504 Research Design (3) Geographical research from selection of topic and development of research design through field work and final report.

505 Directed Research (2-6) Research on problems as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/N or letter grade.

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/N or letter grade.

509 Topics in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs. S/N or letter grade.

510 Topics in Cartography (3) Trends, concepts, problems, and methods in cartography. Prereq: 411 and 412 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

511 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data. Prereq: 413 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

512 Topics in Cartography (3) Trends, concepts, problems, and methods in cartography. Prereq: 411 and 412 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

513 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data. Prereq: 413 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

514 Graduate Practicum in Cartography/Remote Sensing (2-6) Prereq: Written consent of department before registration. May be repeated with consent of instructor. Maximum 6 hrs.

515 Topics in Geographical Information Management and Processing (3) Concepts and methods in management of geographical information. Database design, manipulation, sampling and analysis. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

516 Graduate Practicum in Cartography/Remote Sensing (2-6) Prereq: Written consent of department before registration. May be repeated with consent of instructor. Maximum 6 hrs.

517 Geographic Information Management and Processing (3) Concepts and methods in management of geographical information. Database design, manipulation, sampling and analysis. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

518 Graduate Practicum in Cartography/Remote Sensing (2-6) Prereq: Written consent of department before registration. May be repeated with consent of instructor. Maximum 6 hrs.

521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography. Prereq: 421 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

522 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography. Prereq: 421 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

533 Topics in Physical Geography (3) Examination of trends, problems, and methods in geography of land surface system or in modern climatology. Prereq: 433 or 434 and consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

534 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography. Prereq: 435 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

535 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography. Prereq: 435 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

536 Plant Communities and Plant Geography (4) (Same as Botany 536.)

541 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 441 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

542 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 441 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

543 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 441 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

547 Topics in the Geography of Transportation (3) Examination of trends, problems, and methods in transportation geography and transportation networks. Prereq: 448 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

548 Topics in the Geography of Transportation (3) Examination of trends, problems, and methods in transportation geography and transportation networks. Prereq: 448 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

550 Regional Geomorphology (3) (Same as Geology 550.)

556 Geology (4) (Same as Chemistry 556.)

571 Biological Conservation (3) Analytical treatment of political, policies, and forms of biological conservation as practiced in U.S. and abroad. Prereq: Consent of instructor.

591 Foreign Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

592 Off-Campus Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

593 Independent Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

594 Independent Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

595 Independent Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

596 Independent Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

597 Independent Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

598 Independent Study (1-15) See page 32. Prereq: Written consent of department prior to registration. S/N or letter grade.

THE MASTER'S PROGRAM

The department offers the thesis option in the Master's program. Graduation requires successful oral defense of a written thesis and a minimum 3.0 GPA in all graduate coursework.

Course requirements are a minimum of 30 semester hours, including:
1. Six hours of Thesis 500.
2. Registration in 595 during the first two years in residence. Two hours may be counted toward the 30-hour minimum. This requirement may be waived in unusual circumstances.
3. Sixteen hours of geology courses, with at least 14 hours at the 500 or 600 level, including at least one course from each of the following groups:
   - Group I: 510, 530, 560, 580.
   - Group II: 521, 525, 545, 546, 550, 557, 561.
   - Group III: 570, 571, 576, 577.
4. Eight hours of additional graduate coursework.

THE DOCTORAL PROGRAM

The prerequisite for the Ph.D. program, in addition to that for the M.S. program, is either a Master's degree in Geology, or a Bachelor's degree plus completion of 9 hours of coursework from the list in #3. above, including one course from each group. These courses may be taken while completing other course requirements.

Graduation requires passing a comprehensive examination, taken no later than the end of the second year, completion of all course requirements with a minimum 3.0 GPA, completion of the language requirement, and successful oral defense of the dissertation.

The comprehensive examination includes both written and oral parts in which the candidate will be tested on his/her knowledge of the area concerning the proposed dissertation and of related fields. The candidate is expected to be conversant in a wide field of geological sciences.

A minimum of 24 hours of graded coursework beyond the Master's degree is required in addition to the 24 hours of Dissertation 600. The coursework includes the sum of 9 hours of 600-level geology courses, 9 hours of 500-level or higher geography courses, and 6 hours of additional graduate courses. Extra-departmental coursework is encouraged.

The student must demonstrate a reading knowledge of a foreign language in which they are qualified.
GRADUATE COURSES

401 Quantitative Methods in Geology (3) Applications of calculus and differential equations to problems in earth sciences. Examples of diffusion equation in hydrogeology; wave equations in geophysics; mechanical modeling and boundary conditions in structural geology and tectonics. Prereq: The Dynamic Earth or Earth, Life, and Time, 2 semesters of Calculus.

410 Advanced Mineralogy (3) Crystal chemistry of rock-forming minerals of electromagnetic radiation and crystalline solids. Optical properties of minerals, visible and infrared spectroscopy, and x-ray diffraction. Laboratory exercises emphasize thin section and x-ray diffractometer methods of mineralogy. Prereq: 310. 2 hrs and 1 lab.

420 Paleocology (4) Principles of ecological analysis as applied to fossils and fossil assemblages; data collection and interpretation. Laboratory designed around preparation of scientific reports based on field and laboratory analysis. Writing emphasis course. 3 hrs and 1 lab.

421 Invertebrate Paleontology I (3) Survey of preservational processes and geologically important representatives of Protista, Porifera, Cnidaria, Bryozoa, and Brachiopoda. Micropaleontology, skeletal structures, ecology, and stratigraphic distribution. Prereq: 320 or consent of instructor. 2 hrs and 1 2-hr lab.

422 Invertebrate Paleontology II (3) Survey of "higher invertebrates". Arniacea and other worms, Mollusca, Arthropoda, Cephalopoda, Chordata. Functional morphology, skeletal structures, ecology, and stratigraphic distribution. Prereq: 320 or consent of instructor. 2 hrs and 1 2-hr lab.

426 Paleobotany and Palynology (3) Evolutionary history of terrestrial plant life through examination of fossil record of macrobotanical remains, spores, and pollen grains. Origin and diversification of Gymnosperms and Angiosperms in floristic provinces through geologic time. Prereq: 102; Botany 310-20 or consent of instructor. (Same as Botany 426.) 3 hrs and 1 lab.

440 Field Geology (6) Summer field course for advanced undergraduate geology majors and first-year graduate students in geology. Out-of-campus work at Geology Field Station requires full time of student. Synthesis of major aspects of geological sciences in societal context. Field techniques demonstrated, practiced, and applied to solution of geological problems. Prereq: Completion of major core courses and consent of instructor.

445 Regional Geology of the United States (3) Evolution of geologic provinces within U.S.; integration of sedimentary, tectonic, and geophysical components of continental crust. Prereq: 370 or consent of instructor. 3 hrs and 1 lab.

450 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery. Prereq: 101-02. (Same as Geography 450.) 1.2 hrs and 1-2 lab.

455 Basic Environmental Geology (3) Applications of geological sciences toward comprehension of effects of geological processes on humans and effects of human activities on earth's environment. Prereq: 12 hrs of geology courses. 2 hrs and 1 3-hr lab or field period.

460 Principles of Geochemistry (3) Application of chemical principles of chemistry and crystal chem-istry and relation between basic atomic structure and distribution and behavior of elements in earth's crust. Prereq: Chemistry 120-30. Recommend prereq: 350. 2 hrs and 1 lab.

350 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery. Prereq: 101-02. (Same as Geography 450.) 1.2 hrs and 1-2 lab.

470 Applied Geophysics (3) Basic principles of geo-physical exploration: applications to environmental problems. Seismic and electromagnetic methods. Prereq: 6 hours of geology courses numbered above 300. Elements of Physics required. Prereq: 470 or consent of instructor.

475 Physical and Chemical Systems of the Earth (3) Development of physical earth from solar nebula to present. Formation, composition and evolution of hydro-sphere, crust, mantle, and core. Interdependence of earthquakes, volcanism, plate tectonics, geodynamics, chemical and isotopic processes of interior, and earth's temperature. Historical perspective on major controversies of past, and problems unresolved today. Prereq: 16 hrs of geology courses numbered 300 and above. 2 hrs and 1 discussion.

480 Principles of Economic Geology (4) Ore-forming processes, classification of mineral deposits, survey of different types of mineral deposits with examples, and metallogeny. Prereq: 310 and 330 or equivalents. Recommended prereq: 460. 1 hrs and 1 2-hr lab.

485 Principles of Geohydrology (3) Ground water flow, aquifer analysis, ground water contamination, and ground water management. Prereq: General Geology and equivalent or consent of instructor. General Chemistry or equivalent, and Calculus or equivalent. (Same as Civil Engineering 485.)

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

505 Structure of the Southern and Central Appalachian (3) Structure of Southern and Central Appalachians from an integrated tectonic--early Paleozoic rift-drift-platform margin through processes related to compressional events producing accretionary elements. Amalgamation of Appalachian and Ouachita Folding. Comparisons to similar orogens. Prereq: Structural Geology.

510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques in clay mineral studies. Prereq: 310 and 568 or equivalent. 2 hrs and 1 lab.

520 Advanced Paleontology (3) Detailed analysis of selected groups of fossil organisms; functional morphology, evolutionary development.

521 Data Analysis in Geology and Paleobiology (3) Application of statistical and other quantitative techniques to geological and paleontological data. 2 hrs and 1 seminar.

525 Biostatistics (3) Examination of principles of stratigraphy and biostatigraphy through selected case histories. 1 hr and 1 2-hr seminar.

530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metamorphic rocks, magmatic and subduction processes and physical conditions. Laboratory involves petrographic study of crystalline rocks in thin section. Prereq: 413. 3 hrs and 1 lab.

535 Ground Water Hydrology (3) Same as Environmental Engineering 535.)

540 Seminar in Local Geology (1) Introduction of geology of Southern Appalachians. 1 hr plus fieldtrip.

545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of terrigenous clastic rock types: physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. Prereq: 340 or equivalent. 3 hrs and 1 lab.

546 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonate sediments and diagenesis of resultant rocks; field and laboratory analysis of sampling and preparation of scientific reports. 3 hrs and 1 lab.


550 Regional Geomorphology (3) Integrative approach to study of natural geomorphological regions stressing links and similarities across boundaries, unique characteristics of major regions, provinces, sections, and districts. May be repeated with consent of instructor. Maximum 6 hrs. (Same as Geography 550.)

556 Quaternary Geology of North America (3) Interpretation of geomorphic, stratigraphic, and sedimentologic evidence in order to reconstruct Quaternary landscapes - glaciated, periglacial, and nonglacial regions of North America; correlation of major episodes of North American glacial with paleo-oceanographic changes in Atlantic and Pacific Oceans. Prereq: 101 or consent of instructor.

557 Quaternary Paleocology (3) Perturbation, proc-ess, and pattern within Quaternary ecosystems; climatic change and vegetational responses during last 2.5 mil-lion years. Prereq: Consent of instructor.


568 Geochemical Analysis (3) Collection and treat-ment of geochemical data using electron microprobe, x-ray fluorescence, and instrumental mass spectrometry techniques. Prereq: 310 or consent of instructor. 2 hrs and 1 lab.

570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; re-quired of graduate students and may be repeated. Prereq: 370 or equivalent, or consent of instructor. 3 hrs and 1 lab or seminar.

571 Regional Tectonics and Structural Geology (3) Major subdivisions of earth's crust and processes that form them. Comparison of internal structure of mountain chains and how they function in increasing continental crust. Examples from different parts of world. Prereq: Structural geology or consent of instructor.

575 Plate Tectonics and Crogeny (4) Tectonic develop-ment of continental and oceanic plates; major aspects of plate tectonic theory: current literature and ongoing research for both modern and ancient examples. Prereq: 370 or consent of instructor. 3 hrs and 1 seminar.

576 Reflection Seismology (3) Imaging subsurface features using reflected seismic waves. Energy sources, modes of wave propagation, field procedures, computer data processing, and pitfalls. Applications to tectonic and environmental problems. Prereq: 470 or consent of instructor.


580 Ore Petrology (3) Detailed study of selected ore deposits; petrology of ore-gangue assemblages. Prereq: 480 or consent of instructor. 2 hrs and 1 2-hr lab.

590 Special Problems in Geology (1-3) Directed study or special topics. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.

591 Foreign Study (1-15) See page 32.

592 Off-Campus Study (1-15) See page 32.

593 Independent Study (1-15) See page 32.

594 Field Problems in Geology (1-2) Literature study and seminars on specific regions of geologic interest, supplemented by extended field trip. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

595 Selected Topics in Geology (1) Presentation of graduate, faculty, and visiting scientist research. Registration required each semester except summer for resident full-time graduate students. S/NC only.

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

610 Seminar in Mineralogy (3) May be repeated with consent of department. Maximum 5 hrs.

620 Seminar in Paleontology (3) May be repeated with consent of department. Maximum 9 hrs.
GERMANIC AND SLAVIC LANGUAGES

(College of Liberal Arts)

MAJORS                DEGREES
German ........................................ M.A.
Modern Foreign Languages .................. Ph.D.
David E. Lee, Head

Professors:
Falen, James E., Ph.D. ....................... Pennsylvania
Fiene, Donald M., Ph.D. ...................... Indiana
Kratz, Henry (Emeritus), Ph.D. ............. Ohio State
Osborne, J. C. (Liaison), Ph.D. ............... Northwestern
Rice, Martin P., Ph.D. ....................... Vanderbilt
Rittenhoff, Ursula C. (Emeritus), Ph.D. ....... Connecticut

Associate Professors:
Hodges, Carolyn R., Ph.D. ................... Chicago
Lauckner, Nancy A., Ph.D. .................... Wisconsin
Lee, David E., Ph.D. ......................... Stanford
Mellor, C. J., Ph.D. .......................... Chicago

Assistant Professor:
Moser, Beverly, Ph.D. ......................... Georgetown

The Department of Germanic and Slavic Languages offers two advanced degrees: the Master of Arts in German and the Doctor of Philosophy in Modern Foreign Languages. Inquiries should be addressed to the head of the department.

THE MASTER'S PROGRAM

The department requires a minimum of 30 semester hours including 15 hours of coursework numbered 500 and above and 6 hours of Thesis 500.

THE DOCTORAL PROGRAM

The Ph.D. in Modern Foreign Languages is offered jointly by the Department of Germanic and Slavic Languages and the Department of Romance Languages and requires advanced training in at least two foreign languages.

Admission Requirements

Applicants must have completed a B.A. in either French, German or Spanish to be accepted into this program. Both graduates of institutions in the United States and those with undergraduate degrees from institutions outside the United States must have a grade point average of at least 3.0. Consideration will also be given to applicants who do not have an undergraduate degree in one of the three foreign languages but do have the equivalent of an undergraduate major in one of them.

Degree Requirements

Candidates must complete a minimum of 63 semester hours of coursework beyond the Bachelor's degree in addition to 24 hours of doctoral research and dissertation. Two tracks are available.

The coursework for Track I must be distributed as follows: (1) at least 39 hours in the first concentration; (2) at least 18 hours in the second concentration; and (3) at least 6 hours in a cognate field.

1. First Concentration: French, German, or Spanish. It consists of a minimum of 39 semester hours beyond the Bachelor's degree, distributed as follows:
   - A maximum of 6 hours of 400-level classes taken for the M.A. may be applied.
   - A minimum of 21 hours at the 500 level (exclusive of thesis hours) including French 584(3), German 560(3), or Spanish 550(3); German 512(3), French 512(3), or Spanish 512(3); French 515-16(2,2) or German 550(3).
   - At least 12 hours at the 600 level (exclusive of dissertation hours).

2. Second Concentration: French, German, Italian, Russian, or Spanish (different from the first concentration). It consists of at least 18 hours of courses beyond the Bachelor's degree, at least 12 of which must be at the 500 or 600 level.

3. Cognate Field: Six hours must be in graduate courses numbered 400 and above in a field outside the department of the first concentration but related to the student's principal area of research. If the cognate field is yet a third foreign language, a reading proficiency exam will be administered after completion of the 6 cognate hours by the language section concerned.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Modern Foreign Languages is available to residents of the state of Alabama or Kentucky. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

German

GRADUATE COURSES

331-32 Elements of German for Upper-Division and Graduate Students (3.3) Elements of language, elementary and advanced readings, and a final 10,000 word translation project. Open to graduate students preparing for foreign language examinations, and upper-division students desiring reading knowledge of the language. No credit for
students having completed 101-02 or 107. 332 may be repeated. Maximum 6 hrs. Undergraduate credit only.

411-12 Advanced Conversation and Composition (3,3) Prereq: 311-12 or equivalent or consent of department.

420 Selected Topics in German Literature from 1750 to the Present (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

421 German Lyric Poetry (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

422 German Drama (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

423 German Narrative Prose (3) Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.

424 German Literary Movements (3) Survey of major periods in development of German literature since 1750: problems and pitfalls of periodization.

425 Introduction to Descriptive Linguistics (3) (Same as French 425, Spanish 425, Linguistics 425, and Russian 425.)

426 Methods of Historical Linguistics (3) Phonetics, distinctive feature analysis, sound change types, nature of sound change, principles of reconstruction, and fundamental assumptions about language change through time. Survey of non-phonological linguistic changes, language families. Proto-Indo-European, and other proto languages. Prereq: 6 hrs of upper division foreign language courses (excluding courses in translation or graduate reading courses). (Same as Russian 426, French 426, Spanish 426, and Linguistics 426.)

431 Structure of the German Language (3) Contrastive English-German segmental and suprasegmental phonemes, contrasting English-German linguistic structures, selected topics in advanced German grammar and syntactic analysis. Prereq: 6 hrs of upper division German language courses (excluding courses in translation or graduate reading courses). (Same as Linguistics 431.)

432 History of the German Language (3) Development of German language from Indo-European through Proto-Germanic, Old High German, Middle High German to New High German. Internal and external linguistic history of German speech. Prereq: 6 hrs of upper division German language courses (excluding courses in translation or graduate reading courses). (Same as Linguistics 432.)

435 Business German (3) Survey of German used in fields of business, government, administration, and economics. Prereq: 6 hrs of upper-division German excluding courses in translation and graduate courses.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities or on faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 German Phonetics and Advanced Grammar (3) Advanced work in phonetics, pronunciation, and selected topics in German grammar. For teachers and prospective teachers. Prereq: Consent of instructor.

512 Teaching a Foreign Language (3) Practical application of methods for teaching and evaluating basic language skills and foreign language skills, and cultural knowledge through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all M.A. and Ph.D. students holding GTAs, except those whose previous training or experience warrants excuse by department.

