Clinic Placement (1-3) Graduation Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 24 hours.
Comment(s): Admission to the doctoral concentration in clinical psychology or consent of instructor required.
Registration Permission: Consent of instructor.

Public Health (839)

400 Consumer Health (3) (See Health 400.)

493 Directed Independent Study (1-3) Individual study of selected issues.
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.

509 Graduate Seminar in Public Health (1) In-depth discussion of timely topics reflecting scope of public health as discipline and its interrelationship with many other academic and professional disciplines. Speakers both internal and external. (Same as Exercise Science 509; Nursing 509; Nutrition 509; Social Work 509.)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 4 hours.

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.
Comment(s): Admission to MPH or public health nutrition (MS) programs or consent of instructor required.

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.
(DE) Prerequisite(s): 521 or consent of instructor.

525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply techniques.
(DE) Prerequisite(s): 520 or consent of instructor.

530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of vital statistics and introductory research methodology preparatory for first course in epidemiology.
Recommended Background: Introductory statistics course.
Comment(s): Admission to MPH or public health nutrition (MS) programs or consent of instructor.

540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of health problems. Historical origins of discipline, hypothesis formulation, research design, data and error sources, measures of frequency and association, etiologic reasoning, disease screening, and injury control.
(DE) Prerequisite or (DE) Corequisite: 530.

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

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.
(DE) Prerequisite(s): 530, 540, and 542.
Registration Permission: Consent of instructor.

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.
(DE) Prerequisite(s): 550 or consent of instructor.
Overview of health legislation, sociological 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. Registration Permission: Consent of instructor.

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. Grading Restriction: Satisfactory/No Credit grading only. Comment(s): MPH admission and one semester advance notice required. Registration Permission: Consent of major advisor.

588 Internship (3) Internship (community health education, gerontology, or health planning/administration) in either approved organization or research setting under supervision of designated preceptor. Grading Restriction: Satisfactory/No Credit grading only. Comment(s): MPH admission and one semester advance notice required. Registration Permission: Consent of major advisor.

589 Internship (3) Internship (community health education, gerontology, or health planning/administration) in either approved organization or research setting under supervision of designated preceptor. Grading Restriction: Satisfactory/No Credit grading only. Comment(s): MPH admission and one semester advance notice required. Available only for approved extended placements. Registration Permission: Consent of major advisor.

590 Research Methods in Health (3) (See Health 590.)

593 Directed Independent Study (1-3) Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.

635 Physical Activity and Positive Health (3) (See Exercise Science 635.)

650 Health Aspects of Gerontology (3) (See Health 650.)

655 Seminar in Nation's Health (3) (See Health 655.)

660 International Health (3) (See Health 660.)

Public Relations (841)

470 Public Relations Campaigns (3) Research, planning and communication, and evaluation of major public relations campaigns. Oral and written presentation of a public relations project from inception to completion. Requires extensive out-of-class work. (DE) Prerequisite(s): 320 and 370 or consent of instructor.

490 Special Topics (3) Topics vary. Repeatability: May be repeated. Maximum 6 hours.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated. Comment(s): Admission to a degree program in Communication and Information required.

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.

516 Seminar in Public Relations Issues (3) Topics vary. Repeatability: May be repeated. Maximum 6 hours.

525 Public Opinion (3) (See Journalism and Electronic Media 525.)

540 Public Relations Management (3) Theories of leadership and management and organizational structure and functions of public relations agencies and departments in public, private, and non-profit sectors. Analysis and management of problems in communication between organizations and their publics with emphasis on ethics and standards of the profession.

550 Public Relations Strategies (3) Strategic communication planning to achieve overall goals of organizations. Emphasis on decision making, the budgeting process, including cost-benefit analysis of tactics, and managerial execution of public relations plans. Measurement and evaluation of effectiveness of communication programs.

561 Fund Raising and Proposal Writing (3) History, philosophy and practice of philanthropy in U.S. Sources of funds from foundations, corporations, and public agencies. Research and preparation of fund-raising proposals.

590 Project (3) Capstone project under guidance of faculty. Application of principles from previous coursework. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours. Comment(s): Admission to a degree program in Communication and Information required.

597 Independent Study (3) Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Must be a graduate student. Advanced undergraduate students who wish to be considered must seek permission of instructor.

598 Internship (3) Professional work in public relations supervised by communications manager with faculty approval. No retroactive credit for previous work experience. Recommended Background: Completion of core curriculum.

Reading Education (847)

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.

519 Transacting with Literature (3) Strategies for integration of language, writing, content, literature, and higher level thinking skills (K-12).

529 Emergent Literacy (3) Theory and practice in emergent literacy. Focus on the development of early reading and writing from preschool through first grade.

530 Teaching Reading in the Elementary School (3) Trends in methods, materials, basic approaches, skill development and assessment procedures for teaching reading at elementary school level. Recommended Background: Course in teaching of reading 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 or reading in child’s overall intellectual development. Affective and cultural factors. Recommended Background: 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. Recommended Background: 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. Recommended Background: 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. (DE) Prerequisite(s): 537 or 538.

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. Recommended Background: Course in reading education, or equivalent teaching experience, or consent of instructor.

543 Literacy and Literacies 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. Recommended Background: 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.  
Recommended Background: 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.  
Recommended Background: 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 an/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 Leisure Services Organizations (3)  
Application of fiscal policies and procedures to operation of recreation, leisure services, and sport related organizations. Organization of fiscal policy, finance, performance based budgeting, revenue generating strategies, cash and inventory control, commercial/public cooperative ventures, development of logic models, fundraising and development, and strategies for seeking grants and contracts.  
(DE) Prerequisite(s): 430 or consent of instructor.

541 Management Strategies for Recreation and Leisure Services Organizations (3)  
A survey of advanced management theory, concepts, and strategies for contemporary recreation, leisure services, and sport organizations. Topics covered in the course include: strategic management and leadership, benefits based management, benchmarking and performance measurement, high performance organizations (HPO), transforming the culture of organizations, the pursuit of excellence, strategic staffing, risk management, development of partnerships and alliances, research and evaluation as strategic functions of managerial leadership.  
Registration Permission: Consent of instructor.

590 Graduate Internship (3-6)  
Required of all graduate students. Application of previous theoretical and applied knowledge and skills in an appropriate recreation/leisure setting. The internship is intended to simulate a full time professional level work experience during the entire semester. Therapeutic recreation internship must meet NCTRC national guidelines.  
Grading Restriction: Satisfactory/No Credit grading only.  
Repeatability: May be repeated. Maximum 6 hours.  
Recommended Background: Completion of 24 graduate hours.  
Credit Restriction: 3.00 GPA required.  
Registration Permission: Consent of instructor.

591 Directed Study in Leisure and Recreation (1-6)  
Detailed study of theme, issue, or concern. Designed to meet needs of individual students.  
Repeatability: May be repeated. Maximum 6 hours.

592 Special Topics in Recreation and Leisure Studies (1-6)  
Repeatability: May be repeated. Maximum 6 hours.

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 Caseload 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. Application 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 Current Issues in Rehabilitation Counseling (3)  
An examination of current issues in rehabilitation counseling. Topics will include use of technology, professional issues in the public, private-not-for-profit and proprietary rehabilitation systems, ethical and professional behavior issues, and other topics selected by the instructor.

