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.

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

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

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.

540 Communication Theory (3) Overview of theory-building process and theories in communication.

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

615 Perspectives on Communication and Information Knowledge and Research II (6) Examination of the paradigmatic underpinnings that drive research in interpretivist traditions. Integrative study of the role of theory, various theoretical traditions and methods within interpretivistic communication and information research. Emphasis on classic and contemporary literature and on conducting primary research across the various fields represented by the college.

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.

630 Theory and Literature in Communication and Information Disciplines (3) Topics covering specific areas in communication and information. Theory intensive.

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.

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.

664 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.

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.

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.

Registration Permission: Consent of instructor.

542 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.

543 Medieval Latin (3) Selected readings from the Latin prose and poetry of medieval Europe. Registration Permission: Consent of instructor.

546 Cities and Sanctuaries of the Greek and Roman World (3) Major cities and sanctuaries in Greece, the Greek colonies, and the Roman Empire. Approach is archaeological, focusing on physical evidence – landscape, architecture and artifacts – as well as description by ancient authors. Cities include various types: planned and unplanned, seaports, caravan centers, government and commercial centers. The sanctuaries also vary in function, including prophetic centers, athletic centers, theater centers, and healing centers. (Same as Anthropology 436.)

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

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

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

444 Intensive Survey of the Archaeology of Etruria and Rome (3) Survey of the archaeology of Italy and the Roman world from prehistoric times to the fall of the Roman Empire (1000 BC–AD 476). Highlights are the rise and fall of Etruscan culture; development of art, architecture, art, and urban planning; and architecture used for political propaganda; and Roman cosmopolitan culture during the Empire. (Same as Anthropology 444.)

445 Ancient and Medieval Seafaring (3) Survey of seafaring in the Mediterranean and northern Europe from its very beginning, c. 11,000 BCE, until the late Middle Ages. Discussion of shipwrecks, iconographic evidence, and texts. Emphasis on ship construction and the evidence it provides about seafaring, naval warfare, technology, the exploitation of natural resources, levels of labor, social differences in society, and changes in the economy.

551 Special Topics in Mediterranean Archaeology (3) Selected topics in archaeology or art of the prehistoric Aegean, historic Greece or Rome. Lectures, discussions, student presentations, and papers. (Same as Anthropology 551.) Repeatability: May be repeated. Maximum 9 hours.

555 Graduate Seminar in Ancient Mediterranean Civilization (3) Theoretical and practical issues in the civilizations of the prehistoric Aegean or historic Greece. Study and discussions conducted in seminar format. Emphasis on developing students’ skills in research and oral as well as written presentation. (Same as Anthropology 555.) Repeatability: May be repeated. Maximum 9 hours.

571 Special Topics in Medieval Latin Literature (3) Selected topics in Medieval Latin literature. Discussions, student presentations, examinations, papers. Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 431, 432, or 435.

572 Latin Paleography (3) Introduction to the Latin hands used in Western Europe from the Roman through the Humanistic period, when most writing in the West was in Latin. Focus is on identifying and dating hands and on transcribing them accurately. Discussions, student presentations, examinations, papers. (DE) Prerequisite(s): 431, 432, or 435.

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 (1-6) Repeatability: May be repeated. Maximum 15 hours.
654 Contemporary Issues in Management of Communication and Information within Organizations (3) Integrative approach to the role of communication and information in organizational management.
   Repeatability: May be repeated. Maximum 12 hours.
   (DE) Prerequisite(s): 610 and 615. Registration Permission: Consent of instructor.

655 Contemporary Issues in International and Intercultural Communication and Information (3) Integrative approach to international and intercultural communication and information topics.
   Repeatability: May be repeated. Maximum 12 hours.
   (DE) Prerequisite(s): 610 and 615. Registration Permission: Consent of instructor.

697 Independent Study (3) Directed research in a topic of mutual interest.
   Repeatability: May be repeated. Maximum 6 hours.
   Registration Permission: Consent of instructor.

Communication Studies (250)

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 student uses university facilities and/or faculty time before degree is completed.
   Grading Restriction: Satisfactory/No Credit grading only.
   Repeatability: May be repeated. Maximum 12 hours.
   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.

Comparative and Experimental Medicine – Graduate School of Medicine (262)
Participating departments include Anesthesiology, 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. 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.
   Registration Permission: Consent of instructor.

541 Cellular and Molecular Basis of Disease (4) Disease at molecular level. Changes in molecular events in cells that lead to disease and occur as result of disease. Correlation with clinical and pathological states. (DE) Prerequisite(s): Biochemistry and Cellular and Molecular Biology 410 and 419.

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

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

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

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

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 personnel employed by the Tennessee Department of Health and enrolled in the Applied Epidemiology Certificate Program.

530 Wildlife Diseases (2) (See Wildlife and Fisheries Science 530.)
561 Pharmacology (4) 
Basic principles of pharmacokinetic and pharmacodynamic theory and data modeling. The student will learn the physiological 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 interpretation of observations. Preparation of specimens for sectioning.
Repeatability: May be repeated. Maximum 3 hours.
Registration Permission: Consent of instructor.

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

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

607 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (3) 
Advanced study of viral diseases important to domestic animals: virus biology, pathogenesis, pathology and 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, inflammation, immunopathology, hemostasis. Principal biochemical and morphologic responses of various cells, tissues, and organs to injury and other metabolic derangements. Selected contemporary topics from current literature and textbooks.
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 future research methodology, recent advances in instrumentation in analytical techniques for comparative medicine.
Repeatability: May be repeated. Maximum 12 hours.
Registration Permission: Consent of instructor.

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

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

613 Journal Club in Large Animal Clinical Sciences (1) 
Readings and discussions based on current literature.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
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, entomology, and environmental health. Prior introductory statistics and/or epidemiology 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 instructor.

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

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

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

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

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

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

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

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

501 Project in Lieu of Thesis (3) 
Capstone course taken under supervision of student’s major professor and master’s committee. Individual project involving literature survey, development of some 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.

Registration Permission: Consent of instructor.

Repeatability: May be repeated. Maximum 45 hours.

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.

Registration Permission: Consent of instructor.

Repeatability: May be repeated. Maximum 45 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 567.)

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with individual clients. (Same as Psychology 569.)

Grading Restriction: May be repeated. Maximum 9 hours.

(CE) Prerequisite(s): 480, 551, 550 or 556, and 554.

Credit(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.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 525 and 555.
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.
Repeatability: May be repeated. Maximum 9 hours.
(DE) Prerequisite(s): 525 and 555.
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): 550.

565 Facilitating 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.

660 Advanced Theory and Practice of Counseling (3)
An in-depth exploration of theories of human nature and the practice of counseling.
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)
Exten-sive 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.

511 History of American Education (3)

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 Educa-tional Implications (3)
Critique and transformation of critical thinking to more holistic, relational, and aesthetic model of multicultural and gender-sensitive constructive thinking; confronting power and addressing educational implications.
(See as Women’s Studies 548.)

549 Topics in International Education (3)
Historical, philosophical, and sociological foundations; selected nations and their cultures.
Repeatability: May be repeated. 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-6. A mini-teaching experience is involved in this course.

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.

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.


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

509 Foundations: Readings in Ecology (1-2) Readings and discussion of classic papers in field.
  Repeatability: Not repeatable. May be taken once for 1-2 hours.

511 Foundations: Readings in Evolution (1-2) Readings and discussion of classic papers in field.
  Repeatability: Not repeatable. May be taken once for 1-2 hours.

512 Foundations: Readings in Conservation Biology (2) Readings and discussion of classic papers in field.

514 Foundations: Readings in Mathematical and Computational Ecology (2) Readings and discussion of classic papers in field.

515 Foundations: Readings in Environmental Toxicology (1-2) Readings and discussion of classic papers in field.
  Repeatability: Not repeatable. May be taken once for 1-2 hours.

530 Advanced Taxonomy of Flowering Plants (3) Evolution and classification of families of angiosperms, local flora.
  Contact Hour Distribution: 2 hours lecture and 1 lab.
  (DE) Prerequisite(s): 330 or equivalent.

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: Statistics course.

577 Landscape Ecology (3) Ecological structure, function, and change through time of landscape mosaics; quantitative measures of landscape heterogeneity; responses of organisms to changes in landscape heterogeneity.
  (DE) Prerequisite(s): Biology 250 or consent of instructor.

581 Mathematical Ecology 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 evolution, 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 Ecology (1-3) Exposure and in-depth training in contemporary topics and approaches important to advanced research in mathematical, theoretical, and computational ecology. Consult departmental listing for offerings.
  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 civilized 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 microeconomics. 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/No Credit grading only.  
Repeatability: May be repeated.

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

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 of 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 of 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/No Credit only.  
Repeatability: May be repeated.

621 International Economics (3) Comparative advantage, trade migration, commodity composition of trade, protectionist devices, protectionist negotiations, 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: Advanced topics in economics. Student participation. 
Repeatability: May be repeated. Maximum 9 hours. 
Registration Permission: Consent of instructor.

693 Independent Study (1-3) Directed research on topic of mutual interest to faculty and student. Variable title for transcript purposes. 
Repeatability: May be repeated. Maximum 6 hours. 
Registration Permission: Consent of instructor.

Education (289)

540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and in-service programs. 
Grading: Satisfactory/No Credit or letter grade. 
Repeatability: May be repeated. Maximum 6 hours.

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

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. 
Registration Permission: Consent of instructor.

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 6 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 re habilitation plan.

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

583 Educational Leadership-Principalship (3) Knowledge, skills and relationships for principals to be effective educational leaders.

592 Field Problems in Educational Administration and Supervision (3) Repeatability: May be repeated. Maximum 6 hours.

596 Seminar in School Leadership, K-12 (3) On-site study of quality school processes throughout region. Repeatability: May be repeated. Maximum 6 hours.

605 Advanced Seminar in Administrative Theory (3) (See Higher Education Administration 605.)

606 Leadership Forum (1-3) Development of research, evaluation, policy analysis skills and critical analysis and evaluation of philosophical principles undergirding American education. Continuous on-campus enrollment for 2 years. (Same as Higher Education Administration 606.)

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

608 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.

610 Internship in Educational Administration (3) Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical tasks of educational administration under supervision of practitioner and university representative.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated at discretion of student’s committee. Maximum 12 hours.

614 Statistics for Educational Administrators (3) An introductory statistics course that focuses on the application of statistical procedures to problems in educational administration. Included are: scales of measurement, hypothesis testing, and descriptive and inferential statistical techniques. Computer applications are explored. (Same as Higher Education Administration 614.)

615 Research Design (3) The foundations of designing, conducting, and evaluating quantitative, qualitative, and mixed-methods research and the philosophical assumptions underlying these approaches. Topics covered include: identifying a research problem, reviewing the literature, specifying a purpose, writing research questions and hypotheses, and collecting and analyzing data. (Same as Higher Education Administration 615.)

616 Research Methods (3) The techniques of multiple regression, analysis of covariance, and multivariate analysis as applied to problems in educational administration. Computer applications are explored. (Same as Higher Education Administration 616.)

(DE) Prerequisite(s): 614.

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

(DE) Prerequisite(s): 615.

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.

(DE) Prerequisite(s): Cultural Studies in Education 560 or Educational Administration 615.