519 Bibliographical Methods (1) Bibliographical methods, major reference works and bibliographical problems in language and literature.

520 Proseminar (2) Advanced training in use of bibliographical and reference tools; illustrative problems; paper preparation.

541-42 Medieval German Language and Literature (3,3) 541—Introduction to Middle High German; 542—Readings in Medieval German Literature.

550 Studies in German Literature (3) Content varies. May be repeated. Maximum 6 hrs.

551 German Humanism, Reformation and Baroque (3) Content varies. May be repeated. Maximum 6 hrs.

552 German Enlightenment, Rococo, and Sturm und Drang (3) Content varies. May be repeated. Maximum 6 hrs.

553 German Classicism and Romanticism (3) Content varies. May be repeated. Maximum 6 hrs.

554 German Realism and Naturalism (3) Content varies. May be repeated. Maximum 6 hrs.

555 Modern German Literature 1890-1945 (3) Content varies. May be repeated. Maximum 6 hrs.

556 Modern German Literature 1945-Present (3) Content varies. May be repeated. Maximum 6 hrs.

550 German Literary Theory and Criticism (3)

561-62 Directed Readings in German Language and Literature (3,3)

571-72 Old Norse Language and Literature (3,3)

591 Foreign Study (1-15) See page 32.

592 Off-Campus Study (1-15) See page 32.

593 Independent Study (1-15) See page 32. Letter grade or S/NC.

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

610 Gothic (3) Phonology, morphology, and syntax of Gothic language. Relationship to Indo-European languages and other Germanic languages. Readings from Gothic Bible.

611 Old High German (3) Phonology, morphology, and syntax of Old High German. Representative readings.

612 Old Saxon (3) Phonology, morphology, and syntax of Old Saxon. Representative readings.

621-22 Seminar in German Literature (3,3) May be repeated. Maximum 18 hrs.

631-32 Seminar in German and Germanic Philology (3,3)

Russian

GRADUATE COURSES

425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, Spanish 425, and Linguistics 425.)

426 Methods of Historical Linguistics (3) (Same as French 426, German 426, Spanish 426, and Linguistics 426.)

510 Russian Phonetics and Advanced Grammar (3) Phonetics, pronunciation, stylistics, and selected topics in Russian grammar. For teachers and prospective teachers. Prereq: Consent of instructor.

520 Proseminar (3) Bibliography; methods; illustrative problems; preparation of papers.

521 Works of Dostoevsky in English Translation (3) Crime and Punishment, Brothers Karamazov, and other works. No foreign language credit.

522 Works of Tolstoy in English Translation (3) War and Peace, Anna Karenina, and other works. No foreign language credit.

550 Studies in Russian Literature (3) Content varies. May be repeated. Maximum 6 hrs.

591 Foreign Study (1-15) See page 32.

Health, Leisure, and Safety

MAJORS

Health

Graduate programs are available leading to the Master of Science, the Master of Public Health, the Specialist in Education, the Doctor of Education, and the Doctor of Philosophy with a major in Education. Inquiries should be directed to the department head.

Health

Graduate programs are available leading to the Master of Science with a major in Health Promotion and Health Education (thesis and non-thesis options) and to the Doctor of Education with a major in Health Education.

The Master of Science, with thesis and non-thesis options, requires completion of 30 semester hours.

The Doctor of Philosophy with a major in Education offers a concentration in health education and choice of supporting speciali-
zations from public health or safety as listed under Education.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ed.D. program in Health Education is available to residents of the states of Kentucky or West Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

400 Consumer Health (3) Survey of major consumer health care providers and health care services; selecting, purchasing, evaluating and financing medical and health care products/services. (Same as Public Health 400.) Sp

405 Alcoholism and Alcohol Education (3) Problems of alcoholism. Factors which make alcoholism serious health and safety problem. Various types of instructional/educational and intervention programs. F

406 Death, Dying and Bereavement (3) Aspects of dying, death and handling trauma of loss. Medical, financial, physical, psychosocial, and social issues related to dying. F, Sp

420 Sex Education as it Relates to Human Sexuality (3) Exploration of science of human sexuality. Trends, issues, and content of sex education. E

425 Women's Health (3) Factors influencing women's and men's health priorities. Women's health care decisions. Women's health issues. May be repeated. Maximum 3 hrs. F, Sp

430 Suicide and Crisis Intervention (3) Factors which make suicide a serious health problem. Assessment, intervention, and prevention techniques. Sp

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. Sp

465 Aging and Health (3) Aging process in health perspective as related to health promotion and wellness. F, Sp

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

520 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. Sp

530 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. Sp

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

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

560 Graduate Workshop (1-3) Specific health/wellness or health promotion issues. Special health problems in concentrated period of time. May be repeated. Maximum 12 hrs.

570 Special Topics (1-3) For graduate students, in-service teachers and other health professionals. Health/wellness or health promotion issues. May be repeated. Maximum 12 hrs.

580 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 580.) F

593 Directed Independent Studies (1-3) Individual identification and study of health/wellness or health promotion problems/issues. Specific proposal to instructor before registration. May be repeated. Maximum 12 hrs. E

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

601 Internship/Research in Safety and Health (3-6) (Same as Safety 601.) Sp

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

620 Advanced Research Techniques in Health (3) Advanced theory and techniques of research design and methodologies in health discipline. Prerequisite: 590, 610. Sp

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

655 Seminar in Nation's Health (3) Comprehensive study of definition, determinants, resources and health status of nation. (Same as Public Health 655.) F

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

660 Seminar in Health (1) Ramifications of health and health education innovations in relation to evolving field and discipline. Prerequisites: Advanced standing as doctoral candidate. May be repeated. Maximum 3 hrs. F, Sp

676 Seminar in Gerontology (3) Comprehensive study of the aging process in society. Rates of aging, determinants of aging, health problems of the aged. F

680 Seminar in Health Education (3) Ramifications of health and health education innovations in relation to evolving field and discipline. Prerequisite: Advanced standing as doctoral candidate. May be repeated. Maximum 3 hrs. F

Public Health

Graduate study with a major in Public Health leads to the Master of Public Health (M.P.H.), Three professional concentration options are available: community health education, health planning/administration, and occupational/environmental health and safety. The M.P.H. program is accredited by the Council on Education for Public Health. A minor in statistics is available to interested M.P.H. students due to public health affiliation with the Intercollegiate Graduate Statistics Programs.

ADMISSION REQUIREMENTS

A statement of the applicant's educational and career goals and three rating forms are required. Appropriate forms are available from the department's program in Public Health. Preferential consideration for admission to degree status shall be given to those with a minimum undergraduate grade-point average of 2.8 and with at least one year of professional experience in a health-related occupation. No provision will be made. As a restricted program, non-degree admission requires departmental recommendation.

THE MASTER'S PROGRAM

The M.P.H. is a non-thesis program requiring completion of 38 semester hours of coursework, including 9 weeks of field practice. Field practice provides a full-time experience with an affiliated health agency or organization offering one or more health programs. Of importance, field practice allows the student to apply academic theories, concepts, and skills in an actual work setting. Students must complete all assigned prerequisite courses and 21 semester hours of the curriculum with a minimum overall GPA of 3.0 prior to placement in the field.

As an alternative to field practice, preparation of a Master's essay may be used to fulfill the professional skills development component of the curriculum. Approval must be received from the Public Health Academic Committee and is contingent on consent of major advisor, formal written proposal by the student, and completion of an additional research methodology course. Written guidelines stipulating expectations and eligibility criteria are available.

MINOR IN GERONTOLOGY

Graduate students in Public Health may pursue a specialized minor in gerontology. This interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.P.H. program in Public Health is available to residents of the states of Arkansas, Florida, Kentucky, Louisiana, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

COURSE REGISTRATION

Provisional graduate students are ineligible to enroll in 500-level public health courses. Non-degree students must obtain permission from department/program head to register for 500-level public health courses. Prerequisite coursework assigned as a condition of admission to the M.P.H. program must be completed promptly, with a grade of B or better, typically within the first semester or two years of enrollment in graduate study.

GRADUATE COURSES

400 Consumer Health (3) (Same as Health 400.)

410 Health in the Work Environment (3) Fundamental activities in field of industrial health aimed at reducing health problems for employees. Workplace health hazards and problems of concern to nurses, medical staff, management, engineers and others in industrial health and safety fields. Prerequisite: Consent of instructor. May not be repeated. Maximum 9 hrs.

480 Special Topics (3) Prerequisite: Consent of instructor. May be repeated under different topic. Maximum 6 hrs.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

505 Continuing Education in Public Health (1-3) Selected learning activities and experiences in special areas of public health utilizing workshop format. May be repeated. Maximum 6 hrs.

509 Graduate Seminar in Public Health (1) In-depth discussion of timely topics reflecting scope of public health as discipline and its interrelation with many other academic and professional disciplines. Speakers both internal and external. May be repeated. Maximum 4 hrs. (Same as Nursing 509.) F

510 Environmental and Occupational Health (2) Complexities of personal and ambient environment recognizing health as individual's response to diverse and dynamic world. Principles of occupational safety and health.
Survey of contemporary issues and their implications for healthful living today and in the future. Sp

511 Fundamentals of Industrial Hygiene (3) Occupational health, safety and environmental recognition, evaluation and control of workplace health hazards. Pertinent workplace problems and situations. Prereq: 2 yrs of chemistry and biology and consent of department. F


513 Industrial Hygiene Instrumentation and Sampling (3) Instruments and methods for evaluating industrial environment for personal exposure to chemical and physical stressors affecting worker health. Lecture, demonstration, and lab. Prereq: 511, MPH (CEHS) major, and consent of department. Sp

514 Industrial Toxicology and Occupational Exposures (3) Principles of industrial toxicology, basic toxic mechanisms, portals of entry, physiologic and biobehavioral responses. Occupational exposure assessment, physical factors and environmental conditions that influence exposure characterization, statistical aspects of sampling, duration of exposure determinants into general environment. Prereq: 1 yr of general chemistry and 1 semester of human biology. Sp

520 Public Health Policy and Administration (3) Administrative considerations of community-based health care programs and practices. Health policy formulation, political environment and governmental involvement in health, legal responsibilities, and management concepts/techniques. Prereq: F, Su

521 Organization Theory and Health Care Delivery (3) Administrative and Organization theory relating to health facilities; operation and management of community hospital. Case discussions and problem-solving exercises; managerial functions and skills. F

523 Management in Extended Care Settings (3) Managerial concepts and foundations essential to supervision and administration of domiciliary health services programs. Management and operation of health services programs for patients and clients in settings which provide activities of daily living and special psychosocial environmental needs. Programs for home health services, comprehensive medical care, nursing homes, congregate living centers and similar health programs. Prereq: 521 or consent of instructor. Sp

525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply techniques. Prereq: 520 or consent of instructor. F

530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of vital statistics and introductory research methodology preparatory for first course in epidemiology. Prereq: Introductory statistics or consent of instructor. F

540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations. Principles of planning, design, and evaluation of health programs. Historical origins of discipline, hypothesis formulation, research design, data and error sources, measures of frequency and association, etiologic reasoning, disease screening, and injury control. Prereq or coreq: 530. F, Sp


550 Principles and Practices of Community Health Education (3) Theoretical foundations for community health education; opportunities for skill development in variety of educational processes; and introduction to community health analysis. F

552 Community Health Problem Solving (4) Dynamics of community organization, community needs assessment, educational interventions, and application of program planning and evaluation techniques. Opportunity to practice skills in realistic setting. Prereq: 550 or consent of instructor. Sp


560 Theories and Techniques in Health Planning (4) Overview of health planning concepts and methodologies, systems-oriented planning process. Major elements of planning: formulation and conceptualization of problem, plan design, evaluation and implementation. Health problems of institutions, communities and selected population groups, appropriate diagnoses, and programs for addressing needs. Sp

562 Group Processes in Health Planning (3) Application of group process techniques used in health planning. Tailoring group processes, leadership roles and techniques to encourage innovation and creativity in health planning groups. Sp

566 Physical Activity and Positive Health (3) Same as Phys Ed 566.

569 Fitness Testing, Programming, and Leadership for Diverse Populations (2) Same as Physical Education 569.

580 Special Topics (3) Prereq: Consent of instructor. May be repeated under different topic, maximum 6 hrs.


587-88-99 Internship (3,3,3) Internship (community health education, health planning/administration, or occupational/environmental health and safety) in either approved organizational or research setting under supervision of designated preceptor. Prereq: MPH major, one semester advance notice and consent of major advisor. S/NC only. E

590 Research Methods in Health (3) (Same as Health 590).

593 Directed Independent Study (1-3) Prereq: Consent of Instructor. May be repeated. Maximum 6 hrs.

650 Health Aspects of Gerontology (3) (Same as Health 650).

655 Seminar in Nation's Health (3) (Same as Health 655).

660 International Health (3) (Same as Health 660).

Recreation and Leisure Studies

Graduate study with a major in Recreation and Leisure Studies leads to the Master of Science Professional Concentration. Professional-level concentrations are available in therapeutic recreation, general recreation, and sport administration. The third concentration is an interdisciplinary program with the department of Human Performance and Sport Studies.

The M.S., with thesis and non-thesis options, requires completion of 32 semester hours.

The following retention policy applies to graduate students seeking the M.S. with a concentration in sport administration/management:

1. Graduate students are required to maintain an overall 3.0 GPA.
2. Any student who falls below this standard will be advised in writing by the department head of the need to discuss the matter with his/her advisor.

3. If a student's overall GPA remains below 3.0 for a second semester, the student will have his/her degree status revoked.

GRADUATE COURSES

410 Maintenance and Management of Recreation and Sport Related Facilities (3) Principles for operating modern facility maintenance systems and management strategies. Cost tracking, inventory systems, facilities maintenance management, safety guidelines, management maintenance systems, and security. Prereq: 110, 310 or consent of instructor. F

430 Organization and Administration of Leisure Services (3) Principles of administration applied to provision of leisure services offered by public and/or commercial enterprises. Organizational structures, personnel management, evaluation, legal authority, introduction to budgeting and fiscal procedures. Prereq: 310 or consent of instructor. F

440 Dimensions of Private and Commercial Recreation Businesses (3) Nature and function of recreation in private, commercial, and industrial settings. Survey of development and management of commercial goods and services offered in leisure market. Factors influencing participation, membership considerations, and research in commercial recreation and tourism. Prereq: 110, or standing, or consent of instructor. Sp

450 Specialized Study in Leisure Education (1-6) Special interest leisure activities; developing positive attitudes toward leisure. Demonstrates how leisure contributes to one's mental and physical health. May be repeated. Maximum 6 hrs. E

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC option.

510 Perspectives and Trends in Leisure Studies and Services (3) Basic role of leisure delivery systems in today's society, scope of leisure services, determinants of leisure behavior, development of leisure services and recreation. Current trends, problems, laws, and issues affected by and/or affecting delivery of leisure services. Prereq: Consent of instructor. Sp

515 Philosophical and Conceptual Foundations of Leisure (3) Philosophy of leisure, recreation, nature of philosophy, concepts of leisure, recreation, play, work, and other, history of field, and relationship of ideas to contemporary society and to professional practice. Prereq: Consent of instructor. F

520 Program Design and Evaluation in Therapeutic Recreation (3) History, philosophy, nature, purpose, special populations served, programmed process, professional aspects of therapeutic recreation. Basic overview of aspects of leisure delivery systems. Prereq: Consent of instructor. F

521 Facilitation Techniques in Therapeutic Recreation (3) Role of therapeutic recreation in clinical and non-clinical settings; application of life-style planning, self-awareness, values clarification and assertiveness training in therapeutic recreation, relationship of leisure education to therapeutic recreation. Prereq: 520 or consent of instructor. Sp

522 Clinical Aspects in Therapeutic Recreation (3) Concepts, techniques, and utilization by experienced and advanced therapeutic recreation specialist; clinical issues, comprehensive program concerns, administrative funding and trends in practice of therapeutic recreation services. Prereq: 520. Su

540 Fiscal Policies for Recreation and Sports Related Organizations and Facilities (3) Application of fiscal policies and procedures to operation of recreation and sports related organizations and facilities. Comprehensive revenue generating strategies, cash and inventory control, commercial/public cooperative ventures and microcomputer applications. Prereq: 430 or consent of instructor. Sp

541 Management and Operation of Recreation and Sport Related Facilities (3) Research for making program and management decision, processes of cost analysis, and basis for design and maintenance of recreation and sport related facilities. Prereq: Consent of instructor. Sp
Safety

Graduate programs are available leading to the Master of Science with a major in Safety Education and Service (thesis and non-thesis options) and to the Specialist in Education with a major in Safety Education and Service. The M.S., with thesis and non-thesis options, requires completion of 30 semester hours.

The Specialist in Education (Ed.S.) requires 30 semester hours beyond the M.S. An internship and research of a significant safety problem are included as professional development activities.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. and Ed.S. programs in Safety Education and Service are available to residents of the states of Alabama, Arkansas, Florida, or South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

441 Driver and Traffic Safety Education (4) Preparation of traffic safety instructors for school, colleges, industry and commercial agencies. Students required to teach at least two non-drivers to vehicles. Valid driver's license required. 3 hrs and 2 labs.

442 Advanced Driver & Traffic Safety Education (3) Development of knowledge in teaching of driver education through use of simulation, multimedia, and multiple-car driving range. Teaching skills and supervision. 2 hrs and 2 labs.

443 Sports & Recreational Safety (3) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and interrelationships in sports. Instructor and student supervision of problem/issue in safety. Extensive reading and analysis of safety literature. Specific proposal to instructor before registration. May be repeated. Maximum 12 hrs.

601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, researched, and reported in acceptable form. May be repeated. Maximum 6 hrs. (Same as Health 601.)

History

(College of Liberal Arts)

MAJOR

History .............................................. M.A., Ph.D.