541 Psychosocial and Multicultural Aspects of Disability (3)  
Psychological impact of disability on person and family. Reaction to loss, coping with disability, and societal rehabilitation. Disability as a cultural phenomenon. Impact of cultural differences on reaction and adjustment to disability. Cross cultural effects upon the rehabilitation counseling process and therapeutic relationship.
543 Physical Disabilities, Rehabilitation, and Employment (3) Etiology and clinical symptoms related to physically disabling conditions. Discussion of various body systems and common disorders and diseases. Emphasis on diagnosis, treatment, and functional and employment implications of physical disabilities. Skills necessary to communicate medical information to lay persons and understand the reports of medical professionals.

544 Cognitive Disabilities, Rehabilitation and Employment (3) Study of cognitive disabilities such as brain trauma, developmental disabilities, substance abuse, and mental illness. Disabilities will be discussed in the context of medical and psychiatric and diagnostic characteristics, functional effects, and rehabilitation and employment implications.

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.

Registration Permission: Consent of instructor.

549 Internship in Rehabilitation Counseling (3-6) Supervised practice in rehabilitation and counseling. 600 clock hours required for graduation. Repeatability: May be repeated. Maximum 9 hours.

579 Special Topics (1-3)
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 9 hours.
Comment(s): Admission to graduate program required.

591 Research Project in Rehabilitation Counseling (3) Explore and research rehabilitation counseling issues directly related to employment, counselor functions, and/or treatment variables.

Repeatability: May be repeated. Maximum 6 hours.

Religious Studies (863)

401 Texts and the Study of Texts (3) Systematic introduction to the nature and function of (primarily, but not exclusively, oral and written) texts and textual traditions in the study of religion. How texts are made and used historically, how they are recovered and created by scholars, and how they are interpreted by religious communities and scholars.

405 Modern Jewish Thought (3) History, culture, and geography of the now Israeli portion of the Levant from 1850 to present. The founding of the modern state of Israel in 1948 and the political complexities of the Middle East. Israeli culture and literature. (Same as Judaic Studies 405.)

415 Psychology of Religion (3) (See Psychology 415.)

425 Seminar in Western Religions (3) Selected figures, themes, movements, and problems.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

430 Seminar in American Religion (3) Selected figures, themes, movements, and problems.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

440 Seminar in Comparative Religion (3) Selected figures, themes, movements, and problems.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

490 Readings and Research in Religious Studies (3) Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

499 Proseminar in Religious Studies (3) For advanced students in religious studies, required for majors. Selected topics, e.g., nature and function of myth in religion, problem of evil, transcendence, theories of religion, hermeneutics, integrating various disciplines involved in study of religion.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

Registration Permission: Consent of instructor.

505 Religious Texts and Contexts (3) Critical study of texts and their interpretations: sacred texts, canons, commentaries, religious autobiographies, and religious themes in literature.
Repeatability: May be repeated. Maximum 6 hours.

506 Historical Study of Religions (3) Description and analysis of religious traditions, phenomena, and themes.
Repeatability: May be repeated. Maximum 6 hours.

507 Religion, Power and Society (3) Studies of religions in relation to social structure and political institutions: issues of gender, race, class, ethnicity, caste, slavery, religion and the state, globalization and human rights.
Repeatability: May be repeated. Maximum 6 hours.

510 Introduction to Pedagogy of Religious Studies (3) Conceptualization, methodology, and practice of teaching about religion and religions in the public university context.
(DE Prerequisite(s): 503.
Registration Permission: Consent of instructor.

513 Religion, the Arts, and the Media (3) Material and expressive culture, religion and journalism, mass communication technologies, popular culture, issues of representation, cultural studies methodologies.
Repeatability: May be repeated. Maximum 6 hours.

514 Religion and Healing (3) Ecology of religion, nature, shamanism, healing of body and mind, spirituality, religious dimensions of medical ethics.
Repeatability: May be repeated. Maximum 6 hours.

Repeatability: May be repeated. Maximum 6 hours.

520 Readings in the Study of Religion (1-6)
Repeatability: May be repeated. Maximum 12 hours.

532 Topics in the History of Religions (3)
Registration Permission: Consent of instructor.

533 Topics in Religious Thought (3)
Registration Permission: Consent of instructor.

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 e-Retailing (3) Issues concerning the use of the Internet and related technologies to improve and/or transform retail businesses. Emphasizes analysis of consumers and product/service types in online retailing and the effective management of online catalogs. Also direct retailing methods that involve technology such as interactive TV and m-commerce (mobile).
(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.

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.
   Recommended Background: 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. Maximum 2 hours.

593 Directed Study (1-3) Individual problems in retailing and consumer sciences.
   Repeatability: May be repeated. Maximum 9 hours.
   Recommended Background: 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.
   Recommended Background: 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.
   Recommended Background: 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.

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.

Safety (890)

406 Death, Dying and Bereavement (3) (See Health 406.)

   Contact Hour Distribution: 3 hours and 2 labs.

452 Safety Principles and Practices (3) An introduction to the general principles, practices, and procedures in occupational and community safety. A survey of historical and present safety issues, problems, and practices addressing safety of individuals and groups in work-site, school, community, transportation, and industrial settings.

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.

532 Behavioral Problems in Safety Education and Accident Prevention (3) Problems of behavior, causes of accidents, and application of principles of psychology in development of safe behavior in all segments of environment.

533 Problems and Research in Accident Prevention (3) Safety problems found in wide variety of accidents that occur in community; findings of current research in behavioral sciences as related to variation incidence of accidents.

534 Organization, Administration and Supervision of Safety Programs (3) National, state and local level programs; administrative, instructional, and supervisory aspects. Implementation of relevant programs.

535 Emergency Management (3) Civil and defense problems: tornadoes, floods, fires, mass civil disasters, and nuclear and personnel attack by alien countries.

536 Safety Instrumentation (3) Selection, calibration, maintenance, and use of sampling instruments available to safety practitioner for evaluating exposures of workers to physical stresses and airborne contaminants.

537 Advanced Emergency Management (3) Advanced study in emergency and hazard mitigation, planning, response and recovery. Theory and practice in identification of appropriate emergency warning systems, hazard assessment, facility inspection, plan development and implementation.
   (DE) Prerequisite(s): 535.

560 Fire Risk Management (3) Development, implementation, and management of comprehensive fire safety program. Basic fire risk management concepts, interpretation of codes and exposure to basic fire analysis techniques.

564 Personnel Policies in Safety Management (3) Contemporary practices in the organization and operation of safety and health programs.

572 Graduate Workshop in Safety (3) Special safety education problems. For advanced graduate students, teachers, supervisors, and administrators.
   Repeatability: May be repeated. Maximum 12 hours.
509 Special Topics (1-3) Advanced study in selected disciplinary or professional area of safety education/management.
Repeatability: May be repeated. Maximum 12 hours.

592 Research Methods in Health (3) (See Health 590.)

593 Directed Independent Study (1-3) Individual identification and study of problem/issue in safety. Extensive reading and critical analysis of safety literature. Requires specific proposal to instructor before registration.
Repeatability: May be repeated. Maximum 12 hours.

601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, researched, and reported in acceptable form. (Same as Health 601.)
Repeatability: May be repeated. Maximum 6 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) Corequisite(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 school psychology major or consent of instructor.

549 Internship in School Psychology (1-6) Supervised employment in units of 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 an 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.
Registration Permission: Consent of instructor.

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.

565 Instructional Trends and Issues in Science Education (3) Analysis of current trends in science instruction, instructional issues facing elementary, secondary, and community college science teachers, and application of learning theory to teaching biological, physical, and environmental sciences.
(DE) Prerequisite(s): 496.