629 Seminar in Policy Issues in Education (3) Local, state, and federal education policy: theory analysis, development and implementation. Why education policy is changing rapidly, ways to follow and influence education policy, and conceptual frameworks to use for future understanding. (Same as Higher Education Administration 629.)

646 Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation.

656 Legal Issues in Education (3) School law; constitutional foundations as they relate to public education at state and local levels.

658 Conflict Management (3) (See Higher Education Administration 658.)

670 Values and Ethics in Educational Leadership (3) (See Higher Education Administration 670.)

680 Administration of Complex Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational programs and organizations. (Same as Higher Education Administration 680.)

Educational Interpreting (287)

431 American Sign Language III (3) Sequence (431-432) stresses fluency of expressive and reception sign communication skills. Using language in context is emphasized. Grammatical structures of ASL and cultural implications of the deaf community. (DE) Prerequisite(s): 226 or consent of instructor.

Comment(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.

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

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

Grading: Satisfactory/No Credit or letter grade. (DE) Prerequisite(s): 431 or consent of instructor.

Educational Psychology (310)

431 Personality and Mental Health (3) (See Counselor Education 431.)

460 Self-Management in the Helping Professions (3) Applications of self-management strategies to career, social, emotional, and health domains for both helping professionals and their clientele.

Grading: Satisfactory/No Credit or letter grade. Recommended Background: Introductory course in psychology or consent of instructor.

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

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

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

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

505 Quasi-Experimental and Single-Subject Design Research (3) History, theory and research design techniques used to examine cause and effect relationships during applied psychoeducational research. Focus on controlling threats to internal validity through research design.

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.

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, 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.

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.)

651 Advanced Qualitative Research in Education (3) (See Cultural Studies in Education 651.)

569 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 various program components, critical variables of organizational learning that affect success of implementation.

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

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

577 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

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 course offered at convenience of unit on topics of interest.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.

609 Advanced Seminar in Curriculum and Learning (3) Team-taught interdisciplinary seminar: trends, themes, and issues in curriculum and learning. Reading and discussions based on significant research and scholarly publications.

620 Seminar in Adult Education (3) Issues in adult education, theories and concepts, philosophical positions, research trends and methodologies.
(DE) Prerequisite(s): 522 or equivalent.
Registration Permission: Consent of instructor.

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

630 Doctoral Seminar in Collaborative Learning (3) Issues, theories, concepts and research in collaborative learning.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Requires admission to collaborative learning specialization.

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

640 Seminar in Applied Educational Psychology (2) Issues, theories, concepts and research in applied educational psychology.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.
Comment(s): Admission to Ph.D. education major, applied educational psychology specialization required.

651 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.

652 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.

653 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.

654 Designing Project Evaluations: Theory and Application (3) Evaluation trends and issues. Theoretical frameworks to design evaluation studies for various educational programs.

655 Research in Psychoeducational Studies (1) Data analyses, collection, and interpretation.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 9 hours.

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

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

663 Scale Construction (3) Development, pilot testing, and revision of attitude inventories, rating scales, and other paper-and-pencil techniques for assessing beliefs, personality characteristics, and opinion.
(DE) Prerequisite(s): Counselor Education 525 and a 2-course sequence in statistical analysis.

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

669 Internship in Educational Psychology (1-6) Supervised employment in unit approved educational psychology internship sites.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 12 hours.

670 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.

671 Mediated Learning Theory (3) Feuerstein's theory of mediated learning experience and its connections to work of Piaget, Vygotsky and others. Implications for transformational learning and building of learning communities for learners of all ages.
Comment(s): Requires admission to doctoral program or consent of instructor.

673 Collaborative Learning (3) Theories of collaborative learning and research related to facilitating collaborative learning in professional practice settings.
(DE) Prerequisite(s): 513 and 617 or consent of instructor.

677 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.

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

Electrical and Computer Engineering (319)

415 Automatic Control Systems (3) Automatic control systems for physical systems with linear models. The models presented include steady-state error analysis, stability, root locus, Nyquist theory, and Bode plots.
(DE) Prerequisite(s): 316.

416 Computer Control Systems (3) Computer controlled systems using state variables and z-transform model representations with sampling theory and its effect of digital control design. Design of digital controllers in both the state space and frequency domains. Includes Level 1 design projects.
(DE) Prerequisite(s): 316.

421 Electric Energy Systems (3) Structure and operation of electrical energy grid, load flow, economic loading, planning, control, and reliability. Balanced and unbalanced faults, system protection, and system stability. Includes Level 1 design projects.
(DE) Prerequisite(s): 316.

(DE) Prerequisite(s): 421.

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

432 Electronic Amplifiers (3) Feedback amplifier principles; wideband linear amplifier design; low-noise preamplifier design; audio power amplifier design. Introduction to radio-frequency amplifier design; oscillator principles. Includes laboratory experiments and design projects. Includes Level 2 design projects which require laboratory work.
(DE) Prerequisite(s): 431.

433 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.

441 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.
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, pattern, 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. 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 personal 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. 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.

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 subthreshold, threshold, and saturation region behavior; short-channel effects in scaled-down transistors; scaling laws; VLSI fabrication technology; 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 discrete-time and modulators, non-linear power amplifiers, bit and carrier synchronizers, equalizers and receivers are discussed along with the error effects resulting from the use of these models. Techniques for modeling time-varying and nonlinear systems are included. Monte Carlo techniques, semi-analytic techniques and variance reduction methods are covered.
(De) Prerequisite(s): 541.

(De) Prerequisite(s): 504.

(De) Prerequisite(s): 543.

545 Introductory Microwave Networks and Components (3) Scattering and transfer representation for multiports; unilateral and bilateral microwave and millimeter wave devices. Component and system parameter measurement by modern network analyzers. Electronic oscillators and amplifiers, frequency swept oscillators, transit time devices, parametric devices, mixers, switches.


552 Digital System Design II (3) State identification and structure 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 and government 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 time-critical embedded systems, such as sensor and actuator networks, multimedia devices and avionics. Topics include real-time operating systems, single-processor 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): 553.
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): 555.
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 organization, RISC (Reduced Instruction Set Computers), and CISC (Complex Instruction Set Computers), implementation issues, technology trends, architecture modeling and simulation.

561 Plasma Diagnostics I (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor based data handling and analysis, and reduction of time series data.
(De) Prerequisite(s): 461 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.

(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 space varying imagery. Imaging physics and color theory, shape-form-X, feature correspondence and tracking, stereo vision, structure from motion, optical flow, motion-based segmentation, and selected topics form current literature.
(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 on 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-system theories, 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-system theories, and advanced-design methods.
Repeatability: May be repeated. Maximum 6 hours.
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): 541 and 543.

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, multiprocessors, dataflow 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. Queueing theory and discrete event (DES) simulation methods are studied with application to a variety of examples drawn from the computer and communications performance evaluation literature. A standard DES language is used in modeling and simulation studies. Topics of current interest such as computer input/output models, mass memory, bus models, and communications network models are discussed. A modeling project is typically required.  
(DE) Prerequisite(s): 504.

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 461, 462 or 563, 564, or consent of instructor.  
Comment(s): 663 and 664 must be taken in sequence.

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

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

672 Image Processing and Robotics II (3) Stereo vision, 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 and theory 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 (6) 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 9 hours. Registration Permission: Consent of instructor.

567 Application of Theory in Early Childhood Education (K-3) (3) Principles and practices from selected theoretical orientations. Repeatability: May be repeated. Maximum 6 hours. 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. Registration Permission: Consent of instructor. Recommended Background: Course in early childhood education.

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

650 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.

651 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. 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.


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.

529 Fatigue of Engineering Materials (3) Fatigue life prediction, crack initiation, crack propagation. Variable amplitude loading, multi-axial loading, environmental fatigue, creep fatigue, metallurgical and microstructural variables, fractography, non-metals.

Registration Permission: Consent of instructor.

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

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

539 Continuum Mechanics (3) Cartesian tensors, transformation laws, basic continuum mechanics concepts; stress, strain, deformation, constitutive equations. Conservation laws for mass, momentum, energy. Applications in solid and fluid mechanics. (Same as Aerospace Engineering 539; Biomedical Engineering 539; Mechanical Engineering 539.)

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

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

551 Finite Elements for Engineering Applications (3) Modern computational theory applied to conservation principles across the engineering sciences. Weak forms, extremization, boundary conditions, discrete implementation via finite element, finite difference, finite volume methods. Asymptotic error estimates, accuracy, convergence, stability. Linear problem applications in 1, 2 and 3 dimensions, extensions to non-linearity, non-smooth data, unsteady, spectral analysis techniques, coupled equation systems. Computational fluid mechanics, heat/mass transport. (Same as Aerospace Engineering 571; Biomedical Engineering 561; Mechanical Engineering 561.)

Comment(s): Bachelor's degree in engineering or natural science required.


553 Computational Solid Mechanics (3) Finite element techniques in structural mechanics and linear elasticity. Energy method and weak form formulations; isoparametric elements, numerical quadrature. Equation solving, matrix iteration techniques. Applications in beams, plates and shells; use of representative commercial finite element software. (Same as Aerospace Engineering 573; Mechanical Engineering 563.)

(DE) Prerequisite(s): Mechanical Engineering 321 or equivalent.

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

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

567 Biomechanics of Hard and Soft Tissue (3) Introduction to terminology, physiology, and analytical methods for mechanics of living tissue. Continuum mechanics analysis of hard and soft issue, biological fluid flows. Flow properties of blood, theology of blood in micro vessels; bioviscoelasticity of fluids and solids, mechanical properties of blood vessels; skeletal, heart and smooth muscle; bone and cartilage. Research paper. (Same as Biomedical Engineering 571.)

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

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


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

595 Seminar (1) All phases of engineering science, reports on current research at UT and UTSA.

Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 20 hours.

600 Doctoral Research and Dissertation (3-15)

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


(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, extremization, finite element/finite volume flux vector discrete implementations, a priori error estimates, accuracy, convergence, stability. Numerical linear algebra, approximate factorization, sparse matrix methods. Dissipation, Fourier spectral analysis, smooth and non-smooth solutions. (Same as Aerospace Engineering 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) (See Mechanical Engineering 659.)

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

681 Advanced Topics in Engineering Mechanics (3) Advanced problems in mechanics, group or individually. Repeatability: May be repeated. 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 previous 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 achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night; English histories, including Henry IV; and early tragedy, including Hamlet.

405 Shakespeare II: Later Plays (3) Shakespeare's dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from great tragedies, including Othello; problem plays, including Measure for Measure; and dramatic romances, including The Tempest.