Russell Buhite, Head

Professors:

Barger, Paul H., Ph.D. .......... Vanderbilt
Buhite, Russell, Ph.D. .............. Michigan State
Chmielewski, Edward V., Ph.D. .... Harvard
Cobb, James C., Ph.D. .............. Georgia
Finger, John R., Ph.D. ............ Washington
Graf, Leroi P. (Emeritus) (Distinguished Prof.), Ph.D. .... Harvard
Haas, Arthur G., Ph.D. .......... Chicago
Hao, Yen-Ping, Ph.D. ............. Harvard
Haskins, Ralph W. (Emeritus), Ph.D. .... California
Jackson, Charles O., Ph.D. .... Emory
Klein, Milton M. (Emeritus) (Distinguished Prof.), Ph.D. .... Columbia
McDonald, Michael J., Ph.D. ...... Pennsylvania
Wheeler, W. Bruce, Ph.D. .... Virginia

Associate Professors:

Becker, Susan D., Ph.D. .......... Case Western
Bing, J. Daniel, Ph.D. .............. Indiana
Bohstedt, John, Ph.D. ............ Harvard
Farr, W. Wayne, Ph.D. .......... Harvard
Fleming, Cynthia G., Ph.D. ...... Duke
Hart, William W., Ph.D. ........... Michigan
McGraw, John R., Ph.D. .......... Yale
Pinkney, Paul J., Ph.D. .......... Vanderbilt
Utley, Jonathan G., Ph.D. ........ Illinois

Assistant Professors:

Brunnett, Paimira R. (Liaison), Ph.D. .... Chicago
Burman, Thomas E., Ph.D. ......... Toronto
Diacon, Todd A., Ph.D. .......... Wisconsin
Gavitt, Philip R., Ph.D. .......... Michigan
Plummer, Betty L., Ph.D. ........ Maryland
Wakeham, Rosemary, Ph.D. .... California (Davis)

534 Organization, Administration and Supervision of Safety Programs (3) National, state and local level programs; administrative, instructional, and supervisory aspects. Implementation of relevant programs. Sp

535 Emergency Management (3) Civil and defense problems: tornadoes, floods, fires, mass casualties; and nuclear and personnel attack by alien countries. Sp

572 Graduate Workshop in Safety (3) Special safety education problems. For advanced graduate students, teachers, supervisors, and administrators. May be repeated. Maximum 12 hrs.

The Department of History offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. The M.A. program includes a thesis and non-thesis option. The doctoral program has concentrations in American and European history with special focuses in the areas identified under group II doctoral fields.

Detailed information may be obtained from the Director of Graduate Studies in History who also advises all incoming students.

THE MASTER'S PROGRAM

Admission Requirements

1. Successful completion of a baccalaureate degree from an accredited institution, preferably with a major in history.

2. Acceptable scores on the Graduate Record Examination (general and subject).

General Requirements

Complete 510 and a 600-level research seminar normally during the fall and spring semesters of the first year in the graduate program. Complete 521 in preparation for the M.A. examination. As many as 9 related hours may be taken outside the department. As many as 9 graduate credits taken elsewhere may be applied toward the M.A. degree. Except by prior approval of the Director of Graduate Studies, a student's coursework must be at the 500 level or above.

Thesis Option

Twenty-four hours of coursework and 6 hours of Thesis 500 for a total of 30 hours are required. Thesis students are required to select one M.A. field and write a thesis. At the end of the program the thesis student will stand for a two-hour oral examination on both the thesis and the field.

Non-Thesis Option

A total of 30 hours of coursework is required. At least 6 hours must be completed in each of two M.A. fields. The primary field is examined by a two-hour written completed within one week by a one-hour oral examination with the single grade of pass/fail given at the conclusion of the oral examination. No examination is given on the secondary field.

M.A. Fields

- United States (colonial to present)
- Premodern Europe
- Modern Europe
- Asia
- Latin America

Retention and Termination

A 3.0 overall grade-point average is required to remain in good standing. M.A. students must take the M.A. examination no later than the semester following the completion of 30 hours. A student who fails the M.A. examination must repeat the examination no later than the following semester. A student who fails the examination a second time may not take the examination when required to test required from the graduate program.

THE DOCTORAL PROGRAM

Admission Requirements

1. Successful completion of the M.A. degree from an accredited institution.

2. Acceptable scores on the Graduate Record Examination (general and subject).
Residence and Coursework
Before being admitted to doctoral candidacy, a student must:
1. Complete History 510 at UT Knoxville.
2. Complete a minimum 6 related hours outside the department.
3. Spend two consecutive semesters in residence.
4. Complete 9 hours in each of two Group I doctoral fields. (The courses in the non-examined field must be graded A-F. There is no minimum hours requirement for a Group II field. Courses taken to fulfill M.A. requirements may be counted toward this requirement.)
5. Fulfill the foreign language requirement.
6. Complete two 600-level research seminars. (One must be completed at UT Knoxville.) Students who have completed a Master's thesis need complete only one research seminar (must be taken at UT Knoxville), and History 621.
7. Maintain a 3.0 overall grade-point average in graduate work attempted.
8. Complete 21 hours of graduate coursework graded A-F at UT Knoxville beyond that required for the M.A.
9. Except by prior approval of the Director of Graduate Studies, a student's coursework must be at the 500 level or above.

Language Requirements
Students must demonstrate competence in one foreign language through coursework or examination. The student's doctoral committee may specify any other languages or research tools, such as statistics, essential for the student's preparation. The foreign language requirement must be fulfilled before taking the comprehensive examination.

Comprehensive Examination
The comprehensive examination is to be taken no later than the semester following the term in which the student has completed the residence, coursework, and language requirements. A student stands examination in one field selected from Group I and one field selected from Group II below. Both parts are 4-hours, written, and taken during the same semester. A general oral exam will be taken following the successful completion of the two written portions. The two written and one oral exams are separate examinations, and Group I must be passed before taking Group II, and the latter passed prior to taking the oral portion. A student who fails any part of the examination must repeat it no later than the following semester. A student will be allowed only one failure on the examination. A second failure, no matter on which part of the examination, will result in termination from the program. Upon successful completion of the residence, coursework, and language requirements and passing the comprehensive examination, a doctoral student may be admitted to candidacy.

Doctoral Fields
Group I:
- Premodern Europe
- Modern Europe
- United States (colonial to present)
- East Asia

Group II:
- To be defined by the student's doctoral committee from within one of the following fields:
  - Political (U.S.)
  - Socio-Economic
  - Military/International Relations
  - Regional/Local (U.S.)
  - National/Regional (Non-U.S.)

Dissertation and Defense
Original research forms the basis for the dissertation. Doctoral candidates must register for a minimum of 3 hours of 600 Dissertation Research each semester and must complete 24 hours of dissertation credit. A final oral defense is given when dissertation is in historical context. The program must be completed within eight years from admission as a potential candidate.

GRADUATE COURSES
500 Thesis (1-15) P/NP only. E.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degrees is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.
510 Foundations to Graduate Study in History (3) Assumptions and methods of historians. Required of all candidates for advanced degrees. E.
532 Topics in Modern Europe (3) Reading seminar: secondary sources on Modern European movements and trends that are multinational in focus. Focus varies. May be repeated. Maximum 15 hrs.
533 Topics in European National History (3) Reading seminar: secondary sources on intra-national topics, usually British, Russian, German or French. Focus varies. May be repeated. Maximum 15 hrs.
541 Topics in Early American History (3) Reading seminar: secondary sources on early North American history. Focus varies. May be repeated. Maximum 15 hrs.
542 Topics in 19th- and 20th-Century United States (3) Reading seminar: secondary sources on intra-national topics, usually British, Russian, German or French. Focus varies. May be repeated. Maximum 15 hrs.
551 Topics in the History of Foreign Relations (3) Reading seminar: secondary sources on foreign relations. Focus varies. May be repeated. Maximum 15 hrs.
552 Topics in Military History (3) Reading seminar: secondary sources on military history; military operations, organization, mobilization, strategy in foreign policy. May be repeated. Maximum 15 hrs.
554 Topics in Comparative Social and Economic History (3) Reading seminar: secondary sources on multinational topics, comparatively structured. Focus varies. May be repeated. Maximum 15 hrs.
555 Topics in United States Social and Economic History (3) Reading seminar: secondary sources on U.S. social and economic history. Focus varies. May be repeated. Maximum 15 hrs.
556 Topics in European Social and Economic History (3) Reading seminar: secondary sources on social or economic history of European nations. Focus varies. May be repeated. Maximum 15 hrs.
557 Topics in Cultural and Intellectual History (3) Reading seminar: secondary sources on cultural and intellectual history. Focus varies. May be repeated. Maximum 15 hrs.
558 Topics in United States Regional and Local History (3) Reading seminar: secondary sources on regions, states and cities of the South. Focus varies. May be repeated. Maximum 15 hrs.
561 Topics in Latin American History (3) Reading seminar: secondary sources in Latin America. Focus varies. May be repeated. Maximum 15 hrs.
562 Topics in Asian History (3) Reading seminar: secondary sources on Asian history; East Asia and Middle East. Focus varies. May be repeated. Maximum 15 hrs.
571 Historical Editing (3) Seminar to develop practical skills applicable to historical editing.
580 Topics in History (3) Reading seminar: secondary sources for new topics. Focus varies. May be repeated. Maximum 15 hrs.
591 Foreign Study (1-15) See page 32.
592 Off-Campus Study (1-15) See page 32.
593 Independent Study (1-15) See page 32.
600 Doctoral Research and Dissertation (3-15) P/NP only. E.
621 Directed Readings (3) Directed readings to prepare candidate for doctoral comprehensive examination. May be repeated. Maximum 1 per doctoral field. S/NC only.
632 Seminar in Modern European History (3) Research seminar in primary sources culminating in scholarly paper in Modern European history. Focus varies. May be repeated. Maximum 15 hrs.
641 Seminar in Early American History (3) Research seminar in primary sources culminating in scholarly paper in American history. Focus varies. May be repeated. Maximum 15 hrs.
651 Seminar in Military and Foreign Relations History (3) Research seminar in primary sources culminating in scholarly paper in military or foreign relations history. Focus varies. Not restricted by national grouping. May be repeated. Maximum 15 hrs.
656 Seminar in United States Regional and Local History (3) Research seminar in primary sources culminating in scholarly paper in regional and local history. Focus varies. May be repeated. Maximum 15 hrs.
680 Seminar in History (3) Research seminar in primary sources culminating in scholarly paper in aspect of history not covered in another 600-level research seminar. Focus varies. May be repeated. Maximum 15 hrs.

Home Economics
(College of Human Ecology)

MAJOR
Home Economics ........................................ M.S.

The Master of Science with a major in Home Economics is a college-wide, multidisciplinary program. This degree provides a flexible graduate program for students wishing to pursue in-depth study across subject areas of home economics/human ecology. Teachers, extension personnel, family life educators and other professionals interested in broad-based areas will find that a diversity of subject matter combinations can be tailored to meet individual needs.
ADMISSION REQUIREMENTS

A completed file for review includes the Graduate School application file, College of Human Ecology application, Graduate Record Examination (GRE) scores for the general section or Miller's Analogy Test (MAT) score, and three Graduate School Rating Forms completed by individuals who can attest to the potential for graduate education. Forms may be obtained from the Dean's Office, College of Human Ecology. The M.S. in Home Economics requires an undergraduate degree in the field of home economics or human ecology.

THE MASTER'S PROGRAM

The M.S. in Home Economics is designed to meet graduate study needs of professionals who work in programs encompassing all areas of home economics. Thesis (33 hours) and non-thesis (36 hours) options are offered. The program includes 6 hours in statistics and/or research methodology, 9 hours in program planning, implementation, and evaluation (may be selected from agricultural extension, home economics education, or other courses approved by committee), 3 hours in the integrative nature of home economics (HE 510), and 9 (thesis option) or 12 (non-thesis option) hours in the College of Human Ecology. At least one course is to be from each department in the college. The thesis option requires 6 hours of Thesis 500, and the non-thesis option requires a creative project (3 hours) and 3 hours of approved electives. An oral/written comprehensive examination will be administered at the end of the program.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Home Economics is available to residents of the state of South Carolina. Additional information may be obtained from the Residence Assistant in the Office of Graduate Admissions and Records.

Home Economics Education

(College of Human Ecology)

Students pursuing graduate study in home economics education or extension are encouraged to enroll in the multidisciplinary Master's degree in Home Economics. Home Economics Education courses may be selected to meet requirements of that program. Home economics teachers may choose courses within this area for updating and certificate renewal. Graduate coursework in Home Economics Education may also be selected for development of a concentration or minor within other areas of specialization.

GRADUATE COURSES

510 Curriculum in Home Economics (3) Development of home economics educational materials and instruction. Prereq: 420 or equivalent or consent of instructor. F, Sp, A

515 Evaluation in Home Economics Education (3) Assessment of programs and pupil progress; techniques, methods and purposes. Prereq: 420 or equivalent. F, Sp, A

520 Supervision of Home Economics in the Public Schools (3) Program planning, organization and administration of vocational home economics education. Supervision of pre-service and in-service home economics professionals. Prereq: Classroom teaching experience. Su, A

563 Family Life Education Programs (3) Same as Child & Family Studies 563.

580 Special Topics in Home Economics Education (1-3) Current issues and trends in home economics. Prereq: Consent of instructor. May be repeated. Su, A

581 Directed Study In Home Economics Education (1-3) Prereq: Consent of instructor. May be repeated. E, Su, A

Human Ecology

(College of Human Ecology)

MAJOR DEGREE

Human Ecology ........................................ Ph.D.

Graduate study leading to the Doctor of Philosophy with a major in Human Ecology is available in the Departments of Child and Family Studies, Nutrition, and Textiles, Retailing, and Interior Design. Concentration areas are child development, family studies, nutrition science, textile science, and consumer environments. A major challenge of the doctoral program in Human Ecology is to draw upon the basic research generated from the natural sciences, social sciences, humanities, and the arts, and to provide a holistic perspective that contributes to the improvements of individual and family well-being. For example, the physiological chemist may study metabolic-dietary interrelationships and psychologists may study child behavior. But, it is within human ecology that the nutrient needs of the growing child are considered along with the factors that affect the child's acceptance of different foods. Within the College of Human Ecology, research from one discipline is enhanced by encompassing and utilizing the findings of research from other disciplines.

ADMISSION REQUIREMENTS

A completed file for review includes the Graduate School application file, College of Human Ecology application, Graduate Record Examination (GRE) scores for the general section, and three Graduate School Rating Forms completed by individuals who can attest to the potential for graduate education. Forms may be obtained from the Dean's Office, College of Human Ecology.

THE DOCTORAL PROGRAM

The doctorate is a research degree granted only to individuals who demonstrate proficiency in conducting original research. Course requirements for the degree are determined by the student's faculty committee, based upon college and departmental requirements and student needs and interests. The Graduate School sets minimum requirements for the doctoral degree. Additionally, the college has requirements that include:

1. Selection of a concentration and fulfillment of the requirements as directed by the major professor and approved committee;
2. Minimum of 78 semester hours in courses beyond the baccalaureate degree (exclusive of Master's thesis), including College Professional Seminar in Human Ecology 610, minimum of 9 semester hours of 600-level coursework (not including dissertation), and 24 semester hours of dissertation;
3. Successful completion of written/oral comprehensive examinations as provided by each department's procedures and the student's doctoral committee;
4. Original research project, which culminates in a dissertation;

The doctoral committee shall determine whether a reading knowledge of a foreign language is required.

More specific information about the course of study is given under the individual academic units that administer the Ph.D. concentrations.

CONCENTRATION IN CONSUMER ENVIRONMENTS

The consumer environments concentration is designed to be most appropriate for students with interests in retail and consumer sciences, foodservice and lodging administration or interior design.

Requirements are a minimum of 90 hours including:

1. HEED 530.
2. HE 610.
3. HRA 532, ID 570 and RCS 550.
4. HRA 537 or RCS 590 or ID 590 (2 hours).
5. Minimum 9 hours of statistics and research methods.
7. Twenty-four hours of dissertation.
8. Electives for 34 hours approved by the committee. (Students must take at least 18 hours in one of three specialty areas: foodservice and lodging administration, retail and consumer sciences or interior design; including a minimum of 9 hours required at the 600 level.)

MINOR IN GERONTOLOGY

An interdepartmental/interdisciplinary minor in gerontology gives the graduate student an opportunity for combining the knowledge and experience about aging in American society with his/her own major concentration.

Core courses and a practicum are offered by the College of Social Work and selected departments within the colleges of Human Ecology, Education, and Liberal Arts. A cross-listed seminar between contributing programs is designed to integrate experiences from different sources and to demonstrate the multi-faceted nature of working within an aging society.

Declaration of a Minor

Prior to earning more than one-half the total hours required for this minor, students must complete a "Declaration of a Minor in the College of Human Ecology" form. Copies of this form are available in the Dean's Office, Room 110, Jessie Harris Building.

Core Experience

Students must complete a core experience of 12 semester hours taken from at least three different departments including nine hours taken from outside the major department. Coursework needs to comply with the following framework:

1. Coursework. 9 hours required. A variety of coursework may be taken toward satisfaction of this requirement. Courses which are offered on a regular basis include: Health 406, 465, Health...
Public Health 650, Interior Design 575, Nutrition 518, Public Health 523, Social Work 566,
Sociology 415, Technological & Adult Education 522, 513.

2. Applied practicum. 2 hours required. Students should register under practicum experiences in the “home” department of the supervising faculty.


4. Successful completion of a written comprehensive examination covering subject matter of the minor.

Graduate Committee
At least one faculty member from the Gerontology Policy Committee who is qualified to work with graduate students, must serve on the graduate committee of each student who declares a gerontology minor. Contact Dr. Jim Moran, Associate Dean in Human Ecology, for a current list.

Admission to Candidacy
When application is made for admission to candidacy, indication of the minor must be noted on the Admission to Candidacy form.

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Human Ecology is available to residents of Alabama, Arkansas, Kentucky, Louisiana, Mississippi, South Carolina, Virginia or West Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

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

501 Microcomputer Research Applications in Human Ecology (3) Advanced microcomputer concepts and applications for research. Overview of statistical analysis software, computer graphics, computer-assisted design and national data base searches.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Integrative Nature of Home Economics (3) History and philosophy of home economics. Analysis of current programs and future directions in field. Examination of research, integrative framework, F.A

520 Directed Study in Human Ecology (1-3) Integrative topical project. Prereq: At least 9 hrs of graduate study in college including courses from at least two departments or consent of instructor. May be repeated. Maximum 6 hrs. E

525 Practicum in Home Economics (1-6) Field based experiences. Prereq: Consent of instructor. E

530 College Teaching in Human Ecology (3) Instructi onal effectiveness, techniques, organization, and eval uation. Prereq: Consent of instructor. Sp

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 UTK. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. (Same as Educational and Counseling Psychology 585, Nursing 585, Human Performance and Sport Studies 585, Public Health 585, Psychology 585, Social Work 585, and Sociology 585.) S/NP only.