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 for research for classroom practice.
Repeatability: May be repeated. Maximum 6 hours.

696 Research Trends in Science Education (3) Analysis of current research trends in science education and relationship of such trends with broader educational community.

Social Science Education (900)

Comment(s): Admission to teacher education required.

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.
Recommended Background: Course in teaching of social studies or consent of instructor.

525 Strategies, Programs and Materials for Teaching Elementary Social Studies (3) Analysis of new and innovative social studies program materials and techniques. Exploration of current trends in social studies education.
Recommended Background: Course in teaching of social studies or consent of instructor.

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 Social Studies (3) Strategies, projects, materials, and programs in social studies.
Recommended Background: Undergraduate course in teaching of social studies or consent of instructor.

599 Seminar in Social Studies Education (3) Research, trends, and issues in secondary social studies.

621 Seminar in Social Studies Research and Theory (3) Status of research and theory. Needed research, related research from other fields, and application of research.
Recommended Background: Recent course in teaching of social studies or consent of instructor.
Social Work (505)

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)

| Registration Restriction: | P/N/P 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 conflicts time before deadline 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 social systems and processes. Various social work roles and intervention strategies pertaining to client systems.

504 Foundations of Social Work Practice III (3)

Basic theory, methods, problems, and strategies in implementing planned change within and among larger social systems: task groups, human service organizations, and community systems. Various practice roles: planner, program developer, supervisor, administrator, advocate and task group leader.

506 Social Work Research (3)

Research methodologies with respect to evolution and application to social work theory and practice. History and philosophy of science; problem formulation; research design; ethics; instrument use and construction; data collection; analysis and reporting, and evaluation and utilization of research.

509 Graduate Seminar in Public Health (1) (See Public Health 509.)

510 Social Work and Social Welfare Policies and Programs (2)

History and contemporary contexts of social welfare. The profession’s distinctive mission, history, values and ethical standards, and multiple roles with individuals, families, groups, organizations, and communities are examined using local to international comparisons. Key professional competencies, diversity, justice, critical thinking, and evidence-based practice are emphasized. Organizational, community, and legislated policies related to social issues, problems, and client systems using local to international comparisons. Use of justice, power, social construction, and social work values and ethics in analyzing, influencing, developing, implementing, and advocating for policies and programs.

512 Social, Economic, and Political Environments (2)

Examines the profound influence on and critical interfaces of client systems with the world in which we live. Incorporates local to international information about social, economic, and political trends and innovations, and about effects of social problems, injustice, and power on client systems and on social change and service delivery systems.

513 Lifespan and Neurophysiologic Development (4)

Theories, frameworks, and research that address culturally sensitive understanding of human development and behavior. Effects of risk/protective factors, culture, and other environmental effects, such as poverty, on developmental milestones. Includes neurophysiologic development across the lifespan, starting with early childhood; the profound influence of the environment on these processes; and implications for early prevention, treatment, policies, and services. Includes identification, assessment, and treatment of developmental delays and neurodevelopmental disorders. Processes critical to understanding human behavior and community risk and resilience for vulnerable populations are emphasized.

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 macrosocial change is effected and through which aggregate social welfare services are proposed, authorized, financed, and programmed. Theories of complex organizations applied to social welfare service delivery settings.

517 Diversity, Social and Economic Justice, and Oppression (2)

In context of the cultural, ecological, developmental, and transactional theories, social work values and ethics, and a human rights perspective, critically assesses theory and research about sources, forms, and outcomes of oppression for at-risk client systems. Integrates local to international information about our global, diverse, multicultural society with evidence-based knowledge and skills that address oppression, are culturally affirming, and promote social and economic justice and human dignity.

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.

519 Foundation Research (3)

Social work-focused quantitative and qualitative research knowledge and skills. Includes critical evaluation of empirical literature and basic research methodology including construct operationalization; study design; selection, development, implementation, and evaluation of measures and instruments; and data management and analysis using statistical software.

520 Evidence-Based Practice (1)

Examines how to (1) convert information related to professional practice into well-structured answerable questions; (2) efficiently locate the best evidence with which to answer such questions; (3) critically appraise such evidence; (4) apply results to practice and policy decisions; and (5) evaluate the effectiveness and efficiency of the application of such results to practice and policy decisions.

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.

522 Introduction to Social Work Practice (4)

Historic and contemporary contexts of social welfare. The profession’s distinctive mission, history, values and ethical standards, and multiple roles with individuals, families, groups, organizations, and communities are examined using local to international comparisons. Theories are examined in the context of critical thinking and evidence-based practice. Defines generalist practice philosophy, methods, roles. Emphasizes skills (i.e., interpersonal communication, relationship building, power analyses, assertiveness, conflict management) that are essential to problem identification, assessment, and intervention with all client systems (individuals, groups, organizations, communities), and with other professionals and decision-makers. Uses local to international examples to translate theory and evidence-based knowledge into practice that is competent, ethical, culturally affirming, and empowering.

523 Social Clinical 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.

536 Foundation Field Practice (1-6)
Instruction and supervision in generalist social work practice. Practicum is completed on a block schedule. Students may take concurrent foundation courses, but are not required to do so. Students may complete block placements in Tennessee, in other states, or in other nations.
Grading Restriction(s): Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Registration Restriction(s): Master of Science in Social Work – social work major.

537 Introduction to Psychopathology and Social Work Practice (2)
Examines psychopathology and mental disorders from an ecological perspective. Emphasis on understanding biopsychosocial influences on the incidence, course and treatment of the most commonly presented mental disorders and the differential effect of these factors on diverse populations. Emphasizes the acquisition of diagnostic skills as they relate to comprehensive social work assessment and the development of social work interventions. Stresses ethical issues, collaboration with families, knowledge of psychopharmacology and the varied roles social workers play in mental health settings.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 522, 538.

538 Social Work Practice w/At-Risk Populations (2)
In-depth study of evidence-informed and evidenced-based practice models with at-risk populations. Assessment and interventions focus on individuals, groups, families, and communities.
Registration Restriction(s): Master of Science in Social Work.

539 Leadership Skills and Knowledge for Advanced Social Work Practice (2)
Organizational management knowledge, leadership skills and supervision required in development and management of structure, resources and cultures of human services delivery systems. Administrative financial knowledge and skills in budgeting, resource allocation, marketing and expenditure control. Issues regarding organizational management change in organizations, communities and national global contexts.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 522, 538.

540 General Topics in Social Work (3)
Current topics in advanced social work.
Repeatability: May be repeated. Maximum 6 hours.

541 Leadership and Management in Human Services (3)
Management practices and leadership skills required in development and management of human services delivery systems. Issues regarding human resources management, resource allocation, strategic planning, and organizational dynamics.

542 Foundation Field Practice I (1-3)
Instruction and supervision in generalist social work practice. This course includes a seminar and agency-based internship.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Registration Restriction(s): Master of Science in Social Work.

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.

544 Foundation Field Practice II (1-3)
Instruction and supervision in generalist and transition to advanced social work practice. This course includes a seminar and agency-based internship.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated only if a grade of S has been earned. Maximum 3 hours.
(DE) Prerequisite(s): 542.
Registration Restriction(s): Master of Science in Social Work.

545 Evidence-based Resource Development Practice Across Systems (3)
Students build evidence-based knowledge and skills to advance social and economic welfare, social justice, and change through acquiring, diversifying, and managing financial resources. Tools and strategies are examined with individuals, families, groups, and organizations, such as fundraising, grants, contracts, and fees-for-service; grant writing and program development; budgeting and accounting; marketing and social entrepreneurship; and human resources. Students examine financial and resource development including the dimensions and scope of public and private, and for- and not-for-profit organizations.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.