406 Renaissance Drama (3) English theatre between 1590 and 1640. Representative plays by Shakespeare's contemporaries – Marlowe, Webster, 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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Repeatability</th>
<th>Maximum Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>482</td>
<td>Major Authors (3)</td>
<td>Concentrated study of at least one of the most influential writers in British or American literary history (e.g., Donne, Pope, Austen, Tennyson, Whitman, Faulkner, Lawrence, Baldwin, or Morrison). Content varies.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>483</td>
<td>Special Topics in Literature (3)</td>
<td>Topic varies.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>484</td>
<td>Special Topics in Writing (3)</td>
<td>Original writing integrated with reading, usually taught by professional author.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>485</td>
<td>Special Topics in Language (3)</td>
<td>(Same as Linguistics 485.)</td>
<td>May be repeated with consent of department.</td>
<td>6 hours</td>
</tr>
<tr>
<td>486</td>
<td>Special Topics in Criticism (3)</td>
<td>Special topics in theoretical and practical approaches to British and American literature. Content varies.</td>
<td>May be repeated with consent of department.</td>
<td>6 hours</td>
</tr>
<tr>
<td>489</td>
<td>Special Topics in Film (3)</td>
<td>Particular directors, film genres, national cinema movements, or other topics. Content varies. (Same as Cinema Studies 489.)</td>
<td>May be repeated with consent of department.</td>
<td>6 hours</td>
</tr>
<tr>
<td>490</td>
<td>Language and Law (3)</td>
<td>Language in the Anglo-American legal process. Focus on differences between spoken and written language; lexical and syntactic ambiguity; pragmatics; speech act analysis; and the language rights of linguistic minorities. (Same as Linguistics 490.)</td>
<td>May be repeated with consent of instructor.</td>
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<tr>
<td>495</td>
<td>Introduction to Rhetoric and Composition (3)</td>
<td>Introduction to the historical, theoretical, and empirical modes of inquiry in rhetoric and composition and their implications for the teaching of composition.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>496</td>
<td>The Rhetoric of Legal Discourse (3)</td>
<td>Nature of legal language and written discourse types (opinions, memoranda, briefs). Introduction to legal research resources and techniques. Issue identification and argumentative techniques. Students will write position papers, memoranda, and briefs. No prior legal knowledge necessary. Recommended Background: 355 or consent of instructor.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>500</td>
<td>Thesis (1-15)</td>
<td>Grading Restriction: P/NP only.</td>
<td>May be repeated.</td>
<td></td>
</tr>
<tr>
<td>502</td>
<td>Registration for Use of Facilities (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. Credit Restriction: May not be used toward degree requirements.</td>
<td>May be repeated.</td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>Teaching Freshman Composition (3)</td>
<td>Introduction to teaching Freshman English through study of various techniques and philosophies of composition. Required of all first-year teaching associates.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>506</td>
<td>Introduction to Literary Research (3)</td>
<td>Critical examination of aims of English studies, profession of English teacher, theory of literature, and methods of research: collection of information, evaluation of material, and transmission of results of scholarship.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>507</td>
<td>Applied Criticism: The Rhetoric of Literary Forms (3)</td>
<td>Study and application of ways in which major critics have analyzed form in poetry and prose fiction.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>508</td>
<td>History of the English Language I (3)</td>
<td>Phonological, morphological, and syntactic development of English language: Old and Middle English.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>509</td>
<td>History of the English Language II (3)</td>
<td>Phonological, morphological, and syntactic development of the English language with concentration on developments after 1500, especially in American English.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>513</td>
<td>Readings in Medieval Literature (3)</td>
<td>Reading and analysis of selected masterpieces of Old and Middle English literature and their conceptual sources in modern English.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>514</td>
<td>Readings in Medieval Literature (3)</td>
<td>Reading and analysis of selected masterpieces of Old and Middle English literature and their conceptual sources in modern English.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>520</td>
<td>Readings and Analysis in Selected Areas of 16th- and 17th-Century Prose, Poetry, and Drama (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>521</td>
<td>Readings and Analysis in Selected Areas of 16th- and 17th-Century Prose, Poetry, and Drama (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>530</td>
<td>Readings in English Literature of the Restoration and 18th-Century (3)</td>
<td>Topics vary. Genre: poetry, prose, fiction, drama; or period: Restoration, earlier 18th-century, later 18th-century.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>531</td>
<td>Readings in English Literature of the Restoration and 18th-Century (3)</td>
<td>Topics vary. Genre: poetry, prose, fiction, drama; or period: Restoration, earlier 18th-century, later 18th-century.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>540</td>
<td>Readings in English Literature of the 19th-Century I (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>541</td>
<td>Readings in English Literature of the 19th-Century II (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>550</td>
<td>Readings in American Literature (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>551</td>
<td>Readings in American Literature (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>552</td>
<td>Readings in Black American Literature (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>560</td>
<td>Readings in 20th-Century Literature (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>561</td>
<td>Readings in 20th-Century Literature (3)</td>
<td>Content varies: genre, theme, literary movement, or other coherent emphasis.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>575</td>
<td>Issues in Second/Foreign Language Rhetoric and Composition (3)</td>
<td>Examination of cross-linguistic and cross-cultural issues in the development of academic writing proficiency in a second/foreign language. (Same as Linguistics 575.)</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>576</td>
<td>Introduction to Contemporary Criticism (3)</td>
<td>Introductory survey of 20th-century literary criticism from New Criticism to present.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>580</td>
<td>Fiction Writing (3)</td>
<td>Advanced fiction projects under supervision of instructor and time for independent study.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>581</td>
<td>Colloquium in Poetry Writing (3)</td>
<td>Major poetic project or continuation of project begun in 463. Individual consultation with instructor supplements class analysis; readings in contemporary poetry and theory. Repeatability: May be repeated. Maximum 9 hours. (DE) Prerequisite(s): 463 or consent of instructor.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>582</td>
<td>Special Topics in Writing (1-3)</td>
<td>Topics vary. Repeatability: May be repeated. Maximum 6 hours. Comment(s): Enrollment by consent of director of graduate studies.</td>
<td>May be repeated.</td>
<td></td>
</tr>
<tr>
<td>583</td>
<td>Special Topics in Literature (3)</td>
<td>Topics vary: genres, modes, and other literary subjects not in standard period divisions.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>584</td>
<td>Topics in Feminist Studies (3)</td>
<td>Topics vary. Repeatability: May be repeated. Maximum 9 hours.</td>
<td>May be repeated.</td>
<td></td>
</tr>
<tr>
<td>585</td>
<td>Issues in Invention, Style, and Audience (3)</td>
<td>Theoretical perspectives on contemporary research in rhetoric and composition.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>586</td>
<td>History of Rhetoric I (3)</td>
<td>Survey of rhetoric from Sophists to Ramus.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>588</td>
<td>Readings in Applied Rhetoric (3)</td>
<td>Content varies: Writing across curriculum, writing centers, technical communication, text linguistics. Repeatability: May be repeated. Maximum 6 hours.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>589</td>
<td>Special Topics in Language (3)</td>
<td>Topics vary. Repeatability: May be repeated. Maximum 6 hours.</td>
<td>May be repeated.</td>
<td>6 hours</td>
</tr>
<tr>
<td>590</td>
<td>Topics in Critical Theory (3)</td>
<td>Topics vary. Repeatability: May be repeated. Maximum 9 hours.</td>
<td>May be repeated.</td>
<td>9 hours</td>
</tr>
<tr>
<td>591</td>
<td>Foreign Study (1-15)</td>
<td>Repeatability: Not repeatable. May be taken once for 1-15 hours.</td>
<td>May be repeated.</td>
<td></td>
</tr>
<tr>
<td>592</td>
<td>Off-Campus Study (1-15)</td>
<td>Repeatability: Not repeatable. May be taken once for 1-15 hours.</td>
<td>May be repeated.</td>
<td></td>
</tr>
</tbody>
</table>
594 Film History, Form, and Analysis (3) Issues in film studies: history of narrative film; concept of film form; critical approaches to film study (genre, auteur, formalist, and others); and critical analysis of individual films.

593 Independent Study (1-15)
Repeatability: May be repeated once.
Comments: May be taken once in the MA program and once in the PhD program.

598 Film History, Form, and Analysis (3) Issues in film studies: history of narrative film; concept of film form; critical approaches to film study (genre, auteur, formalist, and others); and critical analysis of individual films.

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

610 Studies in Old English Language and Literature (3) Old English grammar with readings in prose and poetry.

611 Studies in Beowulf (3) Translation and critical study of Beowulf.
(DE) Prerequisite(s): 610 or consent of instructor.

620 Studies in Medieval English Literature (3) Seminar in literature and literary genres of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year.
Repeatability: May be repeated. Maximum 9 hours.

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer’s writings.
Repeatability: May be repeated. Maximum 6 hours.
Recommended Background: Previous course in Chaucer.

630 Studies in Renaissance Literature (3) Seminars: Spenser, Milton, 17th-century prose and poetry, Shakespeare, 16th-century prose and poetry, non-Shakespearean drama.
Repeatability: May be repeated. Maximum 9 hours.

Repeatability: May be repeated. Maximum 9 hours.

640 Studies in Restoration and 18th-Century Literature (3) Topics vary. Swift, satire, restoration literature, Johnson and Boswell, Addison and Steele, restoration drama, Dryden.
Repeatability: May be repeated. Maximum 9 hours.

641 Studies in Restoration and 18th-Century Literature (3) Topics vary. Swift, satire, restoration literature, Johnson and Boswell, Addison and Steele, restoration drama, Dryden.
Repeatability: May be repeated. Maximum 9 hours.

650 Studies in English Romanticism (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
Repeatability: May be repeated. Maximum 9 hours.

651 Studies in Victorian Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
Repeatability: May be repeated. Maximum 9 hours.

652 Studies in Victorian Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
Repeatability: May be repeated. Maximum 9 hours.

660 Studies in American Literature (3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain.
Repeatability: May be repeated. Maximum 9 hours.

661 Studies in American Literature (3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain.
Repeatability: May be repeated. Maximum 9 hours.

662 Studies in American Literature (3) Southern literature before 1830, frontier, regionalism, women’s literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain.
Repeatability: May be repeated. Maximum 9 hours.

670 Studies in 20th-Century Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
Repeatability: May be repeated. Maximum 9 hours.

671 Studies in 20th-Century Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
Repeatability: May be repeated. Maximum 9 hours.

672 Studies in 20th-Century Literature (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
Repeatability: May be repeated. Maximum 9 hours.

680 Topics in English Language (3)
Repeatability: May be repeated with consent of director of graduate studies. Maximum 9 hours.

682 Studies in Rhetoric and Composition (3) Content varies. Advanced work in theory and/or history of rhetoric and composition. Issues in invention, textuality, literacy, historiography, style and ethics.
Repeatability: May be repeated. Maximum 9 hours.

686 Studies in Creative Writing (3) Content varies. Connection between theory and practice in writing.
Repeatability: May be repeated. Maximum 9 hours.

688 Studies in Literary Criticism (3) Content varies. Advanced work in theory and history of literary criticism.
Repeatability: May be repeated. Maximum 9 hours.

690 Special Topics (3) Content varies. History of ideas, humor, biography, autobiography, extra-literary disciplines.
Repeatability: May be repeated. Maximum 9 hours.

694 Studies in Film (3) Content varies. Advanced work in film history and analyses.
Repeatability: May be repeated. Maximum 6 hours.

English Education (340)

460 Teaching Reading and Literature in the Secondary School (3) Teaching basic reading skills and literature.

507 Teaching Poetry Grades 7-12 (3) Research and theory in application to teaching of poetry. Design of strategies and materials for teaching and writing and reading of poetry. Review of texts and materials.

508 Teaching Composition in the Secondary School (3) Teaching narration, description, exposition, and argumentation; writing process and marking of student papers.

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

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 propagule 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: 8 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, histology and pathological structures in ornamental forest and crop species. (Same as Plant Sciences 545.)

Contact Hour Distribution: 1 hour and 4 labs weekly for 5 weeks.

Recommended Background: 8 hours of biology or botany and 8 hours of chemistry.