610 Professional Seminar in Human Ecology (3) Review of various approaches taken by different disciplines to study of ecology; ecological applications in human ecology; temporal/spatial properties of human ecosystems; model building/systems thinking and future thinking in human ecology. Sp

Human Performance and Sport Studies

(College of Education)

MAJORS

Human Performance and Sport Studies
Education ........................................................................ M.S., Ed.D.
Ph.D.

Joan Paul, Head
University Professor:
Kozar, Andrew J., Ph.D. .................................................. Michigan

Professors:
Capen, Edward K., Emeritus, Ph.D. .................... Iowa
Howley, Edward T., Ph.D. ........................................... Wisconsin
Lay, Nancy E., Ph.D. .................................................. Florida State
Liemohn, W. P., Ph.D. ............................................... Iowa
Mead, B. J., Ph.D. ...................................................... Purdue
Paul, Joan (Liaison), Ed.D. .................................. Alabama
Phillips, Madge M. (Emeritus), Ph.D. .............. Iowa
Watson, Helen B. (Emeritus), Ph.D. .......... Michigan
Wisberg, C. A., Ph.D. ........................................... Michigan

Associate Professors:
Batei, Patricia A., Ed.D. ...................................... North Carolina (Greensboro)
DeSensi, J. T., Ed.D. .............................................. North Carolina (Greensboro)
Jones, Ralph E., Ph.D., ......................... Toledo
Morgan, W. J., Ph.D. ............................................... Minnesota
Namey, Thomas, M.D. ..................................... Washington (St. Louis)

Assitant Professors:
Bassett, David R., Jr., Ph.D. ......................... Wisconsin
Borovjak, Patricia C., M.S. ............................. Tennessee
Kelley, D. R., Ed.D. ........................................... Georgia State
Lewis, J. L., Ed.D. .............................................. Tennessee
McCutchen, M. G., Ed.D. ................... North Carolina (Greensboro)

Adjunct Faculty:
Aker, J. E., M.D. .................................................. Tennessee
Buckles, Tina M., Ph.D. .......................... Tennessee
O'Connell, D. G., Ph.D. .............................. Toledo

THE MASTER'S PROGRAM
The department offers two tracks for the Master's degree. Track 1 is for students who are already certified to teach or those who are seeking a Master's degree without certification. Track 2 is for students seeking initial licensure. Thesis and non-thesis options are available for both tracks.

Track 1 - Concentrations are available in exercise science (adapted physical education, exercise physiology/fitness), motor behavior,
### Human Performance and Sport Studies

#### GRADUATE COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>405</td>
<td>Sociology of Sport (3) (Same as Sociology 405.)</td>
</tr>
<tr>
<td>411</td>
<td>Adapted Physical Education (3) Developmental disabilities, other physical/mental handicaps and variant invarian characteristics of educational populations. Study of motor development/programming for those with special education needs.</td>
</tr>
<tr>
<td>423</td>
<td>Readings in Physical Education (2) Review of current and classic literature in physical education.</td>
</tr>
<tr>
<td>480</td>
<td>Physiology of Exercise (3) Functions of body in muscular work; physiological aspects of fatigue; training and adaptation to environment. Prereq: Human Physiology or general physiology, 2 hrs and 1 lab. (Same as Zoology 480.)</td>
</tr>
<tr>
<td>500</td>
<td>Thesis (1-15) P/NP only. E</td>
</tr>
<tr>
<td>501</td>
<td>Special Project (3) Studying for experience for nonthesis major. Research study suitable for publication, or praducum requiring special written work. Prereq: 532.</td>
</tr>
<tr>
<td>502</td>
<td>Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time is before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E</td>
</tr>
<tr>
<td>509</td>
<td>Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 509, Nursing 509 and Social Work 509.)</td>
</tr>
<tr>
<td>511</td>
<td>Administrative/Supervisory Processes in Physical Education (3) Organizational concepts, management strategies, and supervision techniques related to physical education programs at all levels.</td>
</tr>
<tr>
<td>512</td>
<td>Application of Theory to Curricular/Methodological Decision in Physical Education (3) Application of curricular principles to educational situations for development of curricula and lessons in physical education. Various methodological approaches.</td>
</tr>
<tr>
<td>514</td>
<td>Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues.</td>
</tr>
<tr>
<td>515</td>
<td>Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport. (Same as Sociology 594.)</td>
</tr>
<tr>
<td>520</td>
<td>Motor Behavior: A Theoretical Perspective (3) Behavior from information processing perspective; overview of current research that supports theoretical bases. Prereq: Undergraduate course in general psychology or consent of instructor.</td>
</tr>
<tr>
<td>531</td>
<td>Biomechanics of Human Performance (3) Human movement: teaching, coaching and sports medicine. Prereq: 452 or equivalent.</td>
</tr>
<tr>
<td>532</td>
<td>Seminar in Research Techniques in Physical Education (3) Evaluate, compare, and contrast research techniques in physical education with the purpose of investigating and for and experiences in appropriate review, design, and analysis procedures, and proposal development.</td>
</tr>
<tr>
<td>533</td>
<td>Psychology of Sport (3) Social psychological factors influencing human behavior in sport context; discussion of contemporary theory, research, and methodology. Prereq: General psychology course or consent of instructor.</td>
</tr>
<tr>
<td>534</td>
<td>Motor Behavior and Skill Acquisition (3) Topical explanation and application of principles of human movement behavior to acquisition and performance of skills; discussion of current research and methodology.</td>
</tr>
<tr>
<td>535</td>
<td>Sport Administration (3) Development of knowledge and analytic skills desirable for middle and upper level managers/administrators in sport business/organization.</td>
</tr>
<tr>
<td>541</td>
<td>Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated.</td>
</tr>
<tr>
<td>542</td>
<td>Sociological Aspects of Sport and Physical Education (3) Social and cultural factors influencing sport and physical education. Prereq: Consent of instructor. (Same as Sociology 542.)</td>
</tr>
<tr>
<td>544</td>
<td>Theories of Physical/Movement Education (3) Integration of theories in physical education and sport. (Same as Sociology 544.)</td>
</tr>
<tr>
<td>553</td>
<td>Advanced Adapted Physical Education (2) Curriculum development and teaching methodologies in programming for children with special education needs. Prereq: 411 or consent of instructor. Coreq: 554.</td>
</tr>
<tr>
<td>555</td>
<td>Motor Assessment and Programming for the Child with Special Education Needs (3) Selection and evaluation of test batteries appropriate for educational programming. (Same as Psychology 555.)</td>
</tr>
<tr>
<td>560</td>
<td>Laboratory Techniques in Exercise Physiology (3) Laboratory course in experimental methodology and instrumentation: respiratory and metabolic measurements, blood chemistry, and gas analysis. Prereq: 460; S/NC or letter grade.</td>
</tr>
<tr>
<td>565</td>
<td>Advanced Physiology of Exercise (3) Quantitative analysis of current and classical questions in exercise physiology. Prereq: 480 and 563.</td>
</tr>
<tr>
<td>599</td>
<td>Fitness Testing, Programming, and Leadership for Diverse Populations (2) Clinical experience in selecting, administering, and evaluating exercise tolerance tests on cycle ergometer and treadmill. Individual fitness programs for diverse populations. Practice in leading variety of activities aimed at improved fitness. Prereq: 414 and 414/415. Coreq: 568. (Same as Public Health 568.)</td>
</tr>
<tr>
<td>585</td>
<td>Seminar in Gerontology (1) (Same as Human Ecology 585, Educational and Counseling Psychology 585, Nursing 585, Psychology 585, Public Health 585, Social Work 585, and Sociology 585.)</td>
</tr>
<tr>
<td>593</td>
<td>Directed Independent Study (1-3) May be repeated. Prereq: 532 or consent of instructor. S/NC or letter grade.</td>
</tr>
<tr>
<td>600</td>
<td>Doctoral Research and Dissertation (3-15) P/NP only. E</td>
</tr>
<tr>
<td>601</td>
<td>Research Seminar in Physical Education (1) Research topics in different aspects of physical education. Prereq: Consent of instructor. May be repeated. S/NC only.</td>
</tr>
<tr>
<td>622</td>
<td>Directed Independent Research (3-6) Prereq: Doctoral student or consent of instructor. May be repeated. S/NC or letter grade.</td>
</tr>
<tr>
<td>633</td>
<td>Advanced Motor Behavior (3) Length analysis, synthesis, and discussion of contemporary theory and topics; research development and production: motor control, motor sport psychology, motor development. May be repeated. Maximum 9 hrs.</td>
</tr>
<tr>
<td>661</td>
<td>Seminar in Exercise and Applied Physiology (1-6) Selected topics in exercise and environmental physiology. Prereq: 563 and 565. May be repeated with consent of instructor.</td>
</tr>
<tr>
<td>664</td>
<td>Research Participation in Applied Physiology (1-6) Participation in research with faculty member whose interests coincide with those of student. S/NC only.</td>
</tr>
<tr>
<td>681</td>
<td>Practicum (1-3) Intern experience in areas of major interest. May be repeated.</td>
</tr>
</tbody>
</table>

#### Dance

##### GRADUATE COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>410</td>
<td>Ballet: Level III (2) Instruction and practice in advanced classical ballet techniques. Prereq: Dance majors and minors or consent of instructor. May be repeated. Maximum 16 hrs.</td>
</tr>
<tr>
<td>415</td>
<td>Teaching Creative Dance for Children (2) Theory, methods, materials and practical experience in presentation and integration of creative dance in grades K-6. Miniteaching experience.</td>
</tr>
<tr>
<td>420</td>
<td>Jazz: Level II (3) Instruction and practice in advanced jazz and musical theater dance styles and techniques. Prereq: Dance majors and minors or consent of instructor. May be repeated. Maximum 16 hrs.</td>
</tr>
<tr>
<td>430</td>
<td>Modern: Level III (2) Instruction and practice in advanced modern dance techniques. Prereq: Dance majors and minors or consent of instructor. May be repeated. Maximum 16 hrs.</td>
</tr>
<tr>
<td>450</td>
<td>Composition III (3) Application of choreographic and production skills culminating in presentation of two works. Prereq: 440 and 445 or consent of instructor.</td>
</tr>
<tr>
<td>460</td>
<td>Rhythmic Analysis (3) Basic nature and principles of music, rhythm, and rhythmic notation; correlation with dance movement and composition. Prereq: Consent of instructor.</td>
</tr>
<tr>
<td>465</td>
<td>Dance Notation (3) Fundamentals of movement notation; notation and reading of elementary movement studies.</td>
</tr>
<tr>
<td>480</td>
<td>Dance Through the 19th Century (3) Dance of various societies and culture from pre-history through 19th century.</td>
</tr>
<tr>
<td>481</td>
<td>History of Dance II (3) Development of dance in Europe, recreation and education during 20th century.</td>
</tr>
<tr>
<td>490</td>
<td>Dance in the 20th Century (3) History and philosophy of dance.</td>
</tr>
<tr>
<td>493</td>
<td>Directed Independent Study (1-3) Independent study in specialized area with dance. Prereq: Consent of advisor. May be repeated. Maximum 9 hrs.</td>
</tr>
</tbody>
</table>
| 495 | Dance Pedagogy (3) Principles and methods of teaching dance with practical application in mini-teach-
The Master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Management. They are designed to prepare students for personnel, managerial, and organizational research; for university teaching; and for consulting relationships with industry. The program emphasizes a scientist/practitioner model in applying and conducting research based on accepted theory, organizational behavior, psychology, management, and statistics. The programs are administered by a joint committee of the two departments, appointed by the Associate Vice Chancellor and Dean of The Graduate School on recommendations from the two department heads and the program director.

It is intended that students entering the I/O Program will represent widely different undergraduate and graduate backgrounds including psychology, business administration, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses that will assist the students in attaining a reasonable level of sophistication in areas of deficiency.

ADMISSION REQUIREMENTS

Applicants for admission should request information and application forms from both The Graduate School and the Director, Industrial and Organizational Psychology Program, 408 Stokely Management Center, The University of Tennessee, Knoxville, TN 37996-0545.

Two separate applications must be completed: one application for admission to The Graduate School (apply for major in "Industrial and Organizational Psychology") and one application for admission to the Industrial and Organizational Psychology program. Deadline: Now students are admitted in fall semester only, and applications must be received by the Graduate Admissions and Records Office by February 1.

General Requirements

At least one year of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade point average of 3.0 or above is required with no evidence of special weakness in mathematics and physical sciences.

Test scores on each section of the general portion (verbal and quantitative) of the Graduate Record Examination (GRE) are required. Customarily, those students admitted to the program have performed at or above the 69-79th percentile on the general tests. (This corresponds to a raw score of approximately 600 on each of the tests.)

THE MASTER'S PROGRAM

A thesis is required with 6 semester hours of Management or Psychology 500-600.

The Master's degree can be completed with a minimum of 33 semester hours in the major as follows:

Management 567, 568 or Psychology 517-18; Psychology 557; Statistics 537, 538.

Twelve hours of additional coursework to be selected primarily from the following with the approval of the student's advisor: Management 511, 522, 610; Management/Psychology 625, 626, 627, 638; Psychology 505, 550, 610, 620, 624.

Electives, as approved for an individual's plan of study, may be selected from graduate courses in psychology, social work, sociology, management, education, planning, etc. Students who wish to pursue special research interests aside from their thesis may register for Management 525, 526 (Maximum 6 hrs per term; courses may be repeated) or Management/Psychology 690.

An internship, practicum, or field experience is recommended. A student is expected to be in residence full time one year (two years recommended).

Doctoral candidates must pass a final oral examination on their dissertation research. In addition to course requirements, a doctoral student must attain a score of 650 (90th percentile) on the Subject GRE (Psychology-81) within two years of entry, successfully complete the qualifying examination covering scientific methodology before or during the third fall semester, and successfully complete the comprehensive examination in the areas of the student's major research and professional interests.

An overall B average is required in the course sequence Management 567-68 or Psychology 517-18 to continue in the program beyond the first year.

ACHAEDMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. and Ph.D. programs in Industrial and Organizational Psychology are available to residents of the states of South Carolina or Virginia. The Ph.D. program is also available to residents of Arkansas or Kentucky. Additional information may be obtained from the Residency Assistant in The Office of Graduate Admissions and Records.

Industrial Engineering

(112 College of Engineering)

MAJOR DEGREE

Industrial Engineering ......................... M.S.

C. H. Aikens, Head

Professors:

Bontdell, J. A., Ph.D. ......................... Ohio State
Claycombe, W. W., PE, Ph.D. ............... VPI
DePorter, Elden L., Ph.D. ............... VPI
Doulet, Dan C. (Emeritus), PE, M.S. Tennessee
Emerson, H. P. (Emeritus), PE, S.B. ....... MIT
LaForge, R. M. (Emeritus), PE, M.S. ..... Georgia Tech
Loveless, Howard L. (Emeritus), PE, M.S. NC State
Schmidt, Harold W., Ph.D.  Texas
Snider, John N., Ph.D.  Ohio State

Associate Professors:
Aikens, C. H. (Liaison), PE, Ph.D.  Tennessee
Halev, M. L. (UTSII), PE, Ph.D.  Texas Tech
Hungerford, J. C., Ph.D.  Ohio State
Hutchinson, D. H., Ph.D.  Georgia Tech
Kirby, K. E., Ph.D.  Tennessee

Assistant Professors:
Chatterjee, S., PE, Ph.D.  VPI
Goodman, Marvin K. (Emeritus), PE, M.S.  Tennessee
Jackson, D. F., Ph.D.  Tennessee
Sawhney, Rupy S., Ph.D.  Purdue

Lecturer:
Fortney, W. B., M.S.  Purdue

The Department of Industrial Engineering offers a graduate program leading to the Master of Science degree in Industrial Engineering, concentrations in traditional industrial engineering and engineering management. The Ph.D. with a major in Engineering Science is available through the Department of Engineering Science and Mechanics with a specialization in industrial engineering.

THE MASTER'S PROGRAM

Students who enroll in the Master of Science degree may select a concentration in either industrial engineering or engineering management. Admission is open to graduates of ABET-accredited undergraduate curricula in engineering, or to graduates of other technical curricula who satisfy prerequisites depending on their academic backgrounds and industrial experiences. Policies concerning prerequisite requirements will be determined by the Industrial Engineering faculty.

Industrial Engineering

Under the industrial engineering concentration, students may select either the thesis or non-thesis option. The thesis option requires 24 hours of coursework and 6 hours thesis. The non-thesis option requires 36 hours of coursework plus a 3-hour industrial design project.

Depending upon a student's background and career objectives, graduate work in industrial engineering enables the student to select an area of specialization from operations research, manufacturing systems, human factors engineering, information systems, quality engineering, or general industrial engineering. It is also possible for a student to select minors in engineering, mathematics, psychology, business, computer science, statistics, or economics.

Engineering Management

The engineering management concentration has an additional admission requirement of two years' industrial experience as a practicing engineer or scientist, or current full-time employment in an appropriate engineering or applied science position. The program is non-thesis and requires 38 hours of coursework plus a 3-hour capstone project. This concentration is fully supported off-campus utilizing electronic media for video taping and interactive distance teaching methods.

Note: Any 400-level course required in the Bachelor of Science in Industrial Engineering program at UT Knoxville may not be used for graduate credit in the M.S. degree program.

Industrial Engineering

GRADUATE COURSES


403 Production Facilities Design and Material Handling (3) Design of production facilities: plant layout, analysis and planning for overall moving, packaging and storage of materials. Office layout and service areas. Design of facilities for such diverse groups as hospitals, banks, industry. Prereq: 302, 401.

405 Engineering Economy (3) Methods and problems in selection or replacement of equipment. Decisions among engineering alternatives involving capital recovery, economic life of equipment, and rate of return on investment.


412 Quantitative Methods in Project Management (2) Project planning, scheduling, and control based on network and precedence diagramming methods. Resource allocation and time-cost trade off algorithms, multi-project control, computer applications, and PERT methods of handling uncertainty in activity time estimates.

413 Research Methods in Industrial Engineering (3) Methods to collect and analyze data. Process control, statistical modeling of processes, behavioral sampling, single subject experimental designs, classical experimental design methods, and time series models of experiments. Validity and reliability concepts as related to measurement and collection of data. Strategies to control rival hypotheses: randomization, matching, blocking, variance analysis, and regression analysis. Selection of appropriate experimental designs for given research situations and to analyze messy data. Prereq: 300 and senior standing, Statistics 251.


422 Industrial Engineering Problems Analytical (3) Application of industrial engineering to field assignments in local organizations. Problem definitions, data collection and presentation. Prereq: 402, 403, and 405.