546 Evidence-based Social and Economic Development Practice Across Systems (3)
Advanced course examining programmatic, national, and global issues related to social and economic development. Topics include history, philosophies, alternative approaches and critical thinking about social and economic development, applied across multiple, at-risk and culturally diverse systems: individuals, families, groups, communities, organizations, nations, and the world. Students will develop knowledge and skills for assessing and planning ethically sound, evidence-based sustainable development interventions across systems and environments including micro-enterprise and asset-building, participatory change strategies, and other skills.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.

547 Evaluation Research (3)
History and philosophies, conceptual approaches, techniques and methods, and issues in practice and evaluation of research as applied to development and evaluation of social work programs and policies. Issues pertaining to strengths and limitation of various evaluation methods, microcomputer application of data, and measurement of program goals and objectives.

548 Advanced Policy Practice (2)
Focuses on the theory and evidence-based skill sets of policy analysis, development, implementation and change. Focuses on policy practice in organizations, communities, and regions, and in national and international policy venues. It is guided by the knowledge of, and practice within such areas of policy as health, education, welfare, housing, children, aging-elders, income security, social, economic, and environmental rights and justice, and other areas of significance and interest to the general public and students of social welfare. It provides a framework for policy interventions in client systems including individuals, families, groups, organizations, communities, and national and international systems. Students are expected to design professional policy practice actions to accomplish evidence-based policy outcomes.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.

549 Evaluative Research (3)
Advanced exploration of the techniques, methods, and issues relevant to ethical practice in evaluative research. Topics covered include history, philosophies and conceptual approaches in evaluative research; analysis of the strengths/limitations of needs assessment and program evaluation methods; the analysis and management of program data using statistical software; and the measurement of program goals/objectives through process and outcome evaluations. With an emphasis on critical thinking and evidence-based practice, students will utilize these skills to perform evaluations in their areas of interest.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.

550 Seminar in Management and Community Practice (2-3)
Topics in theory and practice of management and community practice.
Repeatability: May be repeated. Maximum 6 hours.

551 Seminar in Social Welfare Policy (3)
Advanced social welfare policy seminar in specific fields of practice.
Repeatability: May be repeated. Maximum 6 hours.

552 Community Organization (3)
Locality development, social planning and social action as practice models for development of resources to meet human needs.

560 Evidence-based Interpersonal Practice with Groups (3)
Focuses on recruitment and composition of group members, leadership structures of small groups, group development, and such group processes as decision-making, tension reduction, conflict resolution, goal setting, contracting, and evaluation. Students will learn how to assess and address group problems, to employ a variety of intra-group strategies and techniques such as programs, structured activities, exercises, etc. Also considers how gender, ethnicity, race, social class, sexual orientation, and different abilities will impact on various aspects of group functioning such as purpose, composition, leadership, selection of intervention strategies, and group development.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.

562 Evidence-based Interpersonal Practice with Adult Individuals (3)
Provides the foundation for clinical social work practice. Advanced knowledge and skills are developed in the areas of interviewing, the therapeutic alliance, risk assessment, and case formulation. Particular emphasis is placed on the use of evidence-based treatments for specific mental health problems and populations.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.

563 Systematic Planning and Evaluation for Interpersonal Practice (3)
Focuses on the development of knowledge, attitudes and skills necessary to systematically plan and evaluate interpersonal practice for the purpose of informing clinical decision-making. Builds upon the foundation research, human behavior, and practice courses, and examines evidence-based methods for conducting assessments; identifying and implementing evidence-based approaches; and monitoring outcomes for individuals, couples, families, and small groups.
(DE) Prerequisite(s): 510, 512, 513, 517, 519, 520, 522, 537, 538, 539.
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.

570 Evidence-based Practice with Families (3) Covers evidence-supported theories and practice techniques that promote family resiliency. Diverse and non-traditional families are considered including gay or lesbian families, foster families, and kinship care. Attention is given to differences in families across culture, race, and ethnicity. Special topics such as domestic violence, child abuse and neglect, divorce and separation, substance abuse, mental illness, chronic illness, disability, and loss are covered within a family contextual framework. Students are encouraged to think critically about ethical practice with at-risk families.

571 Evidence-based Practice with Children and Adolescents (3) Focuses on evidence-based practices, programs, and interventions for children and adolescents that have been shown to effectively treat a variety of behavioral and emotional problems. The interventions and programs covered in this course will include individual, group, family, and/or community level treatment methods, as well as prevention approaches. Emphasis is on the development of knowledge and skills in assessing and intervening at the individual, group, family, and/or community level.

572 Evidence-based Practice with Older Adults (3) Focuses on practice with the older population within the context of health and mental health care. Evidence-based, ethically sound psychosocial interventions to address the physical and mental health challenges faced by older adults and encountered by family caregivers will be emphasized. Critical examination of skills and strategies for practice with this population with/within interdisciplinary organizations, diverse communities, and related policies and policy issues.

580 Field Practice (3) Methodology (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. Repeatability: May be repeated. Maximum 6 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. Repeatability: May be repeated. Maximum 6 hours.

584 Field Practice (3) Field practice for summer session advanced standing students only.

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

586 Advanced Field Practice (1-6) Instruction and supervision in advanced evidence-based social work practice. Includes an agency-based experience and an integrative seminar. This practicum is completed concurrently with required and elective concentration coursework.

587 Advanced Field Practice (6-12) Instruction and supervision in advanced evidence-based social work practice. Practicum is completed on a block schedule. Students may take concurrent required concentration and elective courses, but are not required to do so. Students may complete block placements in Tennessee, in other states, or in other nations.

588 Advanced Standing Program Field Practice (1) Instruction and supervision which focuses on consolidating generalist social work practice knowledge and skills and provides an introduction to advanced evidence-based practice. Includes an agency-based experience and an integrative seminar. Practicum is completed in the summer, either concurrently with or after completion of advanced standing required coursework.

593 Independent Study (1-6) Individualized study, student selects, design, and completes examination of special issue or problem. 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 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.

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.

670 Critical Literature Reviews (3) Techniques and methods for conducting critical reviews of literature: conceptual and methodological critiques of existing research.

693 Directed Study in Social Work Research (3) Advanced individual study, under faculty guidance, of social work practice issues. Repeatability: May be repeated. Maximum 9 hours. Recommended Background: First-year required PhD courses or consent of instructor.

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 most of the emphasis on the criminal courts and institutions and programs such as the prison, probation, and parole. Analysis of their operation and impacts. Recommended Background: 350.

452 Race, Ethnicity, Crime, and 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. (Same as Women's Studies 454.)

455 Society and Law (3) How laws and legal processes are affected by social change, the social impact of legal sanctions, and relations between law and social justice.

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 the dynamics of responses to white-collar crime by private and public parties.