548 Taxonomy of Adult Insects (3) Classification, phylogeny, and distribution of insects and related arthropods. Lectures on theory and practice of insect systematics and major features of insect evolution. Laboratory practice on methods of collection, preservation, and study of insects, with emphasis on order and family identification of adults. Substantial insect collection (above requirements for 448), one or more field trips, and a taxonomically oriented project required.

Credit Restriction: Students cannot receive credit for both 548 and 448.

Registration Permission: Consent of instructor.

550 Molecular Epidemiology (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; aqueous speciation; surface chemistry; ion exchange, adsorption, and molecular retention; oxidation-reduction; and soil acidity, alkalinity, and salinity.

Recommended Background: Organic chemistry.

442 Soil Genesis and Classification (3) Soil genesis and formation; observing and describing morphology of agricultural and forest soils; chemical and physical properties, classification. Includes 3 weekend field trips.

Contact Hour Distribution: 2 hours and 1 lab.

Recommended Background: General soils.


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 complexion 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 balances; 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 hydraulics, 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 selected element 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 multi-layered aquifer systems. Modeling of complex ground water systems that will include: the development and implementation of conceptual, analytical and numerical models. Numerical approaches to the solution of PDE's 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 and disposal 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.

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

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

Recommended Background: Course in statistics or consent of instructor.

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

Recommended Background: General physics course.

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

Contact Hour Distribution: 2 hours and 1 lab.

Recommended Background: Human physiology or general physiology course and a general chemistry course.

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

Repeatability: May be repeated. Maximum 6 hours.

565 Advanced Physiology of Exercise (3) Systematic study of skeletal muscle and metabolism related to acute exercise and physical training: lectures, discussions of major scientific reviews, and appropriate laboratory experiments.

(DE) Prerequisite(s): 480 or 533.


Recommended Background: Undergraduate courses in human physiology and physiology of exercise.

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

(DE) Prerequisite(s): 480 or 533 and 567.

570 Cardiac Rehabilitation Practicum (1-3) Supervised experience in hospital-based exercise programs for participants with cardiac and/or pulmonary disorders. Use of telemetry monitoring, leading safe exercise regimens counseling participants on safe exercise guidelines. Presenting educational class on topics applicable to participants.

Repeatability: May be repeated. Maximum 6 hours.

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

593 Independent Study (1-3) Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated. Maximum 6 hours.

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

Repeatability: May be repeated.

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

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated. Maximum 6 hours.

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

Repeatability: May be repeated. Maximum 6 hours.

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

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 kinematics, muscle electrical activity and electromyography, and other related methods.

Recommended Background: Basic biomechanics course or consent of instructor.

635 Physical Activity and Positive Health (3) Review of clinical, epidemiological, and experimental evidence concerning relationship and effects of exercise on health-related components of fitness. (Same as Public Health 635.)

(DE) Prerequisite(s): Elementary statistics course, 480 or 533 and 567 or consent of instructor.

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

Repeatability: May be repeated. Maximum 6 hours.

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

Repeatability: May be repeated. Maximum 6 hours.

Finance (349)

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

Grading Restriction: Satisfactory/No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

511 Strategic Management for Creation of Financial Value (3) Strategic issues in corporate finance, investments, and capital markets: how firms can employ financial strategies to create value. Use of derivatives, risk management, real options, fixed income securities, venture capital, initial public offerings and financial restructuring.

(DE) Corequisite(s): Business Administration 513.

Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

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

(DE) Prerequisite(s): 511 and Business Administration 511, 512, 513, and 514 or consent of instructor.

525 Investment Analysis and Portfolio Management (3) Investment process, portfolio applications. Asset allocation decision in global setting: organization and functioning of financial markets; equity and bond valuation; asset valuation models; equity and bond portfolio management; options, forwards and futures contracts; evaluation of portfolio performance; and review of alternative economies and emerging markets.

(DE) Prerequisite(s): 511 and Business Administration 511, 512, 513, and 514 or consent of instructor.


(DE) Prerequisite(s): 511 and Business Administration 511, 512, 513, and 514 or consent of instructor.

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.

(DE) Prerequisite(s): Business Administration 513.

Comment(s): Prior knowledge may satisfy prerequisite with consent of instructor.

581 Real Estate Investment and Finance (3) Financial and market analysis used to make real estate investment decisions. Effects of variety of financing options on rate of return on income-producing properties. Effect of various financing options on consumer’s decisions to purchase. Relationship between primary and secondary mortgage markets and impact of these markets on economic value and stability of funds for real estate lending. Effects of government intervention (taxation, subsidization, and regulation) in both real estate and mortgage markets.

(DE) Prerequisite(s): 511 and Business Administration 511, 512, 513, and 514 or consent of instructor.

593 Independent Study (3) Directed research and study.

Repeatability: May be repeated. Maximum 6 hours.

(DE) Prerequisite(s): Business Administration 511, 512, 513, and 514, or consent of instructor.
599 Special Topics in Finance (1-3) Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

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

641 Seminar in Finance (1-3) Capital markets, utility theory, asset pricing, theory of the firm, capital structure, dividend policy.
Grading: Satisfactory/No Credit or letter grade.
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.
Contact Hour Distribution: One 2-hour lab.
(DE) Prerequisite(s): 410.
Recommendation: Consent of instructor.

652 Seminar in Asset Pricing and Markets (1-3) Recent theoretical and empirical developments in finance. Topics vary.
Grading: Satisfactory/No Credit or letter grade.
Contact Hour Distribution: 3 hours lecture and 1 lab.
(DE) Prerequisite(s): 641.
Registration Permission: Consent of instructor.

653 Seminar in Financial Institutions (1-3) Theoretical and empirical studies of financial institutions. Topics: modeling banking firm, efficiencies in banking, bank lending arrangements and asymmetric information, international competitiveness, and deposit insurance.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 641.
Registration Permission: Consent of instructor.

654 Special Topics (1-3) Recent developments in finance.
Grading: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 641.
Registration Permission: Consent of instructor.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and staff member.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

Food Science and Technology (390)

410 Food Chemistry (3) Reactions of water, proteins, lipids, carbohydrates, minerals, enzymes, vitamins, and additives in foods.
Contact Hour Distribution: 3 hours lecture.
(DE) Prerequisite(s): Chemistry 110, Biochemistry and Cellular and Molecular Biology 310.

415 Food Analysis (4) Principles, methods and techniques for qualitative and quantitative analyses of composition and physical, chemical, and biological properties of food and food ingredients.
Contact Hour Distribution: 3 hours and one 2-hour lab.
(DE) Prerequisite(s): Chemistry 110 or 350.

419 Food Chemistry Lab (1) Interaction of water, proteins, lipids, carbohydrates, minerals, enzymes, vitamins, and additives in foods and methods of evaluation of chemical properties of foods.
Contact Hour Distribution: One 2-hour lab.
(RE) Corequisite(s): 410.

420 Food Microbiology (2) Physical, chemical and environmental factors moderating growth and survival of foodborne microorganisms; pathogenic and spoilage microorganisms affecting quality of foods and their control.
(DE) Prerequisite(s): Microbiology 210.
(DE) Corequisite(s): 429.

429 Food Microbiology Lab (3) Methods for examination, enumeration, cultivation and identification of foodborne microorganisms.
(DE) Prerequisite(s): Microbiology 210.
(DE) Corequisite(s): 420.

430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: Basic statistics course.

445 Application of Food Chemistry and Processing Principles (4) Interactions and functions of dairy, egg, cereal and other plant based ingredients during the production and storage of processed food products.
Contact Hour Distribution: 3 hours lecture and 1 lab.
(DE) Prerequisite(s): 340 and 410 or consent of instructor.

461 Fresh Meats (3) Basic principles in the conversion of muscle to meat and the factors that contribute to the utilization and marketing of quality fresh meat products.

462 Manufactured Meat Technology (2) Basic principles of manufacturing valued-added meat products.
Contact Hour Distribution: 1 hour lecture and 1 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.
(DF) 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.
(DF) Prerequisite(s): 320 and 340 or consent of instructor.

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

501 Seminar (1) Individual reports and discussion on topics from current literature.
Grading Restriction: Satisfactory/No Credit grade only.
Repeatability: May be repeated. Maximum 3 hours.

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

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

522 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.
(DF) Prerequisite(s): 410.

523 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.
(DF) Prerequisite(s): 420 and 429.

541 Food Engineering (3) Transport processes in food engineering; unit operations; thermal and non-thermal processing of foods; food separations; processing and physicochemical properties of foods; calculations, design practices, and equipment used in food processing operations.
Contact Hour Distribution: 2 hours and one 2-hour lab.
Credit Restriction: Students cannot receive credit for both 441 and 541.
Recommended Background: Basic calculus and physics.

590 Special Topics in Food Technology and Science (1-3) Critical reviews of current research and production concerns of food industry.
Repeatability: May be repeated. Maximum 9 hours.

593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry or governmental laboratories.
Repeatability: May be repeated. Maximum 6 hours.

600 Doctoral Research and Dissertation (3-15)
Grading Restriction: Satisfactory/No Credit grade only.
Repeatability: May be repeated.

601 Seminar (1) Reports and directed discussion on research topics from current literature.
Grading Restriction: Satisfactory/No Credit grade only.
Repeatability: May be repeated. Maximum 3 hours.

603 Research Planning (1-6) Preliminary research and investigation of dissertation research topic, and preparation of a research proposal.
Grading Restriction: Satisfactory/No Credit grade only.
Repeatability: May be repeated. Maximum 18 hours.
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 toxins 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): Enrollment 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/FL 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): 576 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)


Comment(s): Senior standing or consent of instructor required.

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, site design projects. Management strategies, methods of visitor and recreation site management. Case studies. Weekend field trips may be required.

Contact Hour Distribution: 2 hours and 1 lab.

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

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

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

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identify, analyze and prepare written report. Topic and report must have approval of graduate committee.

Comment(s): Available only to forestry majors in the non-thesis option.

512 Seminar (1) Current developments in forestry. All M.S. students must complete the course twice during their program.
Repeatability: May be repeated. Maximum 2 hours.

514 Tree Physiology (3) Tree structure, growth and development, and function, and how these are related to the environment and to cultural practices. Influence of environmental variables on plant growth and distribution; effects of forest management practices on growth and function.
Credit Restriction: Students cannot receive credit for both 514 and 414.

(DE) Prerequisite(s): Biology 111 and 112 or Biology 101 and 102.

515 Forest Conservation Workshop (1-3) Relation of forest biology, ecology and management to conservation issues; integration of current conservation issues into classroom work and student projects; environmental education strategies.
Repeatability: May be repeated. Maximum 3 hours.
Comment(s): Not available to students in forestry or wildlife and fisheries science.

520 Advanced Forest Ecology (3) Physiological ecology and adaptations of trees; relationships between overstory structure, microclimate, and understory response; regeneration ecology; competition and effects of natural and human disturbance regimes at multiple scales; forest succession and stand dynamics.

Comment(s): Requires graduate standing in forestry or biological science or consent of instructor.

521 Composite Materials from Renewable Resources (3) Manufacturing processes, science and engineering of composite materials derived from renewable resources. Overview of renewable resources and utilization; structure and properties of natural fibers, thermosets, thermoplastics, and bioplastics; fundamentals of adhesion; engineered wood composites; natural fiber reinforced composites; and mechanical property and durability testing.

(DE) Prerequisite(s): Biology 220
Recommended Background: Basic understanding of polymer chemistry, engineering, physics, a silvicultural methods course or consent of instructor.