500 Thesis (1-15) N/P/NC only. E

501 Design Project (1-3) Enrollment limited to industrial engineering students in non-thesis program. May be repeated. Maximum 6 hrs. S/NC only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E


511 Facilities Planning and Design (3) Modern material handling techniques, computer-aided layout techniques, application of operation research models, and use of these to design manufacturing facility. Prereq: Production Facilities Planning and Design or equivalent, or instructor's permission.

514 Information Systems II (3) Systems analysis and systems control concepts applied to systems of information. Role of IE in office and factory of future. Management support systems, decision support systems, and integrated support systems.


516 Statistical Methods in Industrial Engineering (3) Descriptive and inferential methods. Methods used in analysis and interpretation of data generated by industrial engineering projects. Prereq: Probability and statistics for scientists and engineers. (Same as Engineering Management 516.)


518 Advanced Engineering Economy (3) Financing and investment functions of firm; deterministic analysis of after-tax cash flow projections; separation theorem and basic horizon models; stochastic analysis of capital budgeting problems; Monte Carlo simulation techniques; multiple attribute decision analysis. Prereq: Statistics and engineering economy. (Same as Engineering Management 518.)


521 Human Factors Engineering Methodology (3) Background in methodology used by human factors engineering designer and systems analyst. Observational methods, functional task analysis, design aiding techniques, computerized methods, human reliability and human error prediction, training analysis, evaluation of machine-human interface, subjective and objective techniques, scaling techniques, questionnaire and survey design, critical incident technique, consensus techniques (Delphi), accident investigation behavioral instrumentation, performance measurement, statistical techniques in experimental design, and expert systems. Prereq: 520.

522 Optimization Methods in Industrial Engineering (3) Classical optimization theory, unidimensional and multidimensional search techniques, Lagrangean relaxation, separable programming, linearization techniques, quadratic programming, and dynamic programming. Prereq: 301 or 337.

523 Linear Programming and Extensions (3) Simplex and revised simplex methods, duality, parametric and post-optimality analysis, use of LP software integer programming techniques, brand and bound and cutting planes, network programming. Prereq: 301 or 337.

525 Air Traffic Control System (3) Current systems of air traffic control. Stochastic systems and air traffic control design. Use and applicable of system models. Prereq: Probability and statistics for scientists and engineers.


591-92-93 Special Topics in Industrial Engineering (3,3,3) Individual or group research projects. Prereq: Consent of instructor. May be repeated.

601 Operations Research Models in Engineering Economy (3) Microeconomic and macroeconomic programming techniques applied to capital budgeting; advanced topics in multiple attribute decision analysis; Bayesian analysis of sequential decision making; artificial intelligence in complex decision analysis. Prereq: 519.


604 Advanced Topics in Optimization (3) Multi-stage optimization theory. State increment dynamic programming with parametric programming. Prereq: 503.


691-92-93 Advanced Topics in Industrial Engineering (3,3,3) Forum to study individually or in groups. Prereq: Graduate standing and consent of instructor. May be repeated with consent of instructor.

518 Advanced Engineering Economy (3) (Same as Industrial Engineering 518.)

531 Motivational Theories and Systems in Various Organization Structures (3) Motivational theories in technology-based organizations. Impact of various organizational structures in relation to organizational use and effectiveness of contemporary organizational systems.

532 Productivity and Quality Engineering (3) Productivity and quality measures defined and used to analyze current competitive position of important sectors of American industry. Prereq: 516, 522.

533 Theory and Practice of Engineering Management (3) Comparison of classical management principles and theory with environment, goals, and practices of other technological and engineering organizations. Cases to illustrate contemporary problems and environments.

534 Engineering Management Control Systems (3) Financial and managerial accounting for the engineer/technical manager; accounting fundamentals, transaction recording, understanding financial statements, and management application like costing, budgeting, performance evaluation and control, and ratio analysis.

535 Management of Technology (3) Challenges to implement advanced technology equipment, systems, and methods in businesses and manufacturing organizations: justifying technology, assimilating change, changing management roles, personnel practices and organizational structure, and dealing with impact of new technologies on business policies and strategic planning.

536 Project Management (3) Management and control of multifaceted engineering and technological projects. Coordination and interactions between client and various service organizations. Selection of project manager and progress and management, typical problems associated with various phases of lifecycle of project. Case studies on theories and concepts.

537 Quantitative Methods in Management (3) Survey of management analysis and control systems through IE techniques. Qualitative and quantitative systems: methods analysis, work measurement, incentive systems, wage and salary development, production and inventory control, facility layout, linear programming, and applied operations research techniques. Not for credit for students with undergraduate degrees in industrial engineering.

538 Industrial Development (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.

539 Strategic Management in Technical Organizations (3) Analysis of industries: generic, market share, vertical integration and crises, and tactics of both technology-based organizations. Relationship between buyers and suppliers. Environment and competitor analysis in global market place.


541 Foundations of Total Quality Management (3) Basic understanding of TQM in context of fundamental building blocks of effective management: measurement, problem solving, continuous improvement, teamwork, customer focus, and supportive culture.

These programs include African and African-American Studies, American Studies, Ancient Mediterranean Civilizations, Asian Studies, Cinema Studies, Comparative Literature, Latin American Studies, Linguistics, Urban Studies, and Women's Studies. Certain courses within these programs are available for graduate credit as listed below. See the Undergraduate Catalog for program descriptions and directors.

**African and African-American Studies**

**GRADUATE COURSES**

421 Comparative Studies in African and Afro-American Societies (3) (Same as Political Science 461.)

450 Issues and Topics in Afro-American Studies (3) (Same as Political Science 461.)

461 African Prehistory (3) (Same as Anthropology 461.)


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

**Asian Studies**

**GRADUATE COURSES**

451 Readings in Japanese Literature (3) Same as Literature 451.

455 Special Topics in Film (3) (Same as English 455.)


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

**Cinema Studies**

**GRADUATE COURSES**

420 French Cinema (3) (Same as French 420.)

421 Topics in Italian Literature and Cinema (3) (Same as Italian 421.)

499 Special Topics in Film (3) (Same as English 499.)

**Comparative Literature**

**GRADUATE COURSES**

401-02 Special Topics in Comparative Literature (3,3) Content varies. May be repeated. Maximum 9 hrs.

**Latin American Studies**

**GRADUATE COURSES**

401 Cultural Plurality and Institutional Changes in Latin America (3) Value systems, behavioral patterns, political parties, role of military, church, educational institutions, dictatorship and nationalism.
**Linguistics**

**GRADUATE COURSES**

400 Topics in Linguistics (3) Content varies. May be repeated. Maximum 6 hrs.

411 Linguistic Anthropology (3) (Same as Anthropology 411)

420 The Development of Historical Linguistics as a Science (3) Scientific understanding of language change. Emergence of Neogrammatics paradigm from 19th-century intellectual trends. Impact of synchronic, descriptive, and transformational-generative linguistics on contemporary diachronic theory. Prereq: 6 hrs of courses required for linguistics concentration or consent of instructor.

425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, Russian 425, and Spanish 425).

426 Methods of Historical Linguistics (3) (Same as German 426, French 426, Russian 426, and Spanish 426).

429 Romance Linguistics (3) (Same as French 429 and Spanish 429).


435 Structure of the German Language (3) (Same as German 435).

436 History of the German Language (3) (Same as German 436).

437 Sociolinguistics (3) (Same as English 471 and Sociology 471).

472 American English (3) (Same as English 472).

474 Teaching English as a Second or Foreign Language I (3) (Same as English 474).

475 Teaching English as a Second or Foreign Language II (3) (Same as English 475).

483 Special Topics in Language (3) (Same as English 483).

**Journalism**

(College of Communications)

**MAJOR**

Communications ......................................... M.S., Ph.D.

James A. Crook, Director

Professors:

Adamson, June N. (Emeritus), M.S., Tennessee
Ashdown, Paul G., Ph.D. .................. Bowling Green
Crock, James A., Ph.D. ................. Iowa State
Everett, George A., Ph.D. .................. Iowa
Leiter, B. Kelly (Emeritus), Ph.D. ............. Southern Illinois
Littmann, Mark, Ph.D. .............. Northwestern
Miller, M., Ph.D. .................. Michigan State
Singleton, Michael W., Ph.D. ....... Southern Illinois

Associate Professors:

Bowles, Dorothy, Ph.D. ............. Wisconsin
Caudill, C. Edward, Ph.D. ............ North Carolina
Heller, Robert B., M.A. .............. Syracuse
Morrow, Jerry L., Ph.D. .............. Toledo
Puett, Sammie Lynn, M.S. ........ Tennessee

Assistant Professors:

Foley, Daniel, M.S. ............. Northwestern
Lucarelli, Susan M., Ph.D. ........ Tennessee

The School of Journalism offers a concentration area for the Master's with a major in Communications and participates in the interdisciplinary doctoral program. See Communications for additional information.

**GRADUATE COURSES**

403 International Communications (3) Development and operations of world mass communications channels and agencies. Comparative analysis of media, media practices, and flow of news throughout world. Print and broadcast systems in terms of relevant social, political, economic, and cultural factors. Relation of communication practices to international affairs and understanding. F

412 Opinion Writing (3) Analysis of editorial positions, practices, and pages. Writing of editorials and columns for newspapers, magazines, and company publications, rhetorical devices and use of logic. Prereq: Communications 200, or consent of instructor.

414 Magazine Article Writing (3) Techniques of writing in-depth articles of mass circulation and specialized magazines. Organizing and presenting material, problems in specialized areas: business, science, agriculture, humanities. Prereq: Communications 200, or consent of instructor.

416 Issues in Journalism (3) Topics vary. Prereq: of instructor. May be repeated. Maximum 6 hrs.


433 Advanced Editing (3) Sensitivity to language and editing skills. Headline writing, layout, and production. Prereq: 353.

440 Journalism as Literate (3) Study of writers from 17th century to modern era whose works have endured as both journalism and literature. Emerging genre called literary journalism: means of cultural reporting with personal narrative style. Prereq: Consent of instructor. F

450 Writing About Science, Technology, and Medicine (3) Writing workshop to analyze examples of successful writing and write series of articles for general publication based on scientific journals, news conferences, technical meetings, and interviews. Prereq: Consent of instructor. F,Sp

451 Environmental Reporting (3) Writing for news media on such environmental issues as strip-mining, water pollution, air pollution, allergens, nuclear power, fossil fuel power, and solid wastes. Presentations from and interaction with experts in environmental science and reporting. Exemplary popular literature in environmental reporting. Prereq: Editing for majors; consent of instructor for non-majors.

455 Issues in Science Communications (3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

456 Science Writing as Literature (3) Survey of important science writing for general public across spectrum of science, engineering, and medicine. Works by authors such as Arthur C. Clarke, Stephen J. Gould, and Stephen Jay Gould. Analysis of literary qualities in quest to understand why some science writing succeeds. Prereq: Consent of instructor.

460 Mass Communications History (3) Development of페 role of mass communications in American history. Newspapers, radio, television, and magazines.

470 Public Relations Campaigns (3) Research, planning and programming, and evaluation of public relations campaigns. Oral and written presentation of public relations project from inception to completion. Extensive out-of-class work. Prereq: Public Relations Principles.

480 Journalism in the High School (3) Functions and management of high school publications. Principles and staff selection, content of publications, copy, layout, photography, printing, advertising, and business. Planning course outlines and curricula for journalism/mass media studies.

490 Advanced Photojournalism (3) Advanced principles and methods of black-and-white photography. Introduction to color photography. News and feature photographs and photo essays. Prereq: 290 or consent of instructor.

516 Seminar in Journalism Issues (3) Topics vary. May be repeated. Maximum 6 hrs.


525 Public Opinion (3) Role of press in developing and influencing public consensus. Social theories of public opinion and analysis of mass media's response.

535 Publications Management (3) Problems in management, production, market analysis, and design. Techniques of writing, editing, and presenting comprehensive articles and other material: regional and specialized magazines and individual editorial projects. Prereq: 420 or consent of instructor.

550 Writing and Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science; technical, general publications. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

571 Seminar in Public Relations (3) Analysis and management of problems in communication between institutions and organizations and their publics. Measurement and evaluation of effectiveness of communication programs. Prereq: 470 or consent of instructor. Sp

580 Seminar in Visual Communication (3) Behavioral aspects of communication with images. Theories of psychological effect in color, shape, texture, and other design elements. Prereq: 290 or 350 or Broadcasting 430 or equivalent.

590 Communications and International Development (3) Relationship between mass communications and
The College of Law offers the Doctor of Jurisprudence degree program and a dual program with the College of Business Administration leading to the J.D. and the Master of Business Administration degree. In addition, graduate students may be eligible to take a limited number of law courses to count toward a graduate degree.

Current information regarding admission, financial aid, course requirements, academic policies, extracurricular activities, and student services is available in the College of Law Bulletin from the Admissions Office, The University of Tennessee, College of Law, 1505 West Cumberland Avenue, Knoxville, Tennessee 37996-1800. Completed application should be received before February 1 of the year of requested admission.

DEGREE OF DOCTOR OF JURISPRUDENCE

The degree of Doctor of Jurisprudence will be conferred upon candidates who complete, with the required average, six semesters of resident law study and who have 89 semester hours of credit, including all required courses. The required average is 2.0 and that average must be maintained on the work of all six semesters and also for the combined work of the grading periods in which the last 28 credit hours taken in residence were earned. Averages are computed on weighted grades. Grades are on a numerical basis from 0.0 to 4.0.

A grade of 0.9 or below is a failure. Eligible law students may receive up to six (6) semester hours of credit toward the J.D. degree for acceptable performance in upper-level courses that materially contribute to the study of law and which are taken in other departments at The University of Tennessee. Course selection and registration are subject to guidelines approved by the law faculty which include the requirement that any such course be acceptable for credit toward a graduate degree in the department offering the course. Refer to the Law Bulletin for current degree requirements.

DUAL J.D.-MBA DEGREE PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual degree program leading to the conferral of both the Doctor of Jurisprudence and the Master of Business Administration degrees. A student pursuing the dual program is required to take fewer hours of coursework than would be required if the two degrees were to be earned separately.

Admissions

Applicants for the J.D.-MBA program must make separate application to, and be competitively and independently accepted by, the College of Law for the J.D. degree and The Graduate School in the College of Business Administration for the MBA degree, and by the Dual Degree Committee. Students who have been accepted by both colleges may commence studies in the dual program at the beginning of any term subsequent to matriculation in both colleges provided, however, that dual program studies must be started prior to entry into the last 28 hours required for the J.D. degree and the last 16 hours required for the MBA degree.

Curriculum

A dual degree candidate must satisfy the graduation requirements of each college. Dual degree students withdrawing from the dual degree program before completion of both degrees will not receive credit toward graduation from either college for courses in the other college, except as such courses qualify for credit without regard to the dual degree program. For students continuing in the dual degree program, the J.D. and MBA degrees will be awarded upon completion of requirements of the dual degree program.

The College of Business Administration will award credit toward the MBA for acceptable performance in a maximum of 9 semester hours of approved courses offered by the College of Business Administration. Three of the 9 semester hours must be earned in Accounting 501, 503, or a more advanced accounting course. If College of Law credit is given for such accounting course, the dual degree student may not receive College of Law credit for Accounting for Lawyers (Law College Course 837).

The College of Business Administration will award credit toward the MBA for acceptable performance in a maximum of 9 semester hours of approved courses offered by the College of Law.

Awardees of Grades

For grade recording purposes in the College of Law for graduate business courses and in the College of Business Administration for law school courses, grades awarded will be converted to either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college where such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a College of Law course in which the student has earned a 2.3 grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

Non-Law Elective Course Credit

Students enrolled in the J.D.-MBA degree program may not receive credit toward the J.D. degree for courses taken in other departments of the University except for those taken in conjunction with the dual degree program.

Note: Students are advised to consult The Graduate School's degree requirements as stated in the front section of this catalog as well as the requirements for this college.

DUAL J.D.-M.P.A. PROGRAM

The College of Law and the Department of Political Science in the College of Liberal Arts offer a coordinated dual degree program leading to the conferral of both the Doctor of Jurisprudence and Master of Public Administration degrees. In this program, a student may earn the M.P.A. and J.D. degrees in about four years rather than the five years that otherwise would...
be required. Students pursuing the dual degree program should plan to be enrolled in course work or an internship for one summer term in addition to taking normal course loads for four academic years.

Admission

Applicants for the J.D.-M.P.A. program must make separate application to, and be independently accepted by, the College of Law for the J.D. degree and the Department of Political Science and The Graduate School for the M.P.A. degree. Applicants must also be accepted by the Dual Degree Committee. All applicants must submit a Law School Admission Test (LSAT) score. An applicant's LSAT score may be substituted for the Graduate Record Examination (GRE) score, if required for admission to the M.P.A. program. Application may be made prior to or after matriculation in either the J.D. or the M.P.A. program, but application to the dual program must be made prior to entry into the last 29 semester hours required for the J.D. degree and prior to entry into the last 15 hours required for the M.P.A. degree.

Curriculum

A dual degree candidate must satisfy the requirements for both the J.D. and the M.P.A. degrees, as well as the requirements for the dual program. The College of Law will award a maximum of 9 semester hours of credit toward the J.D. degree for successful completion of approved graduate level courses (500 or 600 level) offered in the Department of Political Science. The M.P.A. program will award a maximum of 9 semester hours of credit toward the M.P.A. degree for successful completion of approved courses offered in the College of Law. All courses for which such cross-credit is awarded must be approved by the J.D.-M.P.A. coordinators in the College of Law and the Department of Political Science. All candidates for the dual degree must successfully complete Administrative Law (Law 821) and are encouraged to take Local Government (Law 824). An internship is strongly recommended for students in the dual degree program, as it is for all M.P.A. candidates, but an internship is not required. During the first two years in the dual program, students will spend one academic year completing the required first year of the College of Law curriculum and one academic year taking courses solely in the M.P.A. program. During those first two years, students may take courses in the opposite area, without the approval of the J.D.-M.P.A. coordinators in both academic units. In the third and fourth years, students are strongly encouraged to take both law and political science courses each semester.

Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit toward either the J.D. or the M.P.A. degree for courses taken in the other program except as such courses qualify for credit without regard to the dual program.

Awarding of Grades

For grade recording purposes in the College of Law and the Department of Political Science, grades awarded in courses in the other unit will be converted to either Satisfactory or No Credit and will not be computed in determining a student's GPA or class standing. The College of Law will award a grade of Satisfactory for an approved M.P.A. course in which the student earns a grade of B or higher and a grade of No Credit for any lower grade. The Political Science Department will award a grade of Satisfactory for an approved law course in which the student earns a grade of 2.3 or higher and a grade of No Credit for any lower grade. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the Instructor without conversion.