463 Community Sociology (3) The environment shapes human interactions and human interactions shape the construction of environments. Explores how individuals construct and participate in communities.
<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Repeatability and Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>464</td>
<td>Urban Ecology</td>
<td>3</td>
<td></td>
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<tr>
<td>465</td>
<td>Social Values and the Environment</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>500</td>
<td>Thesis</td>
<td>(1-15)</td>
<td>Grading Restriction: P/NP only. Repeatability: May be repeated.</td>
<td></td>
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<tr>
<td>502</td>
<td>Registration for Use of Facilities</td>
<td>(1-15)</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>504</td>
<td>Sociological Foundations of Political Economy</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>505</td>
<td>Foundations of Criminology</td>
<td>3</td>
<td>Critical overview of contemporary developments in criminology, theories of crime causation and theories of responses to crime.</td>
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</tr>
<tr>
<td>506</td>
<td>Social Justice and Public Policy</td>
<td>3</td>
<td>Examines the formulation and consequences of public policy, analyzing the general public policy process model; the model’s specific applications to criminal justice policy, environmental policy, and economic and political policies; and techniques of policy evaluation research.</td>
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</tr>
<tr>
<td>507</td>
<td>Foundations of Social Psychology</td>
<td>3</td>
<td>Current and classical theoretical perspectives in social psychology.</td>
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<tr>
<td>510</td>
<td>Professional Preparation</td>
<td>1</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>521</td>
<td>Sociological Theory I</td>
<td>3</td>
<td>Assessment of what sociological theory is; its major figures and their approaches to understanding society.</td>
<td></td>
</tr>
<tr>
<td>531</td>
<td>Research Methods in Sociology</td>
<td>3</td>
<td>Research design, measurement, sampling, quantitative and qualitative data collection techniques, data, reduction, and analysis.</td>
<td></td>
</tr>
<tr>
<td>534</td>
<td>Advanced Sociological Analysis</td>
<td>3</td>
<td>Underlying assumptions and logical procedures used by sociologists in formulating explanations; foundations of sociological research strategies and techniques.</td>
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</tr>
<tr>
<td>541</td>
<td>Collective Behavior, Social Movements, Social Change</td>
<td>3</td>
<td>Basic theory and research on conditions of social unrest in human collectivities and efforts of collectives to change existing society.</td>
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</tr>
<tr>
<td>543</td>
<td>Sociology of Development</td>
<td>3</td>
<td>Sociological theories and studies of development: modernization, colonialism, dependency; comparative impact of various development paths upon selected aspects of social structure and change.</td>
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<tr>
<td>551</td>
<td>Juvenile Delinquency and the Social Structure</td>
<td>3</td>
<td>Examines how juvenile delinquency policies are shaped by social structures and changes in social perceptions of childhood, crime, and punishment.</td>
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<tr>
<td>560</td>
<td>Environmental Sociology</td>
<td>3</td>
<td>Systematic treatment of current research in environmental sociology. Social impact analysis and conflicts over environmental issues.</td>
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<tr>
<td>562</td>
<td>Sociology of Environmental Policy</td>
<td>3</td>
<td>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.</td>
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<tr>
<td>585</td>
<td>Seminar in Gerontology</td>
<td>(1)</td>
<td>(See Health 585.)</td>
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</tr>
<tr>
<td>591</td>
<td>Foreign Study</td>
<td>(1-15)</td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
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</tr>
<tr>
<td>592</td>
<td>Off-Campus Study</td>
<td>(1-15)</td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
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</tr>
<tr>
<td>593</td>
<td>Independent Study</td>
<td>(1-15)</td>
<td>Repeatability: May be repeated. Maximum 15 hours.</td>
<td></td>
</tr>
<tr>
<td>599</td>
<td>Readings</td>
<td>(3)</td>
<td>Selected topics. Repeatability: May be repeated. Maximum 6 hours.</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>Doctoral Research and Dissertation</td>
<td>(3-15)</td>
<td>Grading Restriction: P/NP only. Repeatability: May be repeated.</td>
<td></td>
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</tbody>
</table>

**Spanish (924)**

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
<th>Credits</th>
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<th>Repeatability and Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>420</td>
<td>Applied Linguistics</td>
<td>3</td>
<td>Introduction to applied linguistics, with a special emphasis on the theoretical and practical aspects of the teaching of Spanish as a foreign language. Fundamental concepts in linguistics within the context of Spanish grammar and their use in the study of second language acquisition, foreign language learning and foreign language teaching. Conducted in Spanish, with readings in both English and Spanish. (DE) Prerequisite(s): 323.</td>
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<tr>
<td>421</td>
<td>Phonetics</td>
<td>(3)</td>
<td>(DE) Prerequisite(s): 323 or consent of instructor.</td>
<td></td>
</tr>
</tbody>
</table>
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): 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.)

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.

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.

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. (DE) Prerequisite(s): 323, 330, and completion of 9 additional hours of upper-division Spanish.

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.)

Contact Hour Distribution: 1 hour lecture, 2 hours screening, and 1 hour discussion.

479 Disencheded Texts in Hispanic Literature (3) Texts representing trends and periods of renewal in Spain and Latin American countries. Selected works on traditions in crisis. Content will vary. (Same as Latin American Studies 479.)

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.

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, especially with regard to identity and concepts of nationhood. Among possible course topics – mestizaje; conceptual distinctions between race and ethnicity in Latin America; indigenismo; afrocentrism; issues of monarchy and empire; and relationship between Jews, Christians, and Muslims 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) Grading Restriction: P/INP only.

Repeatability: May be repeated. Credit Restriction: May not be used toward degree requirements.

515 Technology Enhanced Language Learning (3) (See French 515.)

531 Old Spanish (3) Exploration 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 context 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, picaresque, 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) Costumbriismo, 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 through Civil War years.

543 20th-Century Spanish Literature: Post-Civil War through Present (3) Principal achievements and representative directions in literature of Spain from Post-Civil War period to present.

550 Techniques of Literary Analysis and Research Methods (3) Theoretical and critical essays on various techniques of literary analysis. Exploration of bibliographical and research materials.

551 Special Topics in Hispanic Literature or Linguistics (3) Repeatability: May be repeated. Maximum 6 hours.

552 Directed Readings (3)

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

571 Spanish American Narrative: Criollismo 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.


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 or Linguistics (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 or Linguistics (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.

430 Practicum in Applied Behavior Analysis (3) Emphasizes the application of applied behavior analysis principles including the study of designing, implementing, and evaluating behavior analytic interventions relevant to alleviating significant problem behaviors in the classroom setting. Learners examine topics in the use of applied behavior analysis such as direct instruction, behavior reduction, functional analysis, positive behavioral supports, and ethical issues in the use of various procedures.
Registration Restriction(s): Qualification – admission to teacher education.

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): 432.
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 the educational strategies appropriate for those persons.

(DE) Prerequisite(s): 402.
(DE) Corequisite(s): 431.
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.

459 Neuromuscular and Health Disorders: Educational Implications (3) Neurological impairments, physical disabilities and special health conditions, autism. Investigation of instructional techniques and adaptations.

470 Psychology of the Exceptional Child (3) General characteristics and educational needs of exceptional children. Implications of developmental variations for functioning as adults.
Comment(s): Enrollment limited to non-special education majors.

471 Early Childhood Special Education (6) Assessment, curriculum planning and development and teaching approaches used in early childhood special education.
Comment(s): Admission to teacher education required.

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.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 15 hours.
Comment(s): Enrollment limited to those in the fifth-year program.

553 Assessment of Exceptional Students (3) Current issues related to assessment; advanced study of evaluation models for special education; dynamic and other innovative assessment approaches; advanced study of application to educational programming; basic statistics and application in assessment.

554 Assessment in Early Childhood Special Education (3) Development of knowledge and skills in appropriate formal and informal assessments of handicapped infants and young children: screening, identification, diagnosis, placement and programming assessment issues.