530 Advanced Forest Resource Management (3) Analysis of forest management problems in public and private organizations. Classical forest regulation; linear and goal programming, as applied to resource management problems; advanced forest investment analysis; decision-making methods for primary forest management activities; and methodologies for incorporating non-timber values in forest management operations.
Recommended Background: Senior-level forest management course or consent of instructor.

550 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development on forests and associated lands; analysis and critique of specific contemporary alternatives. Includes overnight field trips.
Recommended Background: Senior-level course in forest recreation or consent of instructor.

580 Advanced Silviculture (3) Silvical characteristics, silvicultural practices and systems applied to commercially important hardwoods and softwoods. In-depth analyses of silvicultural principles involved and tools used, prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, structure, growth/yield.
Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: Silviculture course.

590 Advanced Topics in Forestry (1-3) Recent advances and concepts; research techniques and analysis of current problems.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

593 Independent Study in Forestry (1-4)
Repeatability: May be repeated. Maximum 6 hours.

630 Forest Growth and Development (3) Forest stand dynamics, analysis of changes in species composition and forest stand structure (physical and temporal) during forest succession, response of stands to disturbances (anthropogenic and natural), modeling techniques to make predictions of future stand development.

Contact Hour Distribution: 2 hours and 1 lab.
Recommended Background: Undergraduate course in silviculture.
Forrest, 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 bio-physical 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) MAS 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 approaches 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.

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

413 French Literature of the 18th-Century (3) Major works of the Enlightenment.
(DE) Prerequisite(s): 300-level literature course.

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

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

420 French Cinema (3) The French cinema from its earliest days through New Wave directors. May be applied toward the French major. (Same as Cinema Studies 420.)
(DE) Prerequisite(s): 300-level literature course.

421 Phonetics (3) Foundation in the science of phonetics. Practical exercises and individual performance.
Credit Restriction(s): Graduate credit is not available to students majoring in a Romance language.
(DE) Prerequisite(s): 333 or 334 or 345 or permission of department.

422 Advanced Grammar (3) Improving one’s written French by studying basic and more refined structures of the French language. Writing creative free-style compositions.
(DE) Prerequisite(s): 333 or 334 or 345.

423 Advanced Conversation (1) Informal conversation with native speaker on contemporary topics. Stresses in-class contact rather than outside preparation.
Contact Hour Distribution: Meets 2 hours a week.
(DE) Prerequisite(s): 333 or 334 or 345.

424 Advanced Conversation (1) Informal conversation with native speaker on contemporary topics. Stresses in-class contact rather than outside preparation.
Contact Hour Distribution: Meets 2 hours a week.
(DE) Prerequisite(s): 333 or 334 or 345.

425 Introduction to Descriptive Linguistics (3) Initiation into the theory and practice of techniques of linguistic analysis in the subfields of phonetics, phonology, morphology, syntax, semantics, pragmatics and historical linguistics; discussion of their relevance to the learning and teaching of foreign languages and to the study of literary texts. (Same as German 425; Linguistics 425; Russian 425; and Spanish 425.)
Recommended Background: Linguistics 200.

426 Methods of Historical Linguistics (3) (See German 426.)

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.)
519 Bibliography and Methods of Research (3) Critical research tools and scholarly contributions in French literature and language. Practical exercises on compiling of scholarly data using computer-based and non-computer sources.

520 French and Francophone Film (3) French and Francophone culture through film.

530 French and Francophone Theater (3) Changing approaches to French and Francophone Theater.

540 French Literature and Culture I (3) Literary and cultural heritage of French Middle Ages.

550 French Literature and Culture II (3) Literary and cultural heritage of 16th- and 17th-century France.

560 French Literature and Culture III (3) Literary and cultural heritage of 18th- and 19th-century France.

570 French and Francophone Literature and Culture I (3) Literary and cultural heritage of France and other Francophone countries in the first part of 20th-century.

573 French and Francophone Literature and Culture II (3) Literary and cultural heritage of France and other Francophone countries from the late 20th-century to present.


584 Modern Theory and Criticism (3) Survey of 20th-century critical theory, including psychoanalysis, Marxism, structuralism, and more.

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

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

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

594 French Directed Readings (3)

595 French Directed Readings (3)

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

610 Doctoral Seminar in French and Francophone Studies, or Linguistics (3) Content varies. Repeatability: May be repeated with consent of department. Maximum 12 hours.

Geography (415)

410 Global Positioning Systems and Geographic Data (3) Theory, field, and laboratory use of Global Positioning Systems for capturing digital geographic data. Management of geographic data, including coordinate systems, datum issues, scanning digitizing, map standards, and uncertainty in Geographic Information Systems.

Contact Hour Distribution: 2 hours lab and one 2-hour lab.

411 Introduction to Geographic Information Science (3) Concepts and methods of spatial analysis and their application using geographic information systems software and techniques. Emphasizes both theoretical and applied aspects of GIS.

Contact Hour Distribution: 2 hours lecture and 2 hours lab. (DE) Prerequisite(s): 310 or consent of instructor.

412 Advanced Cartography Techniques (3) Cartographic design and data display techniques for reference and thematic maps. Basic principles and methods of map reproduction.

Contact Hour Distribution: 2 hours and 2 labs. (DE) Prerequisite(s): 310 or consent of instructor.

413 Remote Sensing: Types and Applications (4) Principles and uses of remote sensing imagery, digital data, and spectral data, with particular emphasis on geographic interpretation and mapping techniques.

Contact Hour Distribution: 3 hours lecture and 2 hours lab. (DE) Prerequisite(s): 132.

414 Spatial Databases and Data Management (3) Types, sources, acquisition, and documentation of spatial data. Spatial database management methods and strategies for data sharing.

Contact Hour Distribution: 2 hours lecture and 2 hours lab. (DE) Prerequisite(s): 411 or consent of instructor.

415 Quantitative Methods in Geography (4) Geographic application of statistical techniques, point pattern analysis, spatial analyses, and correlation and regression techniques.

Contact Hour Distribution: 3 hours lecture and 2 hours lab per week. (DE) Prerequisite(s): Mathematics 115 or Statistics 201.

421 Geography of Folk Societies (3) Geographical study of folk culture, emphasizing traditional material culture and rural settlement, with examples drawn from eastern North America and selected foreign areas.

423 Geography of American Popular Culture (3) Geographical study of regional variation in popular cultures, especially focused on youth cultures in the United States. (Same as American Studies 423.)

432 Dendrochronology (4) Principles, techniques, and interpretation in tree-ring science. Applications in geography, climate, ecology, forestry, archaeology, and earth sciences.

Contact Hour Distribution: 3 hours lecture and 2 hours lab. (DE) Prerequisite(s): 132.

433 The Land-Surface System (3) Characteristics of surface form, water, vegetation, and surface materials, and their regional interrelationships. People as evaluators and agents of change. (DE) Prerequisite(s): 132.

434 Climatology (3) General circulation system leading to world pattern of climates. Climatic change and modification. Interrelationships of climate and human activity.

(DE) Prerequisite(s): 131 or consent of instructor.

435 Biogeography (3) Study of the changing distribution patterns of plants and animals on a variety of spatial and temporal scales. The effects of plate tectonics, Pleistocene climatic change, and human activity on world biota. Recommended Background: Introductory physical geography or coursework in botany or ecology.

436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues examined from physical and economic geographical perspectives.

(DE) Prerequisite(s): 132.

439 Plant Geography of North America (3) Characteristics and distribution of major plant communities of Canada, the U.S., Mexico, and Central America. Relationships to climate, soil, fire, and human disturbance. Long-term history and future prospects. Recommended Background: Introductory physical geography or coursework in botany or ecology.

441 Urban Geography of the United States (3) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities in the United States.

442 Urban Social Geography (3) Geographical study of urban culture. Social production of neighborhoods; social and behavioral aspects of territoriality, residential mobility, segregation, and the rise of post-industrial and global cities.

443 Rural Geography of the United States (3) Geographical appraisal of rural areas of the United States, including small towns and urban fringes. Problems and potentials of rural America.

449 Geography of Transportation (3) Examination of transportation systems, emphasizing their effects on trade patterns, land use, location problems, and development.

450 Process Geomorphology (3) (See Geology 450.)


454 Terrain Analysis (3) Analysis of landscape history from digital elevation data and traditional topographic maps. Basement materials and structures. Erosional and depositional evidence, including fluvial, glacial, aeolian, and shoreline features, of past climatic and biological regimes. Recommended Background: 132 or Geology 101 and 102 or Geology 107 and 108.

495 Special Topics in Geography (1-4) Topics vary.

Grading: Satisfactory/No Credit or letter grade. Repeatability: May be repeated with consent of instructor. Maximum 8 hours. Registration Permission: Consent of instructor.

500 Thesis (1-15) Grading Restriction: P/NP only. Repeatability: May be repeated.
501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. May be applied toward graduate degree. Registration required of resident graduate students whenever offered.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 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): 415 or consent of instructor.

514 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.

541 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.

545 Topics in Population Geography (3) Human population dynamics and migration, spatial variation in population composition and housing. Demographic analysis techniques.

549 Topics in the Geography of Transportation (3) Examination of trends, problems, and methods in transportation geography and transportation networks.
Repeatability: May be repeated with consent of instructor. Maximum 6 hours.
(DE) Prerequisite(s): 449 or consent of instructor.

591 Foreign Study (1-15) Graduation: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Written consent of department prior to registration.

592 Off-Campus Study (1-15) Graduation: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Written consent of department prior to registration.

593 Independent Study (1-15) Graduation: Satisfactory/No Credit or letter grade.
Repeatability: May be repeated. Maximum 15 hours.
Registration Permission: Written consent of department prior to registration.

599 Geographic Concept and Method (3) Traditional and modern geographic thought; readings on nature, scope, problems, and methods of geography.
Registration Permission: Consent of instructor.

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

609 Seminar in Geography (2-3) Topics vary.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

611 Seminar in Geographic Information Science (3) Repeatability: May be repeated. Maximum 6 hours.
(DE) Prerequisite(s): 517 and 518 or consent of instructor.

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

632 Seminar in Dendrochronology (3) 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 5 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.

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 lecture 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 field (gravity and magnetics), heat flow, electromagnetic (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 and 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, resistivity, magnetic), and geologic control of rock properties, subsurface water, and engineering problems. (Same as Civil Engineering 485.)
Contact Hour Distribution: Introductory calculus, physics, and geology.

500 Thesis (1-15) 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 requirement.

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 schemes, 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 this section.
Contact Hour Distribution: 3 hours lecture and one 2-hour lab.
Recommended Background: Advanced mineralogy or consent of instructor.

535 Applied Ground Water Hydrology (3) (See Environmental Engineering 535.)

539 Geologic Applications of Remote Sensing (3) An introduction to the use of visible, infrared, microwave/radio, and nuclear remote sensing techniques in the geologic study of the Earth. Topics covered include methods of imagery, 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 weeks lecture, 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; abiogenic vs. biotic control of carbonate precipitation; secular change in carbonate mineralogy and fabric through geologic time. Petrographic observation, synthesis of petrographic and geochemical datasets, critical analysis of scientific literature, and oral/written presentation.
Contact Hour Distribution: 3 lecture/discussion hours per week and one 2-hour lab.
Recommended Background: General chemistry, mineralogy and sedimentology and stratigraphy or consent of instructor.