POLICY FOR GRADUATE STUDENTS TAKING LAW COURSES

Students pursuing a graduate degree in another college may, upon approval of the College of Law and the major chairperson, take up to 6 semester hours of law courses and receive credit toward the graduate degree. The graduate student must register for the law course during regular registration at the College of Law requesting an S/N grade only. If a 2.0 or above is earned in a law course, an S will be recorded on the transcript. If a student earns below a 2.0, an NC will be recorded, and the course cannot be used toward meeting degree requirements. Grades for law courses will not be reflected in the cumulative average. Law courses may be taken for credit only by students enrolled in a graduate degree program. Different rules apply to the student enrolled in the Dual J.D.-MBA or J.D.-M.P.A. Programs. Grades must be earned according to the grading system of the respective college, e.g., numerical grades for law courses, letter grades for graduate courses. Refer to section on Grades for the grading scale acceptable toward meeting degree requirements. Cumulative GPA for law courses only will be carried until graduation, at which time both the graduate and the law cumulative will be shown on the permanent record.

PROFESSIONAL COURSES

801 Civil Procedure I (3) Bifurding effect of judgments, selecting proper court (jurisdiction and venue), ascertaining applicable law, and federal and state practice.
802 Civil Procedure II (3) Pleading, joinder of claims and parties, discovery, trials, verdicts, judgments and appeals. Emphasizes Civil Probs. 
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; the implications of performance 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 (2) 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, including battery, assault, false imprisonment, infliction of emotional distress, conversion and trespass; privileges and defenses to intentional torts; negligence; standard of care and proof of negligence; immunities and limitations on duties; cause in fact; and proximate cause.
808 Torts II (3) Defenses, including contributory negligence, assumption of risk, comparative negligence, and statutes of limitations; vicarious liability; strict liability; nuisance; products liability; settlement; problems of multiple defendants; damages; compensation for recovery for personal injury; law reform; defamation, invasion of privacy, and wrongful legal proceedings; misrepresentation, injurious falsehood, misappropriation of trade secrets, and interference with contract; constitutional torts.
809 Criminal Law I (3) Substantive aspects of criminal conduct; general principles applicable to all criminal conduct; specific analysis of particular crimes; defenses to crimes.
810 Property (3) Introductory course treating issues of ownership, possession, and use of property, including 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 salient aspects of nuisance law, eminent domain and zoning.
812 Constitutional Law I (3) Judicial review, limits on judicial power; national legislative power; regulation of commerce; public power to tax and spend; other sources of national power; separation of powers; size and regulation and regulation of commerce; intergovernmental immunities.
813 Evidence (4) Rules regulating introduction and exclusion of oral, written and demonstrative evidence at trials and other proceedings, including relevancy, competency, impeachment, hearsay, privilege, expert testimony, authentication, and judicial notice.
814 Legal Profession (3) Legal, professional and ethical standards applicable to lawyers.
816 Computer-Assisted Legal Research (0) Introductory to major computerized legal data base retrieval systems, LEXIS and WESTLAW. Offered periodically throughout the year. May be taken beginning spring of first year after completion of first draft of appellate brief in Legal Process II. Must be completed satisfactorily prior to end of second year of law study. Prereq: Completion of first draft of appellate brief in 806. S/N only.
816 Income Tax I (4) What is income; whose income is it; when is it income; how is it taxed (capital gains and losses, margin and margin interest, deductions and credits); rates (corporate, estate, and trust).
821 Administrative Law I (3) Administrative agency decision-making processes and judicial review of administrative decisions; procedural standards for informal and formal administrative adjudication and rule-making (attention to federal Administrative Procedure Act); constitutional due process standards in administrative settings; and availability, scope and timing of judicial review of agency actions.
822 Legislation (3) Interpretation and drafting of statutes, legislative process, and legislative power; comparison of judicial views on legislative process with both realities of legislative process and applicable constitutional law.
824 Local Government (3) Distribution of power between state and local governmental units; sources of authority for limitations on local government operations; creation of local boundaries, home rule, problems created by fragmentation of local governmental units, financing of local services; influence of federal programs on local government finance and decision-making.
827 Business Associations (4) Legal problems associated with formation, operation, and dissolution of unincorporated and incorporated business firms; legal rights and duties of firm members (principal and agents, partners and limited partners; and corporate shareholders, directors and officers); and others with whom these members interact in connection with firm's business.
828 Advanced Business Associations (2) Selected topics from law of business associations. Prereq: 827. May be repeated.
830 Securities Regulation (3) Basic structure of federal securities laws; legal and regulatory liabilities raising of capital by new and growing enterprises; securities transactions by promoters, officers, directors and other insiders; regulation of publicly-held companies; litigation under Rule 10b-5 and other securities provisions; and provision of legal and other professional services in connection with securities transactions.
832 Business Planning Seminar (2) Selected problems on corporate and tax aspects of business planning and transactions. Preq: 818, 827, and 970.
library and information science (office of the vice chancellor for academic affairs)

major     degree
library science          m.s.l.s.

jose-marie griffiths, director

professors:
estes, glenn e. assistant director

associate professors:
karrenbrock, marilyn h., ed.d. georgia permberton, j. michael, ph.d. tennessee robinson, william c., ph.d. illinois sinkarkas, george m., ph.d. pittsburgh pollard, richard, ph.d. syracuse brunel (uk)

the graduate school of library and information science provides a program leading to the preparation of librarians and information professionals for work in all types of libraries and information centers. the program of study includes a graduate curriculum leading to the master of science in library science. the program is accredited by the american library association.

the mission of the school is to provide excellence in teaching, research, and public service in library and information science. the goals and objectives of the school are:

1. research which strengthens its instructional and public service programs.
2. the use of a variety of research methods.
3. sharing the results of its research.
4. increased research quality and productivity.

admission requirements

candidates who have at least a 3.0 average in the junior and senior years will receive first consideration. applicants are required to take the general test of the graduate record examination. the test should be taken at least one semester in advance of application for admission to the graduate school. a personal data sheet and three recommendations (obtained from the graduate school of library and information science) should be returned to the director of the school. foreign applicants are required to take the test of english as a foreign language.

master of science in library science

the program leading to the master of science in library science involves a total of 36 semester hours of graduate courses, 18 of which form a core curriculum required of all students. either a thesis or a non-thesis option is available, with 6 hours required for thesis credit. at least 33 hours must be taken in the graduate school of library and information science, allowing up to 6 hours outside the school with a maximum of 6 from outside the university. upon completion of the program, all students are subject to a final examination. for students who elect the thesis option, the examination will be a defense of the thesis.
Students who elect the non-thesis option will be given a written comprehensive examination.

FINANCIAL ASSISTANCE OPPORTUNITIES

Employment with The University of Tennessee Libraries may provide a work-study opportunity for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students usually work at least 20 hours each week and thus may extend the period required for the degree. Similar opportunities exist with some other libraries and information agencies in the Knoxville area.

Work opportunities in a scientific-technical environment are available through subcontracts with Oak Ridge National Laboratory and the Department of Energy.

A limited number of graduate teaching assistantships are available through the school. Assistantships of this type carry a waiver of tuition and fees and stipend and require that recipients work 10 hours per week in the school.

For application forms and information about financial aid and other information about the M.S.L.S. in Library and Information Science, write to Admissions, Graduate School of Library and Information Science, University of Tennessee, 804 Volunteer Blvd., Knoxville, TN 37996-4330.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S.L.S. program in Library Science is available to residents of the states of Arkansas, Georgia, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

430 History of the Book (3) History of writing and various methods of bookmaking from earliest times through 19th century. Sp

475 Utilization of Instructional Media (3) (Same as Curriculum and Instruction 475.)

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Information Professionals and Their Organizations (3) Variety and prospects of information professions; professional organizations; achievements, responsibilities, goals, and issues. E,Su,A

520 Technical Services I (3) Technical services principles and techniques: acquisitions, basic manual and automated cataloging, structure and use of library catalogs, basic subject organization and indexing. E,Su,A

521 Technical Services II (3) Library of Congress subject classification system, MARC standards, automated cataloging and catalogs, cataloging of serials and more difficult materials. Prereq: 520. Sp

530 Information Sources and Services (3) Basic bibliographic and information sources, online databases. Interview and search techniques, selection and evaluation of information collections and development and evaluation of services. E,Su,A

531 Sources and Services for the Social Sciences (3) Information sources in social sciences: political science, sociology, psychology, geography, history, anthropo-
these areas should contact either the chair of Life Sciences or the director of the area of interest. Each program is overseen by a committee and may have unique admission and graduation requirements.

ADMISSION REQUIREMENTS
1. A Bachelor's degree with a major in a biological, behavioral, or physical science.
2. GRE (general) scores.
3. Three letters of recommendation.
4. Coursework including a year of calculus (differential and integral), one year of chemistry, and a year of physics. Specific course deficiencies may be corrected during the first year.

DEGREE REQUIREMENTS
The Master’s degree requires a minimum of 30 semester hours of study approved by the student's committee, a thesis, and an oral dissertation. Individual programs may have additional requirements.

CONCENTRATIONS
Biotechnology
The biotechnology program will prepare students to participate in the wide variety of opportunities presented by the use of living cells and their components for the production of useful materials. This will be achieved at the M.S. level by a prescribed course of study of the biology and chemistry of cells and molecules; by formal study of cells and of engineering aspects of biotechnology; and by the development of special expertise in areas such as animal embryo manipulation, automated chemical synthesis of macromolecules, bioprocess engineering, bioproducts and biotransformations, liposomes, microscopy and image processing, monoclonal antibodies and hybridoma technology, plant tissue culture, recombinant DNA technology and risk assessment, and modeling. The production of a research thesis or an industrial co-op experience will also be an important part of the training experience.

Required courses are Life Sciences 511, 512, 531, and 532.

Environmental Toxicology
The Toxicology program provides intensive training in basic toxicological principles and techniques. Courses and research expose trainees to mechanisms of intended and unintended interactions between living systems and potentially toxic agents from the point of view of biochemistry, physiology, ecology, public health, environmental law and regulation, pest management, pollution control and repair, and testing and residue analysis of toxicants.

Required courses are Biochemistry 561, 562, 604; and Life Sciences 610.

Ethology
Ethology is the naturalist study of normally occurring animal and human behavior. The program provides intensive training in basic ethology with specialized studies available in the development, evolution, and physiology of behavior; comparative psychology; human ethology; and behavioral ecology and sociobiology.

Required courses for the Master's are Psychology/Zoology 450, 459; Zoology 524, 583; Statistics 531-32; and Zoology/Psychology 516.

The Ph.D. requirements are the same as for the Master's with the additional requirements of one additional statistics course and six semester hours of courses numbered above 600 approved by the student's committee.

Physiology
The interdepartmental program in physiology includes research in the areas of cellular, comparative, developmental, exercise, muscle, neurophysiology, regulatory, or reproductive.

Required courses are Zoology 520, 521, Human Anatomy, Comparative Vertebrate Biology, 420; Biochemistry 410; four 600-level semesters; and a statistics sequence.

Plant Physiology and Genetics
This program provides the opportunity for intensive training and research experience in areas transcending the usual boundaries of botany, biochemistry, and agricultural plant sciences. It devotes itself to seeking solutions of problems concerning the interactions of physiology and genetics in applied and fundamental aspects of plant science.

Required courses are Life Sciences 510; Botany 521, 522; Biochemistry 511, 512; Plant and Soil Science 471 or Zoology 560; Plant and Soil Science 551; Microbiology 410.

GRADUATE COURSES

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or for the student in the week before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

509 Biotechnology Seminar (1-2) Topics of importance to biotechnology. May be repeated. Maximum 6 hrs.

510 Special Topics In Life Sciences (1-3) Specializations in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethology; plant physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

511 Advanced Cellular Biology (3) Cell structures and functions at molecular and supramolecular level. Membrane structure, function, and biogenesis; cellular communication; receptors and membrane flow; growth regulation and oncogenesis; plant cell structure and function; contractility and motility; meliosis and meiosis; blood and immune cells.

512 Advanced Molecular Biology (4) (Same as Biochemistry 512.)

525 Research Practicum in Life Sciences (1-3) Individual sections for each of biotechnology; cellular, molecular and developmental biology; environmental toxicology; ethology; plant physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

529 Biotechnology Practicum Co-operative Experience (2) Work experience in commercial organization for students undertaking non-thesis option of biotechnology concentration. Evaluation by supervisor and written report by student. May be repeated. Maximum 4 hrs.

531 Biotechnology Laboratory (3) Growth of microorganisms, analysis of extracellular and intracellular components.

532 Biotechnology Laboratory (3) Pilot scale yeast cultivation, enzyme isolation, purification and characterization. Application of purified enzymes to food production fermentations and fermentation process control.

600 Doctoral Research and Dissertation (3-15) PNP only. E

610 Advanced Topics in Life Sciences (1-3) Topics vary. May be repeated. Maximum 9 hrs.

Logistics
See Marketing, Logistics and Transportation

Management
(College of Business Administration)

MAJOR DEGREES
Business Administration ................. MBA, Ph.D.

Oscar Fowler, Head

Professors:
Boling, Ronald W. (Emeritus), Ph.D. .... Stanford
Dewhirst, H. Dudley, Ph.D. ............... Texas
James, Lawrence R., Ph.D. ............... Utah
Keally, A. H. (Emeritus), MBA .... Pennsylvania
Larsen, John M., Jr., (Emeritus), Ph.D. .... Purdue
Neel, C. Warren, Ph.D. ................. Alabama
Reese, Don (Emeritus), Ph.D. ......... Scottish
RequestBody

Associate Professors:
Dobbins, Gregory H., Ph.D. .......... VPI
Fowler, Oscar S., Ph.D. ............... Georgia
Frykell, Gerald E. (Liaison), Ph.D. .... Indiana
Gilbert, Kenneth C., Ph.D. .............. Tennessee
Ladd, Robert T., Ph.D. ............... Georgia
Maddox, Robert C., Ph.D. ............ Texas
Miller, Alex, Ph.D. ................. Washington
Russell, Michael C., Ph.D. ............ Akron
Russell, Joyce E. A., Ph.D. .......... Akron
Srinivasan, M. M., Ph.D. .......... Northeastern

Assistant Professors:
Bowers, Melissa R., Ph.D. .......... Clemson
Management Science

(College of Business Administration and Intercollegiate Program)

MAJORS

DEGREES

Management Science ............... M.S., Ph.D.
Business Administration ............ MBA

Kenneth C. Gilbert, Chairperson

Associate Professors:
Gilbert, Kenneth C. (Liaison), Ph.D. . Tennessee
Srinivasan, M. M., Ph.D. ............. Northeastern

Assistant Professors:
Bowers, Melissa R., Ph.D. ........... Clemson
Edirisinghe, Chanaka F., Ph.D. British Columbia
Noon, Charles E., Ph.D. .............. Michigan

Additional Committee Members:
Fowler, Oscar S., Management
Leitnaker, Mary G., Statistics
Ralston, Bruce A., Geography

THE MASTER’S PROGRAM

The M.S. program in Management Science is an intercollegiate program and is designed as preparation for a career in the application of quantitative techniques for the solution of complex problems. The program's flexibility also makes it appropriate as preparation for doctoral study in Management Science.

Management Science coursework will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program requires concentrated study in a supporting area. Supporting areas are available in other departments of the College of Business Administration (excluding statistics) as well as in computer science, public administration, ecology, and other areas, subject to approval by the Management Science Committee.

Admissions Requirements

The Master's program requires three Graduate School Rating Forms and the GRE or GMAT. Applications are encouraged from all majors, but mathematics background equivalent of the completion of at least two years of college calculus and proficiency in a computer language is required. The program is designed to be completed in three semesters by full-time students. However, students may start the program in any semester and may pursue an M.S. degree in Management Science on a part-time basis.

Course Requirements

Core Requirements

Management Science 531, 532, 533, 534
Statistics 563

Applied specialization area

(2) (approved by advisor)
Statistics electives—500 level or above (approved by advisor) or Mathematics—400 level or above (approved by advisor)
Electives selected from mathematics, statistics, computer science, and/or management science area

TOTAL 38

A thesis option is available to qualified students which substitutes 6 hours of thesis credit for the following 6 hours of coursework: Management Science 534, 3 hours in the applied concentration area and 3 hours of electives in any area. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must assemble a tentative overall program during the student's first semester and must approve all courses on a semester-by-semester basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. For example, an undergraduate mathematics major with a strong background may be allowed to take 6 additional hours of electives in place of the mathematics requirements. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take such courses to fulfill the 6-hour mathematics requirement. The total course load will remain 38 hours for all non-thesis students and 36 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between 6 and 12 as a function of prior background.

THE DOCTORAL PROGRAM

The Ph.D. program in Management Science under the College of Business Administration is designed to prepare students for research related to the application of mathematical tools to complex decision making. Three primary objectives of the program are:

1. to provide, through management science coursework, a thorough knowledge of common Management Science/Operations Research mathematical models and their uses;
2. to provide sufficient advanced study in a supporting area to qualify the graduate for a joint faculty position in the supporting area and management science.
3. to develop in the student, through coursework in mathematics, statistics, and computer science, a high degree of mathematical maturity to enhance a potential career in management, research, or teaching.

Admission Requirements

The doctoral program requires three Graduate School Rating Forms and the GRE or GMAT, in addition to The Graduate School's requirements.

Coursework

A minimum of 48 semester hours of coursework taken for graduate credit (exclusive of thesis or dissertation) is required. Some of this may be the coursework from a Master's program although a Master's is not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only.

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

502 Registration for Use of Facilities (3-15) Required for the degree, not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E


552 Stochastic Models in Management Science (3) Continuous-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory. Prereq: Statistics 563 and Mathematical Analysis or consent of instructor. Sp

533 Computational Mathematical Programming (3) Advanced modeling, computational and reporting techniques in practical mathematical programming. Prereq: 531 and proficiency in PASCAL.

534 Application of Management Science Methods (3) Application of methods: 531 and 532 to real world problems. Exposure to existing problem in industry or elsewhere.


581 Special Topics in Management Science (3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs.

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

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

621 Network Flows (3) Treatment of network optimization algorithms, transportation and transhipment models, primal-dual and primal-branch tree methods. Prereq: 531 or equivalent.