555 Methods of Teaching Students with Autism Spectrum Disorders (3) Provides an in-depth description of students with autism spectrum disorders (ASD), including differentiating characteristics among the various subtypes of pervasive developmental disorder. Appropriate assessment practices, programming considerations, and effective instructional methods are addressed.

556 Methods of Teaching Students with Emotional and Behavioral Disorders (3) Examines educational strategies and techniques for individual and class wide behavior management as well as curriculum and teaching strategies for promoting the social and emotional development of students with behavior and learning exceptions. Both reactive and proactive strategies for working with students are addressed.

(DE) Prerequisite or (DE) Corequisite: 555.
Comment(s): Admission to graduate program 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.

568 Early Childhood Special Education: Theories and Interventions (3) Theoretical perspectives of early childhood special education; exploration of programmatic models, family-focused concepts and curriculum development.

575 Creative Problem-Solving Strategies for Special Educators (3) Techniques for solving problems encountered by special educators in any setting.

586 Seminar in Research Techniques in Special Education (3) Evaluation of appropriate research methodologies with handicapped populations.


590 Application of Microcomputer Technology in Special Education and Vocational Rehabilitation (3) Application of microcomputer technology with all categories of exceptionalities and across all chronological and functioning age ranges. Microcomputer adaptive software, special switch access, authoring systems, telecommunication, and strategies for cognitive development.

620 Internship in Research in Special Education and Rehabilitation (3-9) Placement with professional engaged in theoretically-based research: public school, institutions, agencies or university settings.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 9 hours.

Recommended Background: 9 hours in statistical research methods.

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)

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/INP only.

Repeatability: May be repeated.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies 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.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

512 Sport Law (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.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

540 Sport Marketing (3) Provides an understanding of diverse aspects of sport marketing research which is a sport business function in order to improve marketing and financial decisions in the sport industry. Students are exposed to the value and types of sport marketing research.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

553 Case Studies in Sport Management (3) Current issues and problems in sport administration at all levels of amateur and professional sport.

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

554 Readings in Sport Management (3) Survey of pertinent literature in refereed and applied journals and texts.

Registration Restriction(s): Master of Science – sport studies major.

555 Evaluation Techniques for Sport Managers (3) Review and application of techniques of evaluation appropriate for sport programs, facilities, and personnel.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

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.

Registration Restriction(s): Master of Science – sport studies major.

590 Practicum (3) Practical experience in areas of major interest.

Grading Restriction: Satisfactory/No Credit grading only.

Registration Restriction(s): Master of Science – sport studies major.

593 Independent Study (1-3)

Repeatability: May be repeated. Maximum 6 hours.

Registration Restriction(s): Master of Science – sport studies major.

595 Internship (1-6) Full-time application of previous theoretical and applied knowledge and skills in appropriate sport setting.

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 6 hours.

Registration Restriction(s): Master of Science – sport studies major.

Sport Studies (959)

490 Psychology of Coaching (3) Major topics and theories dealing with the social-psychological factors affecting the performance of athletes and teams, with practical suggestions for enhancing the effectiveness of teachers and coaches.

500 Thesis (1-15)

Grading Restriction: P/INP 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.

Registration Restriction(s): Master of Science – sport studies major.

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.
Recommended Background: 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) Critical examination of various aspects of health and exercise psychology including the psychological benefits of exercise (e.g., increased well-being) as well as the psychological pitfalls of too much exercise (e.g., exercise addiction, overeating, disordered eating behavior etc.).
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 interact 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) Critical examination of various aspects of professional practice in sport studies with particular emphasis on ethical issues. Also contains a professional development component related to interviewing, resume building, etc.
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 9 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)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

601 Research Seminar (1) (See Exercise Science 601.)

633 Advanced Sport Psychology (3) Analysis, synthesis, and discussion of contemporary theory and topics; research development and production in sport psychology.
Repeatability: May be repeated. Maximum 9 hours.
Comment(s): Requires admission to the sport studies major or consent of instructor.

681 Practicum (1-3) Intern experience in areas of major interest.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Requires admission to the sport studies major or consent of instructor.

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: 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.

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.
Recommended Background: 1 year of college mathematics.

532 Survey of Statistical Methods II (3) Multiple linear regression, including use of dummy variables; single and multiple factor analysis of variance and covariance; issues in experimental design and analysis. Use of computing facilities required.
Credit Restriction(s): Students may not receive credit for both 531 and 537.
Recommended Background: 1 year of undergraduate mathematics and 1 undergraduate statistics course.

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 537.
Recommended Background: 1 year of undergraduate mathematics at graduate level.
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.

560 Introduction to Mathematical Statistics (3) Probability, probability distributions, simulation of random variables, sampling distributions, central limit theorem, hypothesis testing, confidence intervals, maximum-likelihood methods, Bayesian methods. 
Credit Restriction: Not for credit for MS with a major in statistics or management science.  
(DE) Prerequisite(s): Mathematics 241.  
Comment(s): A course equivalent to Mathematics 241 also is acceptable.

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 Statistical Inference I (3) Basic probability and probability models; random variables and distributional models; kernel density estimation; cubic splines; likelihood inference and maximum likelihood estimation and model fitting with information criteria; moment and moment generating functions; functions of random variables; goodness of fit tests and quantile modeling of distributions.  
(DE) Prerequisite(s): Mathematics 241.  
Registration Permission: Prerequisite(s) or consent of instructor required.

564 Statistical Inference II (3) Sampling distributions; point and interval estimation; fixed width confidence intervals; likelihood theory; Fisher information and its inverse; large sample, deviance, and bootstrap confidence intervals; Bayesian estimation and hypothesis testing; informative approach to hypothesis testing; uniformly most powerful and likelihood ratio tests, theory of linear models, estimation, model building and inference.  
(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): Mathematics 425.

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.  
Recommended Background: 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.

Recommended Background: 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 2 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 or letter grade.  
Repeatability: May be repeated. Maximum 6 hours.  
Recommended Background: 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.  
Recommended Background: 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, numerical methods, matrix computations and special matrices, essentials of Monte Carlo simulation, and resampling techniques.  
Recommended Background: 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, multivariate cluster analysis, common principal component model, factor analysis model, covariance structural models with latent variables, mixture-model cluster analysis.
Recommended Background: 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: 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) Exercises in selected concentrated areas such as styles, techniques, approaches, e.g., Shakespeare, movement, humor. Content varies.
Repeatability: May be repeated. Maximum 9 hours.
(De) Prerequisite(s): 420.
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, and 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, and 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 corsetry and the study of historic patterns 1500-1900.
(De) Prerequisite(s): 345 or consent of instructor.

450 Special Topics in Design and 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.

464 Computer Aided Drafting for the Theatre (3) Introduction to entertainment drafting. Emphasis on 2-D graphical standards, drafting techniques, and drawing layout and presentation.

470 Playwriting (3) Advanced instruction in writing of plays.
Registration Permission: Consent of instructor.

484 Photography for the Theatre (3) Digital photography techniques for shooting live performance events under challenging lighting environments.
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.
594 Secondary School Curriculum (3) Focus of this course is curriculum and instructional design for secondary school. Characteristics of students, curriculum designs, instructional patterns, and organization and structure of secondary schools will be studied.

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.

558 Curriculum Planning and Development (3) Focuses on foundations and principles of curriculum planning and development, historical analysis of curriculum theory, principles of planning and development, and classroom applications for improved learning.

588 Instructional Theory and Design (3) Focuses on the relationship of curriculum to instruction; examination of instructional and related learning theories; instructional models and teaching styles.