561 Organic Geochemistry (3) Fundamentals of organic geochemistry; primary production, diagenesis, and preservation of organic matter in the sedimentary rock record; and reconstruction of ancient organic environments using biomarker compounds.
Contact Hour Distribution: 3 lecture hours.
Recommended Background: General chemistry or consent of instructor.

563 Stable Isotope Geochemistry (3) Theoretical aspects of isotope fractionation and applications to geologic systems. Isotope exchange, variations in natural waters, diagenetic, hydrothermal and metamorphic systems.
Recommended Background: General chemistry or consent of instructor.

565 Chemical Petrology (3) Application of thermodynamics to geologic materials. Thermodynamics of condensed phases, solutions, thermodynamic stability, heterogeneous, multicomponent phase equilibria, and conduction of heat through earth.
Recommended Background: Calculus, general chemistry and physical chemistry or consent of instructor.

568 Geochronological Analysis (3) Collection and treatment of geochronological data using electron microprobe, X-ray fluorescence, and atomic absorption spectrophotometry techniques.
Contact Hour Distribution: 2 hours lecture and one 2-hour lab.
Recommended Background: General chemistry and mineralogy or consent of instructor.

570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; recent literature.
Contact Hour Distribution: 3 hours lecture and 1 lab or seminar.
Recommended Background: Structural geology or consent of instructor.
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.
Recommended 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.

Comment(s): Registration required each spring and fall semester for resident full-time graduate students, except when registered for 596.

596 Geology Colloquium (1) Preparation and oral presentation of scientific material. Grade based on content, preparation, presentation, and instructor critique in departmental seminar.
Comment(s): Registration required once during residence for each graduate student.

600 Doctoral Research and Dissertation (3-15)
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)
(ED) Prerequisite(s): 311 and 312 or consent of department.

412 Advanced Conversation and Composition (3)
(ED) 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.
(ED) 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 literary, musical and artistic representations of specific themes.
Recommended Background: 6 hours of 300-level courses, 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 and courses in English translation.

425 Introduction to Descriptive Linguistics (3) (See French 425.)

426 Methods of Historical Linguistics (3) Phonetics, distinctive feature analysis, sound change types, nature of sound change, principles of reconstruction, and fundamental assumptions about language change through time. Non-phonological linguistic change, language families, 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 300-level courses, 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 300-level courses, 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 300-level courses, 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 300-level courses, 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.

Repeatability: May be repeated. Maximum 18 hours.

Grading Restriction: P/NP only.

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 Literature 1890-1945 (3) Content varies.

Repeatability: May be repeated. Maximum 6 hours.

556 Modern German Literature 1945-Present (3) Content varies.

Repeatability: May be repeated. Maximum 6 hours.

560 German Literary Theory and Criticism (3)

561 Directed Readings in German Language and Literature (3) 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 Foreign Languages and Literatures 482.)

Health (449)

400 Consumer Health (3) Major consumer health care providers and health care services. Selecting, purchasing, evaluating and financing medical and health care services/products. (Same as Public Health 400.)

406 Death, Dying and Bereavement (3) Aspects of dying, death and handling the trauma of loss. Medical, financial, physical, legal, and social implications of death. (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.
560 Doctoral Research and Dissertation (3-15)
Grading Restriction: P/INP only.
Repeatability: May be repeated.

561 Internship/Research in Safety and Health (3-6) (See Safety 601.)

560 Critical Analysis of Writing and Research (3) Analysis of writing and research in health related areas.

620 Advanced Research Techniques in Health (3) Advanced theory and techniques of research design and methodologies in health discipline.

560 Health Aspects of Gerontology (3) Knowledge and understanding of biological, psychological and sociological aspects of aging as related to health and wellness of individual. (Same as Public Health 650.)

565 Seminar in Nation's Health (3) Comprehensive study of definition, determinants, resources and health status of nation. (Same as Public Health 656.)

660 International Health (3) Study of quality of health, health promotion and health services in countries throughout world. (Same as Public Health 660.)

Higher Education Administration (461)
455 Seminar in Student Leadership (1) Topics to be assigned. Designed to develop knowledge and skills in leadership roles for resident assistants, student government leaders, student activities, and other student organizations.

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. 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 3 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.

572 Student Development Theory and Practice in Higher Education (3) Theoretical framework of college student personnel services and practical application of theory in student services environment. Applicable administrative theory, human development theory and evaluation assessment techniques.

574 The College Student (3) Critical examination of the characteristics and concerns of current college students in relation to the direction and provision of student services and student personnel administration.

620 Independent Study (1-3) Repeatability: May be repeated. Maximum 9 hours.
Registration Permission: Consent of instructor.

595 Special Topics (1-3)
Repeatability: May be repeated. Maximum 12 hours.

599 Internship in College Student Personnel (1-6)
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

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

604 Seminar in Educational Administration and Policy Studies (1-4) Directed readings and research in educational administration.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

605 Advanced Seminar in Administrative Theory (3) Interdisciplinary seminar. Readings selected by faculty for research and scholarly value from early to current classic theoretical studies and current periodical literature in administrative and organizational theory. (Same as Educational Administration 605.)

606 Leadership Forum (1-3) (See Educational Administration 606.)

614 Statistics for Educational Administrators (3) (See Educational Administration 614.)

615 Research Design (3) (See Educational Administration 615.)

616 Research Methods (3) (See Educational Administration 616.)

617 Case Study Methods in Educational Research (3) (See Educational Administration 617.)

629 Seminar in Policy Issues in Education (3) (See Educational Administration 629.)

640 Policy Issues in College and University Law (3) Legal precedent affecting organizations, administration, and finance of higher education. Academic freedom, faculty termination, religion, tort liability, administrative law, academic due process and affirmative action in employment.

645 Curriculum and Instruction in Higher Education (3) Examination of teaching, learning and curriculum in higher education.

560 Fiscal Policy Issues in Higher Education (3) Revenue sources, appropriation process, budget procedures, cost analysis, and fiscal management in public and independent colleges and universities.

565 Conflict Management (3) Social conflict and its management. Causes of interpersonal, inter-group, and organizational conflict, skills and strategies used to manage conflict, conflict management models associated with different sectors of human activity, and current organizational practices for managing destructive conflict. (Same as Educational Administration 658.)

670 Values and Ethics in Educational Leadership (3) Examination of moral and ethical dimensions of the work of educational leaders. (Same as Educational Administration 670.)

680 Administration of Complex Organizations (3) (See Educational Administration 680.)

693 Independent Study (1-3) Repeatability: May be repeated. Maximum 12 hours.

695 Special Topics (1-3) Repeatability: May be repeated. Maximum 12 hours.
History (462)

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 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. 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/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.
Comment(s): Enrollment limited to hotel, restaurant, and tourism students in non-thesis option.
Registration Permission: Consent of instructor.

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

510 Trends and Issues in Service Management (3) Examination of current and emerging trends and issues in the consumer product and services industry. Implications of trends and their managerial and strategic applications in 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/NP 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/NP only.
Repeatability: May be repeated.

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

503 Problems in Lieu of Thesis (3)
Grading Restriction: Satisfactory/No Credit grading only.
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/NP 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): Management 521.
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 rearrangement 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 568 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): 330.


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 design 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 and hypothesis testing; goodness-of-fit tests; linear regression and correlation; analysis of variance; single and multiple factorial 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 interest rates; uncertainty; using non-probabilistic techniques; capital financing and project allocation; evaluations 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 manufactured 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 the 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, machine 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; Bayesian analysis of sequential decision making; artificial intelligence in complex decision analyses.  
(DE) Prerequisite(s): 518 and 523.

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

(DE) Prerequisite(s): 516.

606 Advanced Topics in Human Factors, Safety and Biomechanical Engineering (3) Application of advanced engineering analysis and design methods to manned system safety, epidemiology of accidents and injuries, and study of injury causal mechanisms. Injury models and theories and development of injury, loss, and risk reduction techniques. Current research issues in manned systems analysis and design. Research into system failures: prevention of injuries.  
Registration Permission: Consent of instructor.

611 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.

612 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.

613 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.

691 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.

692 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.

693 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 advantages, 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, content-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. Curriculum involvement, role of technology, site-based management, relationships with district and state services.
552 Academic Libraries (3) Mission, status, and history of academic libraries and academic librarianship in community colleges, colleges and universities; trends in higher education, information technology, and government's impact on public, technical, and administrative services.
(DE) Prerequisite(s): 550 or consent of instructor.

553 Specialized Information Agencies and Services (3) Development and present status, scope and objectives. Information resources external to information organization.
(DE) Prerequisite(s): 550 or consent of instructor.

554 Public Library Management and Services (3) Development, roles, political environment, governance, organization, fiscal management, services, marketing, and performance evaluations.
(DE) Prerequisite(s): 550 or consent of instructor.

555 Scientific and Technical Communications (3) Evolution of scientific and technical communication; current trends; role of formal and informal communications; major STI organizations and their roles.

556 Knowledge Management for Information Professionals (3) Covers classic theories of knowledge and theories of first and second-generation knowledge management paradigms. Introduces related disciplines and the knowledge lifecycle, types of knowledge, organizational learning, intellectual capital, communities of practice, knowledge ecologies, knowledge audits, knowledge sharing repurposing of information, uses of information technology, and roles of information professionals in developing knowledge management initiatives.

557 User Instruction (3) Theory, strategy, design, and practice in providing instructional services and technology for end users of information and information systems. Includes practical experience.

558 Library Services for a Diverse Society (3) Examines the issues of diversity and multiculturalism in libraries and librarianship. Considers general issues affecting institutions in addition to libraries. Examines specific social characteristics and the social/cultural groups constructed around these characteristics. Considers the needs of such groups, and library responses to these needs, and how to create a more diverse library profession.

560 Development and Management of Collections (3) Selecting and preserving a variety of items (tangible and intangible) to meet needs of particular users; community analysis; policies and procedures; evaluation; purchasing.

561 Contemporary Book Publishing (3) Creation, design, production, marketing, and distribution; various types of publishers.

563 Graphic Design and Media (3) Principles and practice in visual aspects of communications. Graphic design, typography, production techniques and publication design, as these apply to electronic information delivery systems.

564 Archives and Records Management (3) Objectives and functional elements of records systems, archival programs, management information systems and techniques within various types of organizations. Management of information internal to organizations.


566 Business Intelligence for Information Professionals (3) Principles and practices of gathering and synthesizing business intelligence; including competitive intelligence, environmental scanning, and issues management; information evaluation and synthesis; role of strategic information in modern organizations.

567 Information Network Applications (3) Scholarly and community-based electronic communications. National and international standards, tools, resources; identification, analysis, evaluation, and management of tools and resources; construction of local technologies as developed and applicable.


572 Resources and Services for Young Adults (3) Critical survey of books and related materials for young adults; personal, vocational, and recreational needs and interests. Evaluation, selection, and utilization for school and public libraries.

573 Programming for Children and Young Adults (3) Philosophy and objectives of public and school library services for children and young adults. Reading, listening, and viewing guidance for individuals and groups. Program planning, implementation, and evaluation.
(DE) Prerequisite(s): 571 or 572.

574 Resources and Services for Adults (3) Examines strategies and procedures for developing programs in libraries. The course provides public service librarians with the knowledge and skills to create, evaluate, and improve programs with some emphasis on reader’s advisory.
(DE) Prerequisite(s): 560.