631 Integer Programming (3) Theoretical and computational aspects of linear programming with integer variables, branch and bound, cutting plane, and group theoretic algorithms. Prereq: 531 or equivalent.

641 Large Scale Mathematical Programming (3) Large scale mathematical modeling and solution of complex real world problems. Network modeling. Prereq: 531, 532.

651 Nonlinear Optimization (3) Solution of constrained and unconstrained nonlinear programming problems. Prereq: 531 or equivalent.


Prior coursework does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

BUSINESS ADMINISTRATION CONCENTRATION

For complete listing of MBA program requirements, see Business Administration. MBA Concentration: Management Science. Minimum course requirements are 531, 532 and 534.

GRADUATE COURSES

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

502 Registration for Use of Facilities (3-15) Required for the degree, not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E


552 Stochastic Models in Management Science (3) Continuous-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory. Prereq: Statistics 563 and Mathematical Analysis or consent of instructor. Sp

533 Computational Mathematical Programming (3) Advanced modeling, computational and reporting techniques in practical mathematical programming. Prereq: 531 and proficiency in PASCAL.

534 Application of Management Science Methods (3) Application of methods: 531 and 532 to real world problems. Exposure to existing problem in industry or elsewhere.


581 Special Topics in Management Science (3) Prereq: Consent of instructor. May be repeated. Maximum 3 hrs.

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

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

621 Network Flows (3) Treatment of network optimization algorithms, transportation and transhipment models, primal-dual and primal-branch tree methods. Prereq: 531 or equivalent.

631 Integer Programming (3) Theoretical and computational aspects of linear programming with integer variables, branch and bound, cutting plane, and group theoretic algorithms. Prereq: 531 or equivalent.

641 Large Scale Mathematical Programming (3) Large scale mathematical modeling and solution of complex real world problems. Network modeling. Prereq: 531, 532.

651 Nonlinear Optimization (3) Solution of constrained and unconstrained nonlinear programming problems. Prereq: 531 or equivalent.


Prior coursework does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

BUSINESS ADMINISTRATION CONCENTRATION

For complete listing of MBA program requirements, see Business Administration. MBA Concentration: Management Science. Minimum course requirements are 531, 532 and 534.

GRADUATE COURSES

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

502 Registration for Use of Facilities (3-15) Required for the degree, not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E


552 Stochastic Models in Management Science (3) Continuous-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory. Prereq: Statistics 563 and Mathematical Analysis or consent of instructor. Sp

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

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651 Nonlinear Optimization (3) Solution of constrained and unconstrained nonlinear programming problems. Prereq: 531 or equivalent.


Marketing, Logistics and Transportation

(Description of subjects and courses not transcribed.)

Logistics and Transportation

(Description of subjects and courses not transcribed.)

Business Administration Concentrations

(Description of concentrations not transcribed.)

Graduate Courses

(Description of courses and requirements not transcribed.)

Marketing

(Description of marketing courses not transcribed.)
Materials Science and Engineering
(College of Engineering)

MAJORS DEGREES
Metallurgical Engineering.......... M.S., Ph.D.
Polymer Engineering ............. M.S., Ph.D.

Joseph E. Spruell, Head

Professors:
Bogue, Donald C., Ph.D........ Delaware
Borie, Bernard S., Ph.D.......... MIT
Brooks, C. R., Ph.D........ Tennessee
Buchanan, Raymond A., Ph.D.... Vanderbilt
Clark, Edward S., Ph.D......... California
Fellers, J. F., Ph.D........ Akron
Llaw, P. K., Ph.D........ Northwestern
Lowndes, Don A., Ph.D........ Colorado
Lundin, Carl D., Ph.D........ National (Argentina)
McHargue, C. J., Ph.D......... Kentucky
Oliver, Ben F., Ph.D........ Penn State
Pedraza, A. J., Ph.D............ National (Argentina)
Phillips, Paul J., Ph.D......... Liverpool (UK)
Spruell, Joseph E. (Liaison), Ph.D.. Tennessee
Stansbury, E. E. (Emeritus), Ph.D.. Cincinnati

Associate Professors:
Becker, William T., Ph.D........ Illinois
Benson, R. S., Ph.D........ Florida State
Meek, Thomas T., Ph.D.......... Ohio State

Graduate programs are offered leading to the degrees of Master of Science and Doctor of Philosophy in Metallurgical Engineering or Polymer Engineering. Both the metallurgical and polymer programs are flexible and interdisciplinary in nature. Students may be admitted with a wide range of disciplines; these include physics, chemistry, chemical engineering, mechanical engineering, electrical engineering, materials engineering, and engineering science programs. Prospective students should consult materials science and engineering faculty concerning development of individual concentrations or special programs compatible with their backgrounds and goals.

Areas of concentration within the metallurgical engineering program include physical metallurgy; materials processing; welding metallurgy and materials joining; corrosion behavior; failure analysis; and mechanical and physical behavior of materials. Specializations in electronic and ceramic materials are available.

Areas of concentration within the polymer engineering program include rheology and polymer processing; polymer morphology; mechanical, physical, and chemical behavior of polymers; and composite materials.

THE MASTER'S PROGRAM

Thesis Option
A total of 30 semester hours is required for the M.S. degree in either Metallurgical Engineering or Polymer Engineering. Additional requirements include:
1. A major consisting of 12 to 18 semester hours of graduate courses in metallurgical engineering or polymer engineering. The polymer engineering major must include 540, 541, 543, 546, 549, 550 and 572 unless similar material has been covered in prior coursework.
2. Additional courses amounting to 6 to 12 hours total in any approved engineering, chemistry, mathematics, physics, or other related fields.
3. Master's thesis, 500 totaling 6 to 12 hours. All resident students are required to register for and participate in the graduate seminar in metallurgical engineering or polymer engineering, as appropriate, during each semester in which it is offered. Credits for the seminar do not count towards satisfying the coursework requirements.

Non-Thesis Option
Under certain conditions, a candidate may apply for a non-thesis option. To be eligible, the candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience or research publications would be examples of such evidence. A departmental faculty meeting will consider each application individually. Upon acceptance, a supervisory committee of three will be appointed, at least two being from the Department of Materials Science and Engineering. The requirements for completion of the non-thesis option are as follows:
1. A total of at least 33 hours in graduate courses in metallurgical engineering, polymer engineering and related areas. The minimum requirements are 21 hours in the Department of Materials Science and Engineering and up to 12 hours in other engineering or science courses. The candidate's degree program must be approved by the faculty committee.
2. Satisfactory completion of a critical review of the literature in an area related to metallurgical, polymer or materials engineering (580).
3. Satisfactory performance in an oral examination to be conducted by the faculty committee and covering the review paper and other areas of metallurgical or polymer engineering.

THE DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must display concrete evidence of ability to perform and report independent research to the satisfaction of the department. The Master's thesis may be offered as such evidence.

Department requirements consist of the satisfactory completion of:
1. Graduate courses in materials science and engineering amounting to approximately 24 semester hours, at least 8 of which must be in 500 series courses.
2. Supporting courses in related scientific and engineering fields amounting to approximately 24 semester hours, subject to approval by the student's faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.
3. The comprehensive examination, usually given in two parts, and covering such topics as materials science and engineering, metallurgical or polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.
4. Active participation in graduate seminars conducted by the department. Resident students must register for the appropriate 503 or 504 every semester offered.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Metallurgical Engineering is available to residents of the state of Virginia; the M.S. and Ph.D. programs in Polymer Engineering are available to residents of Arkansas, Kentucky, Louisiana, Texas, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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; anisotropic and anisotropic moduli in various materials; yield criteria; brittle fracture; crazing; plastic strain constitutive equations, forming operations and limit criteria. Prereq: Mechanical Behavior of Materials, Mechanics of materials I, sophomores and seniors.

422 Chemical Process Metallurgy (3) Application of chemical thermodynamics to metallurgical processing. Ferrous and nonferrous pyrometallurgical refining; slag-metal equilibria; solidification, gas-metal processing. Prereq: 403.

425 Metallurgical Applications in Manufacturing and Processing (3) Fabrication methods, standards and specifications; principles of thermomechanical processing for finished and semi-finished products; casting, forming, joining, heat treatment, powder metallurgy, corrosion control. Prereq: 201.

426 Materials Joining (3) Processes for joining metals, polymers and ceramics: mechanical, adhesive, fusion-soldering/crystallization; surface characteristics necessary for joining and chemical bonding; thermal effects on structure and properties of joints; design of joints. Prereq: Introduction to Materials Science and Engineering.

443 Polymer Processing (3) Rheological measurements; flow through tubes and dies; and effects and extrudate swell; selected application, screw extrusion, injection molding; synthetic fibers, spinning methods, structure development, properties.

444 Plastics Fabrication and Design (3) Lectures, laboratories and field trips; unit operations of plastics fabrication; plastics classification; design and selection criteria; processing techniques; characterization laboratory.


474 Biomaterials (3) Metals, polymers and ceramics used in orthopedic, cardiovascular, and dental surgical implant devices; corrosion and degradation problems; material properties of primary importance; tissue response to synthetic materials. Prereq: 201. Recommended for engineering science and mechanics majors.

475 Fracture-Safe Design (3) Same as Engineering Science and Mechanics 452.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E
503 Graduate Seminar in Metallurgical Engineering (1) Prereq: Admission to graduate program. May be repeated. S/NC only. E

504 Graduate Seminar in Polymer Engineering (1) Prereq: Admission to graduate program. May be repeated. S/NC only. E

505 Engineering Analysis (3) (Same as Chemical Engineering 505.)

522 Defects in Crystals (3) Analytical and experimental analysis of defects in solids. Prereq: 421 or consent of instructor.

523 Plastic Deformation of Metals (3) Geometry and mechanisms of single crystal plastic deformation; slip, twinning, and cleavage, work hardening, effect of temperature, slip band formation, defect formation; effect of ordering and solid solution alloying; polycrystalline behavior in terms of single crystal deformation mechanisms; texture formation. Prereq: 301, 320 or consent of instructor.

524 Metallurgical Thermodynamics (3) Applications of chemical thermodynamics to metallurgical problems: refining, oxidation, surface treatments, alloy systems. Prereq: 570 or equivalent.

526-26 Welding Metallurgy (3,3) Welding processes; physical metallurgy of welding; phase transformations; heat flow; residual stresses; theory of hot cracking; cold cracking and porosity formation; applications to process utilization.

529 Diffusion in Solids (3) Phenomenology and atomic mechanisms of diffusion in crystal and solid state. Solution and application of diffusion problems; random walk models; mechanisms of diffusion; diffusion in dilute and concentrated alloys. Kirkendall effect; high diffusivity paths.

530 Phase Transformations in Metallic Materials (3) Thermodynamics of phase equilibria; theory of nucleation in solids; kinetics and morphology of diffusion controlled growth: kinetics of interface controlled phase transformations; crystallography and kinetics of martensite transformations.

531 Advanced Corrosion (3) Analyses of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to pitting, crevice, fretting, wear, fatigue and stress corrosion. Prereq: 470 or consent of instructor.


540 Basic Polymer Chemistry (3) Synthesis, reactions and degradation of polymers. Molecular characterization: solution methods and spectroscopy. Prereq: Semester of organic chemistry or thermodynamics or equivalent.

541 Fluid Mechanics and Polymer Processing (3) Navier-Stokes equations and illustrative problems; applications in chemical engineering and polymer engineering, packed and fluidized beds, multiphase systems. Basic concepts in rheology; applications in polymer processing: screw extrusion, fiber spinning, injection molding. (Same as Chemical Engineering 541.)

542 Further Topics in Polymer Processing (3) Description and analysis of selected polymer processing operations; extrusion, injection molding, fiber spinning, etc.


544 Polymer Solution Thermodynamics and Characterization (3) Theories of solution of statistical thermodynamics. Characterization, treatment of chromatography, viscosity, light scattering and osmotic pressure. Prereq: Undergraduate physical chemistry.

546 Mechanical Properties of Solid Polymers (3) Types of structure-property relationships; rubber elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss tangent; experimental techniques. Introduction to mechanical properties of polymeric composites.

549-50 Laboratory Methods in Polymer Engineering (1,1) Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, calorimetry, rheometry, mechanical properties of polymer processing operations. Coreq: 540 or consent of instructor.

560 Principles of Ceramic Processing (3) Treatment of ceramic processing; raw materials preparation and characterization; powder consolidation; drying, firing, sintering techniques, mechanisms and kinetics. Prereq: 360 or equivalent.

561 Inorganic Glass Forming Systems (3) Physical and chemical nature of inorganic glasses; structural theories of glass formation; major glass forming systems: silica, other oxide glasses, nitrate glasses, metal, halide glasses, and chalco-germinate glasses. Prereq: 360, Chemistry 371.

562 Experimental Mechanics of Composite Materials (3) (Same as Engineering Science and Mechanics 562.)

570 Chemical Thermodynamics (3) Enthalpy and entropy of mixing; Gibbs function and chemical potential methods of measuring activity; solution theories; phase rule; heat capacity of gases, liquids and solids; calculation of phase diagrams. Prereq: 303 or equivalent.

571 Electron Microscopy (3) Operation of electron microscope; kinematic and dynamical diffraction theories; structure determination; analysis of lattice defects. Prereq: 304 or equivalent.

572 X-Ray Diffraction (3) Symmetry of crystals, space group theory, reciprocal lattice and application to definition of structures; powder and single crystal x-ray techniques; introduction to crystal structure determination; characterization of orientation; application to inorganic, metallic and polymer structures.

573 Biomaterials Analysis and Development (3) Physical properties of current surgical implant materials and methods of improvement; resistance to corrosion and mechanical damage; detrimental effects of specific metal ions; development of new biomaterials and new materials processing techniques. Prereq: 470, 474 or consent of instructor.

574 Formality of Materials (3) Modeling and analysis of finite plastic strain with application to primary and secondary forming operations; crystallography and noncrystalline materials; flow localization, instability, predictive testing. Prereq: Consent of instructor.

576-77 Special Topics in Materials Science and Engineering (3,3) Topics of current significance and interest. Prereq: Consent of instructor. May be repeated.


600 Doctoral Research and Dissertation (3-15) PNP only. E

621-22 Theoretical Metallurgy (3,3) Topics in solid state physics as applied to metallurgy; introduction to quantum theory, specific heat, electron theory of solids, electrical and thermal conductivity, magnetic properties, theories of alloy formation. Prereq: Consent of instructor.

623-24 Solidification and Crystal Growth (3,3) Theories of solidification, fluid flow effects, magneto hydrodynamics of incompressible fluids, growth stability theory, thermodynamic applications, rapid solidification, their experimental aspects. Prereq: Consent of instructor.

641 Advanced Rheology and Viscoelastic Theory (3) Continuum mechanics, formulation of viscoelastic theories for describing deformation and flow of polymeric materials. Application to polymer processing problems. Recommended for MS candidates working in rheological areas. Prereq: 441.

642 Advanced Topics in Polymer Processing (3) Applications of rheology to behavior of structure development to analysis of polymer processing operations. Prereq: 541. (Same as Chemical Engineering 642.)

643 Phase Transformations in Polymers (3) Glass transition and crystallization; annealing of polyethylene; glasses; reorganization of polynuclear glasses; crystallization of polymers; nucleation and growth; electrical and thermal conductivity; secondary nucleation theory; solidification of copolymers; crystallization under stress. Prereq: 543.

671 Quantitative Microscopy (3) Principal acoustic, x-ray, electron and field-ion techniques for examination of microstructures of materials. Prereq: 405.


678-77 Advanced Topics in Materials Science and Engineering (3,3) Latest developments and/or advanced special topics. Prereq: Consent of instructor. May be repeated.

678-79 Seminar in Recent Advances in Materials Science and Engineering (3,3) Directed and independent study of advanced topics. Prereq: Consent of instructor. May be repeated.

Mathematics

(Major of Liberal Arts)

MAJOR

DEGREES

Mathematics ........................................... M.M., M.S., Ph.D.

John B. Conway, Head

Professors:

Albert, G . E . (Emeritus), Ph .D ........................................ Wisconsin
Alexiades, V ., Ph .D ........................................ Delaware
Allikaka, J . H ., Ph .D ........................................ Brown
Anderson, D . F ., Ph .D ........................................ Chicago
Baker, G . A ., Ph .D ........................................ Cornell
Bradley, John S . (Emeritus), Ph .D ................................ Iowa
Carruth, J . H ., Ph .D ........................................ Louisiana State
Clark, C . E ., Ph .D ........................................ Louisville State
Conway, J . B ., Ph .D ........................................ Louisiana State
Daverman, Robert J ., Ph .D ........................................ Wisconsin
Dessart, Donald J ., Ph .D ........................................ Maryland
Dobbs, D . E ., Ph .D ........................................ Cornell
Dyda, J ., Ph .D ........................................ Warsaw
Friedsman, Henry Ph .D ........................................ Illinois
Gross, L . J ., Ph .D ........................................ Cornell
Hallam, T . G ., Ph .D ........................................ Missouri
Hinton, D . B . (Liaison), Ph .D ........................................ Tennessee
Householder, A . S . (Emeritus), Ph .D ................................ Chicago
Husch, L . S ., Ph .D ........................................ Florida State
Johannson, K ., Ph .D ........................................ Bielefeld
Jordan, G ., Samuel, Ph .D ........................................ Wisconsin
Karakashian, O ., Ph .D ........................................ Harvard
Kuperband, B . A . (UTSI), Ph .D ........................................ MIT
Lenhart, S ., Ph .D ........................................ Kentucky
McConnel, R . M ., Ph .D ........................................ Duke
Mathews, H . T ., Ph .D ........................................ Tulane
Miller, D . D . (Emeritus), Ph .D ........................................ Michigan
Rajput, B . S ., Ph .D ........................................ Illinois
Reddy, K . C . (UTSI), Ph .D ........................................ Indian IT
Rosienski, J ., Ph .D ........................................ Wroclaw
Schaeful, P . W ., Ph .D ........................................ Maryland
Scribn, Steve, Ph .D ........................................ Cornell
Soni, K ., Ph .D ........................................ Oregon State
Stallman, F . W . (Emeritus), Ph .D ........................................ Wisconsin
Giessen
Stephenson, K . R ., Ph .D ........................................ Wisconsin
Sundberg, C ., Ph .D ........................................ Wisconsin
Thistlethwaite, M . B ., Ph .D ........................................ Manchester
Wade, W . R ., Ph .D ........................................ California (Riverside)
Wagner, C . G ., Ph .D ........................................ Duke

Associate Professors:

Kimble, K . R . (UTSI), Ph .D ........................................ Ohio State
Kuo, Y ., Ph .D ........................................ Cincinnati
Malay, S ., Ph .D ........................................ Purdue
THE DOCTORAL PROGRAM

For the Ph.D. in Mathematics, the student must meet the following four requirements in addition to those of The Graduate School:
1. Satisfy either of the following: the standard program or the mathematical ecology concentration. A student intending to work in mathematical ecology may complete either, but he/she is encouraged to complete the mathematical ecology concentration. A student may elect to switch from one to the other provided the constraints of the latter option have not been violated. A student’s status after electing such a transfer is determined by the complete history of his/her earlier examinations from the standard program and part 1 of the mathematical ecology concentration. A description of both programs is below.
2. Demonstrate proficiency in one foreign language, normally French, German or Russian. This requirement is to be met prior to the examination in the area of specialization. The student’s doctoral committee may require that the student pass a second language exam.
3. Pass an examination in the field of specialization. This examination will be given by a committee appointed by the department head at some time after the requirements in 1. have been met. A student may take this examination only twice.
4. Take a one-year, 600-level sequence in mathematics outside of his/her area of specialization. The use of the course selected to fulfill this requirement must be approved by the department head and the student’s doctoral committee (such approval may occur after completion of the course).