593 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 12 hours.

594 Supervised Readings (1-3) Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 12 hours.

595 Special Topics (1-3) Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 24 hours.
Credit Restriction: Only 12 hours can be used to meet degree requirements.

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): 553.

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 academe 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 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 or letter grade.
Repeatability: May be repeated. Maximum 9 hours.

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.


676 Curriculum Theory (3) The focus is on influential curriculum theories and approaches, implications for structure and design of educational programs, the nature and function of theory, and theory building activities.
(Re) Prerequisite(s): 558.

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.
806 Application Based Learning Exercise (ABLE) and Clinical Exposure III (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.
811 Infection and Immunity II – Bacteriology and Mycology (3) Fundamental aspects of microbiology and cell biology relative to pathogenesis of bacterial and fungal diseases of animals: antimicrobial actions and mechanisms of bacterial resistance. General approaches to diagnosis, treatment and prevention.
816 Clinical Correlations and Ethics I (2) Correlations between basic science material from concurrent courses and practice of veterinary medicine. Thoughts on wide spectrum of current veterinary ethical issues.
816 Clinical Correlations and Ethics II (2) Correlations between basic science material from concurrent courses and practice of veterinary medicine. Thoughts on wide spectrum of current veterinary ethical issues. Student-led discussions follow faculty presentations.
821 Veterinary Anatomy I (4) Lectures, laboratories, and demonstrations are used in an integrated approach to the study of macroscopic (gross) clinically relevant anatomy, including neuroanatomy, and embryology of common domestic animals. Dissections of embalmed specimens, prosections, plastinated specimens, and radiographs of common domestic species are examined for comparative purposes.
822 Veterinary Anatomy II (4) Lectures, laboratories, and demonstrations are used in an integrated approach to the study of macroscopic (gross) clinically relevant anatomy, including neuroanatomy, and embryology of common domestic animals. Dissections of embalmed specimens, prosections, plastinated specimens, and radiographs of common domestic species are examined for comparative purposes.
823 Physiology I (4) Introduction to concepts and problems in physiology which form basis for clinical applications and for formal training in pharmacology, medicine, pathology, and surgery. Cellular, neural, cardiovascular, renal, respiratory, digestive, endocrine, and reproductive physiology.
824 Physiology II (4) Introduction to concepts and problems in physiology which form basis for clinical applications and for formal training in pharmacology, medicine, pathology, and surgery. Cellular, neural, cardiovascular, renal, respiratory, digestive, endocrine, and reproductive physiology.
825 Veterinary Microscopic Anatomy I (2) Lectures, laboratories, and demonstrations are used in the study of the cell, embryology, and microscopic anatomy of organ systems in common domestic animals to relate structure with function.
826 Veterinary Microscopic Anatomy II (2) Lectures, laboratories, and demonstrations are used in the study of the cell, embryology, and microscopic anatomy of organ systems in common domestic animals to relate structure with function.
831 Physical Diagnosis (1) Basic care, feeding, restraint, and handling domestic animals. Introduction to physical examination and diagnostic techniques used by veterinarian.
832 Anesthesiology (2) Principles of anesthesiology: pharmacology of anesthetic agents, and introduction to anesthetic techniques in veterinary medicine.
833 Epidemiology and Evidence Based Medicine (2) Study of distribution and determinants of disease in animal populations. Use of knowledge (evidence) gained from management of clinical patients in past to improve future clinical decision-making processes.
835 Principles and Practice of Surgery (2) Principles of veterinary surgery: aseptic technique, patient and surgeon preparation, control of surgical hemorrhage and infection, and general operating room procedures. Proper methods of tissue handling, surgical instrumentation, and selection of suture materials and suturing patterns. Pathophysiology of surgical and accidental wounds; wound healing and management.
836 Toxicology (2) Principles of toxicology, molecular mechanisms, pathologic processes and clinical features of animal diseases caused by common toxic agents.
837 Food Hygiene and Zoonoses (2) Host-agent relationships, public health aspects of veterinary medicine and role of veterinarians in ecology and food hygiene.
838 Clinical Rotation in Pathology I (2) Clinical training and interpretation in post-mortem examination and laboratory diagnostics: clinical pathology and introductory histopathology of biopsy specimens.
839 Clinical Rotation in Pathology II (2) Clinical training and interpretation in post-mortem examination and laboratory diagnostics: clinical pathology and introductory histopathology of biopsy specimens.
840 Integumentary System (3) Pathophysiology, special pathology, medicine and surgery of diseases of integumentary system. Laboratory examination, pathology, diagnosis and treatment.
841 Reproductive System (3) Pathophysiology, special pathology, medicine and surgery of diseases of male and female reproductive systems and mammary glands.
842 Alimentary System (4) Pathophysiology, special pathology, medicine and surgery of diseases of alimentary systems.
843 Musculoskeletal System I (3) Pathophysiology, clinical description and basic treatment modalities of common diseases and conditions of skeletal system of small animals: development of basic diagnostic and treatment skills.
844 Musculoskeletal System II (3) Pathophysiology, special pathology, medicine and surgery of diseases of muscular and skeletal systems. Advanced principles, radiographic interpretation and surgical procedures.
845 Veterinary Nutrition (2) Principles of nutrition, and nutrition of animals in health and disease. Applied nutrition relating to individual small or large animal patient or to herd situations.
846 Multispecies Medicine (3) Anatomy, pathophysiology, medicine, and surgery of avian species, laboratory and zoo animals and reptiles. Species and diseases seen by practicing veterinarian. Current topics on foreign animal diseases.
847 Clinical Rotation in Radiology I (2) Clinical training in radiographic techniques and interpretation, including ultrasonography.
849 Clinical Rotation in Radiology II (2) Clinical training in radiographic techniques and interpretation, including ultrasonography.
851 Urinary System (3) Pathophysiology, special pathology, medicine and surgery of diseases of urinary system. Urinary system in health and disease.
852 Cardiovascular System (2) Pathophysiology, special pathology, medicine and surgery of diseases of cardiovascular system. Anatomic, physiologic and pharmacologic principles which provide basis for treatment.
854 Respiratory System (3) Pathophysiology, special pathology, medicine and surgery of diseases of respiratory system. Upper and lower respiratory systems: infectious and noninfectious diseases.
855 Radiology (3) Basic, advanced and special techniques in radiology with interpretation and use of radiologic and related techniques in diagnosis and treatment of animal diseases.

856 Special Senses (2) Pathophysiology, special pathology, medicine and surgery of diseases of visual and auditory systems.

857 Nervous System (3) Pathophysiology, special pathology, medicine and surgery of diseases of nervous system: clinical neurology and neuropathology.

858 Neurology/Ophthalmology (4) Clinical training in specialty services: ophthalmology and neurology. Direct responsibility for diagnosis, patient care, and treatment of patients in both Large Animal and Small Animal Clinical Sciences.

861 Pharmacology I (2) Principles of pharmacokinetics and pharmacodynamic properties of veterinary drugs; mode of action and pharmacologic effects including important metabolic aspects, chemical and physical properties, side effects (toxicities) and clinical application.

862 Pharmacology II (2) Continuation of 861: modes of action, pharmacologic effects, and clinical application of drugs to control specific disease conditions.

864 Infectious Diseases (2) Pathogenesis and clinical findings of major viral, bacterial, and fungal infectious diseases of domestic animals: cattle, horses, swine, sheep, goats, dogs and cats; relevant case-based presentations.