575 Valuing Diversity: International and Intercultural Resources for Youth (3) Examines texts and materials for youth that reflect the contemporary settings and lives of young people from all over the world. This course will review the scholarship of literature and film to determine how to recognize stereotypes; how to understand publishing worlds; and how to recognize universal themes that transcend ethnicity, religion, gender, class, and nationhood.

576 Storytelling in Libraries and Classrooms (3) Examines the history of those who influenced the programming and styles of storytelling. Additionally, the course will offer techniques and sources for selecting, preparing and telling stories to library and classroom audience.

582 Information Systems Planning and Evaluation (3) Information systems used in libraries and information agencies. Emphasizes planning, evaluation and system implementation. Covers usability engineering, interface design, and human computer interaction.

583 Information Systems Problems and Principles (3) Use of systems theory and analytical tools for understanding and improving information systems. Emphasizes interface between technology, processes, and stakeholders. Focuses on problem identification and problem-solving techniques, system design representations, object-oriented system design, system prototyping, and project management.

584 Database Management Systems (3) Defining data needs, data structures, role of operating systems in data management, file organization, database management systems, logical data models, internal data models, database administration and evaluation. Design and implementation of application using database management system.

585 Information Technologies (3) Evolution, trends, capabilities, and limitations of technologies applied to information capture, storage, preservation, access, and distribution.

586 Information Retrieval Systems (3) Historical perspective on information retrieval research; statistical and probabilistic retrieval techniques; cognitive user modeling; expert intermediary systems; associations, relations and hypertext.

587 Mining the Web (3) Covers strategies for mining the Web, Web engines and directories, cognitive accessibility, Web design and development, and usability engineering.

588 Human-Computer Interaction (3) Survey of human-computer interaction and introduction to human and technological factors of importance to design of usable information systems. Basic phenomena of human perception, cognition, memory, and problem solving, and relationship to user-centered design. Methods and techniques for interaction design and evaluation.


590 Problems in Information Sciences (3-6) Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of academic advisor.

591 Independent Project or Research (3) Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of instructor.

594 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose area coincides with interests of student.
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours. Registration Permission: Consent of advisor and research director.

595 Student Teaching in School Library Information Center (9) Planned professional semester: full day school library work and classroom observation activities.
Grading Restriction: Satisfactory/No Credit grading only.

596 Field-Based Experience in School Library Information Centers (2) Prescribed activities to gain competencies in a school library information center setting. Must be taken twice.
Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 6 hours.
599 Practicum (3-6) Opportunity to translate theory into practice under guidance of qualified information professionals. 
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Recommended Background: Completion of core and pertinent advanced courses relevant to student’s practicum design.
Comment(s): 3.00 GPA required.
Registration Permission: Consent of advisor and approval of practicum coordinator.

601 Advanced Seminar in Information Sciences (3) Theories, research, and traditional practices of information representation, organization, 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) Materials based on specific learner characteristics and objectives.

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.

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.

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

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

518 Educational Specialist Research and Thesis (3) 
Grading Restriction: P/NP only.
Repeatability: May be repeated. Maximum 12 hours.

549 Supervised Readings (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 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 Preerequisite(s): 212 or consent of instructor.

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

403 Literature of the Rinascimento (3) From Pulci to Tasso, Quattrocento and Cinquecento.
(DE Prequisite(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 editorials/columns for newspapers, magazines, corporate publications, and electronic media (radio, television, cable, Internet), with emphasis upon study and use of rhetorical devices and logic. 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): 414 or consent of instructor.

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 examples 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. Regulation, 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 photograph, 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 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.
Comment(s): Requires admission to the program or consent of the instructor.

512 Mass Media Research Methods (3) Applications of communication research techniques for management. Gathering and analysis of data for assessing media audiences and media impact. Comment(s): Requires admission to the program or consent of the instructor.

515 Advanced Reporting across the Media (3) Developing good story ideas, researching them, and translating them into suitable material for news in print, broadcasting, cable, and the Internet. Using video and graphics to reinforce the story concept. Considering the needs of the media and the audience. Theories of how content changes as the medium changes.

520 Seminar in Political Communication (3) Relationships among mass media, public relations and government and their roles in democratic society. Governmental public relations, political campaigns, coverage of military, executive, legislative and judicial branches of government, special interest groups and public access to government information.

522 Seminar in Journalism Issues and Theory (3) Discussion of the important issues in journalism from a variety of theoretical viewpoints. Study of the basic literature on theory involving journalism (print, broadcasting, cable, and the Internet) and its application to current problems.

525 Public Opinion (3) Role of press in developing and influencing public consensus. Social theories of public opinion and analysis of media’s response. (Same as Public Relations 525.)

550 Writing And Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science, technical, general publications.
Registration Permission: Consent of instructor.

555 Seminar in the Technology and Economics of Media and Information Systems (3) Examines how economics and technology shape development and operations of media and information systems. Focus on industry structures, market definitions, and impacts of emerging competition. Implications of emerging technologies on costs, market definitions, and supply and demand characteristics. Discussion of emerging/new media and implications on existing systems. Comparison of traditional and emerging industries, markets, and models.

556 Seminar in Mass Media Health Communication (3) Methods, problems, theories, and issues of communication in health field. Media’s reporting of health issues. Setting of media’s health agenda; strategic uses of media in social marketing efforts; public communication of complex social/medical issues. Discussion of relevant communication theories including uses and gratifications, reasoned action, health belief model, social cognitive and framing.

560 Advanced Web Publishing (3) Electronic research and publishing. Social, legal and ethical challenges surrounding online publishing. Project planning and storyboarding techniques for designing and creating site on Web.
(DE) Prerequisite(s): 488.

590 Project (3) Capstone project under guidance of faculty. Applications 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.

593 Seminar in Journalism And Electronic Media Issues (3) Contemporary topics in communications.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor.

597 Independent Study (3) Independent study.
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.

Judaic Studies (595)
405 Modern Jewish Thought (3) (See Religious Studies 405.)
425 Early Christian and Byzantine Art to 1350 (3) (See Art History 425.)
431 Medieval Art of the West, 800-1400 (3) (See Art History 431.)

Landscape Architecture (596)
Grading Restriction: P/NP only.
Repeatability: May be repeated.

501 Introduction to Sustainable Design (3) Introduction to design and planning professions as intellectual disciplines that shape and sustain regional and global environments. Addresses landscape architecture, architecture, urban design, and planning perspectives and theory.
Registration Restriction(s): Landscape architecture major or Master of Architecture - architecture major.
Registration Permission: Consent of instructor.

503 Landscape Architecture: Histories and Theories I (3) Survey of landscape history and theory from pre-history to approximately 1500 in Europe, Asia, and the Americas. Examination of theories, land forms, settlement patterns, in cultural and historical contexts.
Registration Restriction(s): Landscape architecture major.

504 Landscape Architecture: Histories and Theories II (3) Survey of landscape history and theory from approximately 1500 to the present in Europe, Asia, and the Americas. Examination of theories, land forms, settlement patterns, in cultural and historical contexts.
(DE) Prerequisite(s): 503.

511 A Cultural History of Regional Public Policy and the Land (3) Historical, cultural, and theoretical perspectives of Regional Public Entities (i.e., Tennessee Valley Authority, Department of Energy, National Park Service, U.S. Forest Service) and their policies and impacts on the land. Case studies and site visits.

512 Contemporary Landscape Architecture Design and Discourses (3) Case studies of existing and emerging trends in landscape design and theory.

513 Strategies and Case Studies in Landscape Stewardship and Restoration Ecology (3) Case studies of historical and emerging strategies and techniques of the preservation of various scales of landscapes.

514 Studies in Emerging Global Strategies of Practice (3) Case studies in varying scales and types of international professional landscape architecture practices.

515 Directed Readings in Landscape Architecture (3) Directed readings with faculty.
Registration Permission: Consent of program coordinator required.

520 Visualization/Representation II (3) Advanced exploration of drawing as a means of visual thinking and communication, addressing perception of phenomena. Includes further development of manual graphic capabilities, as well as introduction of emerging digital techniques for mapping and landform modeling applicable to large-scale projects.
Comment(s): Admission to landscape architecture program or completion of Plant Sciences 380 is required.

531 Advanced Landscape Architecture Construction (3) Documentation of landscape, hardscape, and architectural elements in the landscape with an emphasis on appropriate design and detailing for sustainability. Includes site engineering elements and principles.
(DE) Prerequisite(s): Plant Sciences 350.

540 Planting Design (3) Analysis of plant forms, function and composition. Problems faced in design of small scale areas with emphasis on orientation, arrangement and use.
Comment(s): Admission to landscape architecture program or completion of Plant Sciences 220 is required.

541 Landscape/Site Design I (3) Introduction to basic contour mapping and cartographic practices. Engages cultural, historical, and conceptual issues. Techniques and design of natural terrain. Focus on rural (non-urban) settings. Physical and mechanical properties of soils, theory of compaction, strength of soils, analysis of homogeneous slopes.
Registration Restriction(s): Landscape architecture major.

542 Landscape/Site Design II (4) Techniques, concepts, and practices of landscape and garden design in an urban (non-rural) setting. Engages cultural, historical, and conceptual issues.
(DE) Prerequisite(s): 541.

543 Landscape Architecture Design I (6) Fundamentals of landscape design exploring basic themes/issues of inhabitation, space-making and constructing cultural identities. Studio work focuses on a range of explorations from small- to medium-scale projects using a mixture of analog and digital media.
(DE) Prerequisite(s): 542.

544 Landscape Architecture Design II (6) Focus on large scale community and site planning and land use issues. Particular emphasis on both urban and rural development through sustainable design for both human health and natural environments. Exploration of topical/thematic issues using a mixture of analog and digital media.
(DE) Prerequisite(s): 543.

545 Landscape Architecture Design III (6) Advanced studio with urban design focus. Particular emphasis on design of urban projects and infrastructure that enhance human knowledge of and sensual engagement with regional civic, cultural, and ecological aspects of urban place while sustaining human health and natural environments. Exploration of topical/thematic issues using a mixture of analog and digital media.
(DE) Prerequisite(s): 544.

560 Professional Practices (3) Management and organizational theories and practices for delivering professional design services: historical perspective of the profession in the United States; assessment of building and landscape industries and their influences on practice; analysis of basic management functions within professional firms, legal and ethical concerns/imperatives confronting contemporary practitioners, introduction to special obligations and privileges of design professionals.
(DE) Prerequisite(s): 542.

561 Practicum for Landscape Architecture (3-6) Supervised experience in a private practice, governmental or non-governmental organization, or on a landscape oriented research project. Business or research practices, management, and design skills.
Repeatability: May be repeated. Maximum 12 hours.
(PE) Prerequisite(s): 545.
Registration Permission: Consent of instructor and approval of graduate program in landscape architecture.

570 Capstone Studio (6) Advanced, thematically-based (non-thesis) studio.
(DE) Prerequisite(s): 545.
(IE) 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.)
465 Latin American Film and Culture (3) (See Spanish 465.)
479 Disenchanted Texts in Hispanic Literature (3) (See Spanish 479.)
510 Special Topics (3)
Repeatability: May be repeated. Maximum 6 hours.

Law (613)
801 Civil Procedure I (3) Binding effect of judgments, selecting proper court (jurisdiction and venue), ascertaining applicable law, and federal and state practice.


803 Contracts I (3) Basic agreement process and legal protections afforded contracts: offer and acceptance, consideration and other bases for enforcing promises; the Statute of Frauds, unconscionability and other controls of promissory liability. Introduction to relevant portions of Article 2 of the Uniform Commercial Code.

804 Contracts II (3) Continuation of Contracts I. Issues arising after contract formation: interpretation, duty of good faith; conditions, impracticability and frustration of purpose; remedies; third party beneficiaries; assignment and delegation. Considerable coverage of Article 2 of the Uniform Commercial Code with respect to remedies, anticipatory repudiation, impracticability and good faith.

805 Legal Process I (3) Lawyer-like use of cases and statutes in prediction and persuasion. Analysis and synthesis of common law decisions; statutory interpretation; fundamentals of expository legal writing and legal research.

806 Legal Process II (3) Continuation of Legal Process I. Formal legal writing, appellate procedure, and oral advocacy.

807 Torts I (3) Intentional torts, defenses and privileges related to intentional torts; negligence: standard of care, professional malpractice, and liability of owners and occupiers of land; defenses based on plaintiff's conduct; contributory and comparative negligence, assumption of risk, failure to take precautions, and avoidable consequences; causation, proximate cause; duty rules; and questions of joint and several or several liability.

808 Torts II (3) Vicarious liability and related concepts; strict liability for dangerous animals and abnormally dangerous activities; products liability; nuisance, defamation and invasion of privacy; economic torts: misrepresentation and interference with contract and prospective opportunities; immunities: those of government, governmental employees, charities and family members, and damages.

809 Criminal Law (3) Substantive aspects of criminal law; general principles applicable to all criminal conduct; specific analysis of particular crimes; defenses to crimes.

810 Property (4) Introductory course treating issues of ownership, possession, and title in the areas of landlord-tenant relations; estates in land and future interests; co-ownership and marital property; real estate sales agreements and conveyances; title assurance and recording statutes; servitudes; and selected aspects of nuisance law, eminent domain and zoning.

812 Constitutional Law (4) Fundamental principles of American constitutional law: federalism, separation of powers, equal protection of law, and constitutional protection of other fundamental individual rights.

813 Evidence (4) Rules regulating introduction and exclusion of oral, written and demonstrative evidence at trials and other proceedings, including relevance, competence, impeachment, hearsay, privilege, expert testimony, authentication, and judicial notice.
(IE) Corequisite(s): 920 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.
(IE) 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 realties of legislative process and applicable constitutional principles.

825 Business Associations (4) Legal problems associated with the formation, operation, and dissolution of unincorporated and incorporated business firms; legal rights of firms and corporate participants (principals and agents; partners, joint ventures, 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.
(IE) Prerequisite(s): 827.

830 Securities Regulation (3) Basic structure and operation of the federal securities laws, including legal issues associated with: primary and secondary public and private securities offerings; Section 11 of the Securities Act of 1933, as amended, Rule 10b-5 under the Securities Exchange Act of 1934, as amended, and other antifraud provisions; 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.
(IE) Prerequisite or (IE) 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. sect. 1983; actions against federal government officials under the Bivens doctrine; institutional and individual immunities; relationship between state and federal courts in civil rights actions; and remedies for violations of constitutional and other civil rights.

849 Discrimination and the Law (3) Comparison of race, sex, and other forms of discrimination with respect to education, employment, housing, political participation and other social and economic activities; historical landmarks and current issues in discrimination law.

850 Supreme Court (3) History of Supreme Court and of procedures by which Court arrives at decisions; influences of justices’ ideology and role of Court in political system.

854 Investigatory Criminal Procedure (3) Police practices and constitutional rights of persons charged with crimes: arrest; search and seizure; identification; interrogation and confessions; electronic eavesdropping; and right to counsel.

855 Adjudicatory Criminal Procedure (3) Pre- and post-trial procedures in criminal case: bail; preliminary hearing; grand jury; prosecutorial discretion; discovery/speedy trial; plea bargaining; jury trial; and double jeopardy. Federal Rules of Criminal Procedure.

859 Criminal Law Seminar (2) Advanced problems in criminal law and administration of justice.
(DE) Prerequisite(s): 809.

862 Family Law (3) Survey of laws affecting formal and informal family relationships: premarital disputes; ante nuptial contracts; creation of common law and formal marriage; legal effects of marriage; support obligations within family; legal separation, annulment, divorce, alimony, and property settlements; child custody and child support; abortion; illegitimacy.

863 Children and the Law (3) Legal relationships between children, families and state; juvenile justice; foster care; adoption; educational issues: special education; child abuse and neglect; health care and income maintenance; advocacy for children and families.

866 Environmental Law and Policy (3) Study, through methods of public policy analysis, of responses of legal system to environmental problems: environmental litigation; Clean Air Act; Clean Water Act; National Environmental Policy Act; and selected regulatory issues.

867 Environmental Law Seminar (2) Selected topics in environmental law.

868 Natural Resources (3) Considers how our society allocates and regulates the use of natural resources, including national parks, national forests, coastal resources, minerals, timber, and wildlife.

873 American Legal History (3) Selected topics in American legal history.

877 Jurisprudence (3) Critical or comparative examination of legal theories, concepts, and problems: legal positivism; natural law theory; legal realism; idealism; historical jurisprudence; utilitarianism; Kantianism; sociological jurisprudence; policy science; and critical studies.

879 Law and Economics (3) Relationship between legal and economic thought; application of basic economic concepts to legal problems; economics in legal decision making; scholarly support for and criticism of economic analysis of law. Designed for students with no undergraduate background in economics or mathematics.

881 Law and Literature (3) Reading literary works, development of philosophy and reading technique applicable to both law and life.

886 Public International Law (3) Law-creating processes and doctrines, principles and rules of law that regulate mutual behavior of states and other entities in international system.

887 International Business Transactions (2-3) Doing business with foreign persons and in foreign countries; acquisition and use of property within foreign country; regulation of international business transactions by international organizations and foreign governments; analysis of international conventions and laws of foreign countries affecting business and comparison of those conventions and laws with United States law.

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 foster care and 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, drafting and defending claims, conducting fact 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.

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

(DE) Prerequisite(s): 813 (except students in advocacy concentration). (DE) Corequisite(s): 813 for students in the 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 Gratuitoous 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.

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 equity of redemption and/or statutory right of redemption; mechanics’ and material men’s liens; contemporary developments in areas as condominiums, cooperatives, housing subdivisions, and shopping centers.

941 Land Acquisition and Development Seminar (2) Simulated representation of various parties: sellers, buyers, construction lenders, permanent lenders, architects, contractors, subcontractors and consultants, in development of real estate project. Negotiation and drafting of documents essential in large commercial development.

943 Land Use Law (3) Private land use controls: nuisance, easements, 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.

(DE) Prerequisite(s): 818, 826, 827, and 972. (826 may be waived for those with sufficient business background.) (DE) Prerequisite or (DE) Corequisite: 842.

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

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 both substantive and procedural aspects of the law; 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, including 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, enablement and written description, novelty, 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.

Comment(s): Enrollment is limited. Student must prepare a written statement of interest before being admitted to the course.

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.

Comment(s): Enrollment is limited. Student must prepare a written statement of interest before being admitted to the course.

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, and legal memoranda. (DE) Prerequisite(s): 818.

973 Wealth Transfer Taxation (3) Taxation of gratuitous transfers of wealth during life (gift tax) and at death (estate tax) and of generation skipping transfers. (DE) Prerequisite or (DE) Corequisite(s): 935.

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

Comment(s): Limited enrollment.

978 Transactional Tax Planning (3) Advanced study of taxation of business organizations. Consideration of business acquisitions, tax planning for financially troubled entities, and review of recent transactions involving cutting-edge tax planning and shaping changes in law. (DE) Prerequisite(s): 818 and 972.

Comment(s): Limited enrollment.

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

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-employer, administrative and procedural aspects of Workers’ Compensation practice; and various law reform measures.

990 Issues in the Law (3) Selected topics. Repeatability: May be repeated. Maximum 40 hours.

991 Issues in the Law Seminar (2) Selected topics. Repeatability: May be repeated. Maximum 40 hours.

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. Grading Restriction(s): Satisfactory/No Credit or numerical grade. Repeatability: May be repeated. Maximum 40 hours. Registration Permission: Consent of instructor and Associate Dean for Academic Affairs.

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. Grading Restriction(s): Satisfactory/No Credit or numerical grade. Repeatability: May be repeated. Maximum 8 hours. Comment(s): Second-year standing required.

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. Grading Restriction(s): Satisfactory/No Credit or numerical grade. Repeatability: May be repeated. Maximum 12 hours. Comment(s): May only be taken during last three semesters of study.

995 Transactions: The Tennessee Journal of Business Law (1-2) Performance of duties of staff member or editor of Transactions: The Tennessee Journal of Business Law. Responsibilities vary each semester: writing of case synopsis, writing of article, and/or performing other assigned duties related to operation. Members of Transactions who are not on senior editorial board receive one hour of credit for successfully completing two consecutive semesters of service. Members of senior editorial board receive two hours of credit for each full year of satisfactory service. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 4 hours. Credit Restriction: Does not count toward total number of elective upper-division courses taken Satisfactory/No Credit.

996 Law Review (1) Performance of duties as staff member or editor of Tennessee Law Review. Responsibilities vary each semester as specified in Tennessee Law Review Policy Manual: writing of case note, comment or article, and/or performance of other assigned duties related to operations of Tennessee Law Review. Completion of potentially publishable comment or article for Tennessee Law Review satisfies expository writing requirement. Grading Restriction: Satisfactory/No Credit grading only. Repeatability: May be repeated. Maximum 4 hours. Credit Restriction: Does not count toward total number of elective upper-division courses taken Satisfactory/No Credit.
997 Moot Court (1) Participation as member of faculty-supervised 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.
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) Corequisite(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 the following: institutional design and structure, transaction cost economics, operations and logistics cost economics, exchange behaviors and strategies, supply chain relationship types, and evaluation of supply chain performance.

614 Evolution of Logistics Thought (3) Survey of concepts, frameworks, theory, research issues, and empirical research in content and 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.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and staff member.

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.

Registration Permission: Consent of instructor.

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.

455 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.

Registration Permission: Consent of instructor.

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

Registration Permission: Consent of maximum 6 hours.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: Credit only.

Repeatable: May be repeated. Maximum 9 hours.

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.

Registration Permission: Consent of instructor.

Management Science (627)

500 Thesis (1-15)

Grading Restriction: P/NP only.

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.

Registration Permission: Consent of instructor.

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

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

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.

Repeatable: May be repeated. Maximum 9 hours.

600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P/NP only.

Registration Permission: Consent of instructor.

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)

Repeatable: 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.
Marketing (632)
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.
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 analytical, drawing upon a solid understanding of marketing strategy and demand/supply integration.
(DE) Prerequisite(s): 520 and Business Administration 513.
537 MBA Global Product and Brand Management (3) Complex, interdisciplinary 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 dismissal. 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 processes describing people in their roles as buyers, users, and evaluators of goods and services. Includes coverage of both end user consumers and industrial buyers. Topics of interest include motivation, personality, attitude formation and change, information processing, choice, decision making for buying and selling activities as well as operational management, decision-making processes, consumption, post-purchase consumption, cultural and demographic differences, consumer socialization, and ethical considerations. 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 non-profit 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.
(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.)