865 Clinical Rotation in Comparative Medicine (2) Clinical training in avian medicine, laboratory animal and zoo animal medicine, epidemiology, public health, and other related disciplines.

867 Special Problems in Comparative Medicine (1-8) Extramural and specially designed study for students interested in select topics in avian medicine, laboratory animal medicine, zoo animal medicine, epidemiology, public health, pharmacology or toxicology.

866 Introduction to Animal Behavior (2) Basic principles of normal and abnormal animal behavior in domestic animals; clinical case discussions to illustrate common behavioral problems and current approaches to therapy.

870 Anesthesiology (4) Clinical training in sedation and anesthesia of companion animals, food animals and horses. Direct responsibility for diagnosis, care and treatment of clinical patients.

871 General Pathology (3) Principles of pathobiology: causes of disease, disturbances of cell growth and inflammation.

873 Infection and Immunity IV – Parasitology (3) Principles of parasitology: protozoology, helminthology, and entomology and relationship to diseases in animals.

874 Oncology (2) Fundamental aspects of cell biology and pathology relative to etiology and natural behavior of various neoplasms of animals; general approaches to diagnosis, treatment and prevention of neoplasia.

877 Special Problems in Pathology (1-8) Extramural and specially designed study for students interested in select topics in morbid anatomy and pathology; clinical pathology and parasitology.

878 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.

879 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.

881 Clinical Rotations in Small Animal Clinical Sciences I (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, care, and treatment of clinical patients.

882 Clinical Rotations in Small Animal Clinical Sciences II (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, care, and treatment of clinical patients.

883 Clinical Rotations in Small Animal Clinical Sciences III (4) Clinical training in medicine, surgery and specialty disciplines for companion animals. Direct responsibility for diagnosis, care, and treatment of clinical patients.

887 Special Problems in Small Animal Clinical Sciences (1-8) Extramural and specially designed study for students interested in select topics in medicine, surgery, anesthesiology, radiology and medical specialties of small (companion) animals.

888 Clinical Pathology (3) Pathophysiology and diagnosis of hematologic and clinical biochemical disorders in domestic animals; interpretation of laboratory test results using illustrative clinical cases.

890 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.

891 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.

892 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.

893 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.

897 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.

899 Extirpation (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.

909 Extirpation (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)

440 Wildlife Techniques (3) Methods in wildlife damage control, forest, farmland, wetland wildlife habitat management, identification of wildlife field sign, wildlife capturing techniques, and management plan preparation. Weekend field trip required.

442 Fisheries Techniques (3) Active and passive sampling techniques for fish and aquatic organisms. Population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques. Age determination and incremental growth analysis. Stream assessment. Equipment and instrumentation usage and maintenance.

443 Fisheries Science (3) Quantification and management of freshwater fisheries including population estimation, age and growth, biological assessment, and stocking.

444 Ecology and Management of Wild Mammals (3) Biological and ecological characteristics of game mammals and endangered mammals. Current principles and practices of wild mammal management. Weekend field trip required.

445 Ecology and Management of Wild Birds (3) Biological and ecological characteristics of game birds, endangered birds, and bird pests. Current principles and practices of wild bird management. Weekend field trip required.
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.

Repeatability: May be repeated. Maximum 2 hours.
Comments: All master’s students must complete the course twice during their program.

515 Seminar in Avian Ecology and Management (1-2) Readings and discussion based on contemporary topics in avian biology and management. Additional credit awarded for writing review paper on contemporary topic of interest to student.
Repeatability: Not repeatable. May be taken once for 1-2 hours.
Registration Permission: Consent of instructor.

Comment(s): Requires graduate standing or consent of instructor.

530 Wildlife Diseases (2) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. (Same as Comparative and Experimental Medicine – Veterinary Medicine 530.)
Recommended Background: Upper-division undergraduate course in wildlife sciences.

531 Wildlife Physiology and Nutrition (2) Introduction and overview of endocrine and physiological mechanisms regulating wild animal populations (primarily wild birds and mammals); the importance of wildlife physiology and nutrition in monitoring and managing wildlife.
Credit Restriction: Students cannot receive credit for both 431 and 531.
Comment(s): Requires senior or graduate standing in the life sciences.

533 Amphibian Ecology and Conservation (3) An in-depth examination of amphibian life-history strategies, community interactions, and hypothesized mechanisms of amphibian declines. Amphibian monitoring, conservation and management techniques also are covered.
Credit Restriction: Student cannot receive credit for both 433 and 533.
(DE) Prerequisite(s): Forestry 215 or Biology 250.
Registration Restriction: Minimum student level – graduate.

536 Advanced Wetland Ecology (3) 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.
Comments: Day or overnight field trips may be required.

545 Advanced Population Analysis (2) Detail characteristics, assumptions, goals, methods, and current technologies for fish and wildlife population analysis. Use of computers.
(RE) Prerequisite(s): Animal Science 571 or Statistics 538.

546 Advanced Habitat Analysis (2) Habitat analysis as tool to evaluate habitat use and predict occurrences of animal and plant species: principles and goals of modeling, habitat analysis theory, GIS and statistical techniques. Use of computer programs.
Recommended Background: Undergraduate course in GIS.

550 Fish Physiology (3) Mechanisms of gas transfer, circulation, excretion, osmoregulation, locomotion, and neural/hormonal control of these systems in fishes. Comparisons and contrasts with physiology of terrestrial animals. Practical applications of fish physiology to aquaculture, pollution assessment, and fisheries management.
Comment(s): Requires senior or graduate standing in the life sciences.

555 Fish Culture (3) Principles, concepts and techniques of culturing economically important fish and shellfish species.
Contact Hour Distribution: 2 hours and 1 lab.
(DE) Prerequisite(s): 443 or consent of instructor.

556 Recirculating Aquaculture (3) Growing fish in intensive, indoor systems with reconditioned water. Techniques of solids removal, nitrification, and gas balance. Practical experience with operating system.
Recommended Background: Upper-division undergraduate course in fisheries science.

560 Advanced Topics in Wildlife and Fisheries Science (1-3) Recent advances and concepts, research techniques and analysis of current problems.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 443, 444, and 445 or consent of instructor.

593 Independent Study in Wildlife and Fisheries Science (1-4) Repeatability: May be repeated. Maximum 6 hours.

Women’s Studies (994)

400 Topics in Women’s Studies (3) Content varies.
Repeatability: May be repeated. Maximum 6 hours.

410 Sex Role Development: Implications for Education and Counseling (3) (See Counselor Education 410.)

422 Women Writers in Britain (3) (See English 422.)

425 Women’s Health (3) (See Health 425.)

434 Psychology of Gender (3) (See Psychology 434.)

454 Gender and Crime (3) (See Sociology 453.)

469 Sexuality and Cinema (3) Explores issues surrounding sexuality, gender and cinema from points of view of feminist film criticism. (Same as Cinema Studies 469.)

484 African-American Women in American Society (3) (See Africana Studies 484.)

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

512 History of Women’s Education (3) (See Cultural Studies in Education 512.)

543 Women, Sport, and Culture (3) (See Sport Studies 543.)

548 Transforming Critical Thinking: Constructive Thinking and Educational Implications (3) (See Cultural Studies in Education 548.)

593 Independent Study (1-6)
Repeatability: May be repeated. Maximum 8 hours.

609 Feminist Theories and Education (3) (See Cultural Studies in Education 609.)

593 Independent Study (1-4)
Repeatability: May be repeated. Maximum 6 hours.