Standard Program
Pass written examinations covering four subjects, at least three of which must be from the following list:

a. Modern Algebra 551-52
b. Complex Analysis 543-44
c. Topology 561-62
d. Real Analysis 541-42
e. Applied Linear Analysis 547-48
f. Partial Differential Equations 555-56
g. Ordinry Differential Equations 531-32
h. Numerical Mathematics 571-72
i. Statistics 525-26
j. Probability 523-24

Students may not count examinations in both d. and e., in f. and g., nor in i. and j. toward the required four passes. Those who choose four from this list must choose at least two from a. through e. and the students who choose only three from this list must choose one from a. through e.

Students selecting only three from the above list will also be required to pass a written exam on an area of applied mathematics (e.g., fluids, elasticity, mathematical ecology) approved as an examination topic for that student by the Graduate Committee and the Applied Mathematics Committee. The Graduate Committee will appoint a section of faculty who will submit a list of topics and references to the Graduate Committee and the Applied Mathematics Committee for approval.

Students may take as many of the written examinations as desired at any time these exams are given, subject to the following conditions:
1. The exams to be taken must be approved in advance by the student’s advisory committee.
2. At most, 4 minus n exams may be taken at any one time, where n denotes the number of exams previously passed by the student.
3. Students may take a collection of written examinations a maximum of four times, but no one failing five exams, counting possible repetitions, will be permitted to take another round of exams.

Mathematical Ecology Concentration
Students must pass examinations in two areas:
1. Three subjects in mathematics. One must be mathematical ecology and two must be from the list under the standard program. Students may not count passes on examinations in both d. and e., in f. and g., nor in i. and j. toward the required three passes. At least one exam must be chosen from a. through e.

Students may take as many written examinations as desired at any time these exams are given subject to the following conditions:
a. The exams to be taken must be approved in advance by the student’s advisory committee.
b. At most 3 minus n exams may be taken at any one time, where n denotes the number of exams previously passed by the student.
c. Students may take a collection of written examinations a maximum of three times, but no one failing four exams, counting possible repetitions, will be permitted to take another round of exams.
2. Ecology, covering material selected from nine hours of coursework outside of mathematics at the 500 level or above.
a. The courses submitted for examination must be approved by the student’s doctoral committee and the departmental Graduate Committee. The exam is to be prepared, administered, and graded by instructors of the courses involved, along with at least one member of the mathematical ecology section. The student must obtain written agreement to participate in the examination from instructors of these courses and from at least one member of the mathematical ecology section before submitting materials to the committees for approval.
b. Students may take the written examination at most twice.

GRADUATE COURSES

400 History of Mathematics (3) Development of major ideas in mathematics from ancient to modern times and influence of ideas in science, technology, philosophy, art, and other areas. Writing emphasis course: at least one in-class essay examination and 3000 words of writing outside classroom. Prereq: Calculus.

401 Mathematics and Microcomputers (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts and problems in mathematics. Does not satisfy major requirements for a B.S. or M.S. in Mathematics. Prereq: Calculus I.

404 Applied Vector Calculus (3) Topics from multivariable and vector calculus; line and surface integrals, divergence theorem and theorems of Gauss and Stokes. Prereq: Calculus III.


421 Combinatorics (3) Introduction to problems of construction and enumeration for discrete structures:
sequences, partitions, graphs, finite fields and geometries, or experimental designs. Prereq: 323 or consent of instructor.

423 Probability II (3) Law of large numbers and central limit theorems for discrete and continuous random variables; Probability and statistical parameter Markov chains and their applications, Kolmogorov-differential equations; Brownian motion process as limit of random walks. Prereq: Probability I or consent of instructor.

425 Statistics (3) Derivation of standard statistical distributions; independence of sample mean and variance; point and interval estimation, Bayesian estimates; statistical hypothesis, Neyman-Pearson theory, likelihood ratio, and other parametric and non-parametric tests; sufficient statistics. Prereq: Probability I or consent of instructor.


443 Complex Variables I (3) Theory of functions of complex variable: residue theory and contour integrals. Prereq: Calculus III. Recommended prereq: 300- or 400-level mathematics course.

444 Complex Variables II (3) Applications of complex variables to steady-state temperatures, electrostatics, and fluid flow. Prereq. 443.

445-46 Advanced Calculus I, II (3, 3) Theory of sequences and series, uniform convergence, and Riemann integration of functions of one or more variables. Prereq: 341 or consent of instructor.

447-48 Honors: Advanced Calculus I, II (3, 3), Honors version of 445-46. Prereq: 341 or consent of instructor.

451 Topology in Algebra (3) Number theory and theory of polynomial equations such as quadratic reciprocity law and cubic formulas. Prereq: Algebra I or consent of instructor.

453 Matrix Algebra II (3) Matrix theory including Jordan canonical form. Prereq: Matrix Algebra I.

455-56 Abstract Algebra I, II (3, 3) Algebraic structures: groups, rings, fields, vector spaces and linear transformations. Prereq: 351 or consent of instructor.

458-59 Honors: Abstract Algebra I, II (3, 3) Honors version of 455-56. Prereq: 351 or consent of instructor.

460 Geometry (3) Axiomatic and historical development of neutral, Euclidean, and hyperbolic geometry stressing properties, compactness, connectedness, continuous functions, homeomorphisms, continuity and topological invariants. Prereq: 341 or consent of instructor.

461 Topology (3) Topology of line and plane, separation properties, connectedness, continuity, functions, homeomorphisms, continuity and topological invariants. Prereq: 341 or consent of instructor.

471 Numerical Analysis (3) Computation, instabilities, and roundoff error; interpolation and approximation by polynomials and piecewise polynomials. Quadrature and numerical solution of initial and boundary value problems of ordinary differential equations, stiff systems. Prereq: Numerical Algorithms I or consent of instructor. (Same as Computer Science 471.)


490 Readings in Mathematics (1-3) Open to superior students with consent of department head. Independent study with faculty guidance. Prereq: Consent of faculty mentor to supervise independent work. May be repeated. Maximum 9 hrs.

499 Seminar in Mathematics (1-3) Topics vary. Requisite out-of-staff projects and class presentations by students. Credit hours announced for each seminar. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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

502 Registration (3) Registration for use of facilities. Prereq: Consent of instructor. (Same as Computer Science 471.)

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to integers and polynomials. Prereq: Consent of instructor. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to integers and polynomials. Prereq: Consent of instructor. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

509 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

510 Seminar in Topology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

513-14 Modern Algebra I, II (3, 3) Groups, rings, modules, fields and Galois theory. Must be taken in sequence. Prereq: 453 or consent of instructor.

519 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

521 Seminar in Topology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.


523-24 Probability (3, 3) Theory of probability and applications of conditional probability, independence, robust tests; topics from decision theory. Prereq. 445-46. Recommended prereq: 425.

527 Stochastic Modeling (3) Models in probability applied to real world situations; queueing theory, branching processes, Monte Carlo simulation. Prereq: 445-46 or consent of instructor.


534 Calculus of Variations (3) Necessary conditions for extrema, Euler’s equation, broken extrema, Weierstrass-Enneform conditions. Sufficient conditions for extrema of Lagrange’s and Jacob’s conditions, conjugate points. Multiple integrals. Prereq: 431.


539 Seminar in Differential Equations (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.


545-46 Applied Linear Algebra (3, 3) Solution of linear systems, eigenvalues and eigenvectors, Polar decompositions, complex matrices, and numerical applications. Prereq. 445-46 and 455-56 or consent of instructor.

548 Seminar in Analysis (1-3) May be repeated. Maximum 12 hrs.

550 Matrix Algebra (3) Advanced topics in matrix theory: decomposition theorems and applications to matrices with special structure. Prereq: 453 or consent of instructor.

551-52 Modern Algebra I, II (3, 3) Groups, rings, modules and linear algebra, fields and Galois theory. Must be taken in sequence. Prereq: 455-56 or consent of instructor.

553 Linear Programming (3) Theory and applications. Prereq: Consent of instructor or 453 and programming ability.


555-56 Number Theory I, II (3, 3) Introduction to algebraic number theory. Prereq: 455-56 or consent of instructor.

559 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

561-62 Topology (3, 3) Topological spaces; metricization; homeomorphic invariants of point sets. Mappings and homotopies. Covering spaces and fundamental group.

569 Seminar in Topology (1-3) May be repeated. Maximum 12 hrs.


575 Matrix Theory and Techniques in Numerical Analysis (3) Advanced topics in study of linear and direct methods for large systems of linear equations; sparse matrix analysis, relationship to modern computer architectures. Prereq: 453, 471-72, or consent of instructor. May be repeated. Maximum 9 hrs. (Same as Computer Science 575.)

579 Seminar in Numerical Mathematics (1-3) May be repeated. Maximum 12 hrs.

581-82 Mathematical Ecology (3,3) Deterministic and stochastic models of populations, communities, and ecosystems. Prereq: 431, 453 or consent of instructor.

583 Mathematical Evolutionary Theory (3) Population genetics and evolutionary theory. Prereq: 431, 453 or consent of instructor.


589 Seminar in Mathematical Ecology (1-3) May be repeated. Maximum 12 hrs.

593 Independent Study (1-15) See page 32.

598 Graduate Reading in Mathematics (1-3) Independent study with faculty guidance. Prereq: Graduate standing and consent of instructor. May be repeated. Maximum 8 hrs.

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


619 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hrs.


631-32 Advanced Ordinary Differential Equations (3,3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests and preparations of students. Prereq: 531-32 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

635-36 Advanced Partial Differential Equations (3,3) Advanced topics in classical and modern theoretical partial differential equations. Prereq: 541-42 or 547-48 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

THE MASTER'S PROGRAM

Entrance into the Master of Science program is available to qualified graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to qualified graduates of other curricula who satisfy the necessary prerequisites. Three program options are available.

Thesis Option

The requirements of this option are that the student must satisfactorily complete a program of study that includes:
1. A minimum of 24 semester hours of coursework that includes at least 12 semester hours of graduate (500 level or above) courses in the department with at least 6 semester hours in the major and normally 6 semester hours of coursework (400 level or above) in mathematics. No more than 3 semester hours of engineering coursework may be below the 500 level.
2. Six semester hours of thesis.
3. Participation in the departmental seminar program.
4. Submission and defense of a written thesis that demonstrates the ability to conduct research and report on an independent investigation.
5. Passing a final examination on all work submitted for the degree.

Course Option

This option is restricted to those students who have had the equivalent of a thesis experience or, at the time of completion of the degree requirements, have had at least three years of full-time engineering experience since receiving the Bachelor of Science degree. The evaluation of the work experience and the final selection of the student's program of study are left to the student's committee. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
1. A minimum of 30 semester hours of coursework that includes at least 18 semester hours of graduate (500 level or above) courses in the department with at least 12 semester hours in the major and normally 6 semester hours of coursework (400 level or above) in mathematics. No more than 3 semester hours of engineering coursework may be below the 500 level.
2. Participation in the departmental seminar program.
3. Passing a comprehensive written and oral final examination on all coursework submitted for the degree. The student's committee will be of sufficient size to include all of the study areas reflected in the course program.

Problems Option

The requirements of this option are that the student must satisfactorily complete a program of study that includes:
1. A minimum of 24 semester hours of coursework that includes at least 12 semester hours of graduate (500 level or above) courses in the department with at least 6 semester hours in the major and normally 6 semester hours of coursework (400 level or above) in mathematics. No more than 3 semester hours of engineering coursework may be below the 500 level.
2. A minimum of 6 semester hours in 502 Selected Engineering Problems. A written report must be presented for each problem investigated.
3. Participation in the departmental seminar program.
4. Passing a comprehensive written final examination on all coursework submitted for the degree and an oral examination on all work (including problems).

THE DOCTORAL PROGRAM

Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds.

The student must satisfactorily complete an approved program of study that includes a minimum of 72 semester hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems, including:
1. Twenty-four semester hours in doctoral dissertation.
2. A minimum of 12 semester hours of graduate credit in mathematics in courses numbered 400 or above with a minimum of 6 semester hours numbered 500 or above.
3. A minimum of 24 semester hours in the department in courses numbered 500 and above, with at least 12 of these semester hours in the major. A minimum of 9 semester hours of courses is required at the 600 level. These are exclusive of thesis, problems, or dissertation credit. The student's advisory committee can approve a student's petition to replace one 600-level course with one or more 500-level courses(s) that are more appropriate.
4. Participation in the departmental seminar program.
5. The passing of a written and oral comprehensive examination is required as well as a successful defense of the dissertation.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville in an in-state tuition basis. The Ph.D. program in Aerospace Engineering is available to residents of the states of Arkansas, Kentucky, or South Carolina. The M.S. in Aerospace Engineering is available to residents of Kentucky or South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Senior (400-level) mechanical and aerospace engineering courses may be taken for graduate credit by non-mechanical or non-aerospace engineering majors if approved by the student's major department. Mechanical or aerospace engineering majors may not normally use more than one 400-level engineering course to meet their advanced degree requirements. Non-mechanical or non-aerospace engineering graduate students should consult with instructors regarding prerequisites for undergraduate courses.

Mechanical Engineering

NOTE: Not all the courses listed below are available at both the UT Knoxville and the UTSI campuses.

GRADUATE COURSES

422 Environmental Noise (3) Basic principles of acoustics; measurement and control of noise in industrial and community environments. Coreq: 475. 3 labs. Sp
451 Systems and Controls (3) Analytical models of physical systems comprised of combinations of mechanical, fluid, electrical, and thermal components; feedback control systems; transient and frequency response; stability analysis; non-linear control of linear systems; sampled data systems; digital filters. Prereq: Mechanical Engineering Instrumentation and Measurement, Circuits and Electromechanical Components. F
455 Introduction to Design (2) Engineering economy, optimization, design for automation, reliability, patents and product liability; design of mechanical engineering solid mechanics system. Participation in team design effort; design report. Prereq: Dynamics and Vibrations of Machines. F
456 Introduction to Thermal Design (2) Engineering economy, optimization, design for automation, reliability, patents and product liability; design of mechanical engineering thermal-fluid system. Participation in team design effort; design report. Prereq: 332, 344, F
468 Machine Design II (3) Application of strength and properties of materials; design factors, theories of failure to design of machine elements. Mini design experiences. Prereq: Materials Science and Engineering 201, Engineering Sciences and Mechanics 261. F,Sp
469 Machine Design (4) Design of complete machine; documentation, complete specifications, design calculations, working drawings, and cost analysis. Written and oral report. Prereq: 455, 466, Sp
471 Refrigeration and Air Conditioning (3) Vapor compression and absorption cycles; heat pump systems; psychometric processes; air washers; cooling towers; solar radiation; building heat transmission. Prereq: 332, 344.
474 Solar Energy Utilization (3) Nature and availability of solar radiation; review of selected heat transfer topics pertinent to solar energy conversion; design of solar energy collection system; use of solar electricity; design analysis of solar energy collectors and method of storage; selected applications. Prereq: 332, 344, or consent of instructor.
475 Thermal Engineering (3) Thermal systems, turbinology, heat exchangers, combustion and system analysis and design, second law and economic analysis. Prereq: 332, 344, F,Sp
479 Thermal Engineering Design (4) Design of complete thermal-fluid system, economic, technical and opti-
mization aspects. Participation in team design effort, formal presentations and design report. Prereq: 456, 475, Sp
494-95 Selected Topics in Mechanical Engineering (1-4,1-4) Problems and topics related to developments and practice in mechanical engineering. Prereq: Consent of instructor. E
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E
507 Application of Numerical Linear Algebra in Systems and Control Engineering (3) (Same as Chemical Engineering 507 and Electrical and Computer Engineering 507.)


514 Phase Change Heat Transfer (3) Mechanisms and modeling of nucleate, transition, and film boiling processes; critical heat flux; pool boiling and post dry-out heat transfer; condensation processes; heterogeneous nucleation; dropwise and filmwise condensation; flow condensation; liquid-solid phase change processes; moving phase fronts; mathematical modeling. Prereq: 344, 511.

521-22 Thermodynamics I and II (3,3) Macroscopic thermodynamics, including First and Second Law analyses, availability, irreversible processes; gas mixtures, chemical equilibria, phase concepts, chemical reactions, combustion, gas mixtures, and property relations. Determination of thermodynamic properties from molecular structure, statistical mechanics, quantum physics, quantum theory, statistical mechanics, quantum physics, Schroedinger equation. Prereq: 332.

523 Special Topics in Thermodynamics (3) Application of thermodynamics to topics of current interest in mechanical engineering. Prereq: Consent of instructor.

525 Combustion and Chemically Reacting Flows I (3) Fundamentals: reaction kinetics, chemical kinetics and conservation equations; phenomenological approach to laminar flames; diffusion flame modeling; reaction mechanisms: stabilization of combustion; combustion mechanisms in laminar streams; flameability limits of premixed laminar flames; introduction to turbulent flames. Prereq: 522, 531.

526 Combustion and Chemically Reacting Flows II (3) Advanced topics: phenomenological approaches to turbulent flames; fundamentals of turbulent flow; application of probability density functions to turbulent flames; turbulent reacting flows with premixed and non-premixed reactants; spray combustion models; fluidized bed combustion; chemically reacting boundary layer flow; gas turbine and/or rocket motor combustion; turbulence; introduction to supersonic combustion and hypersonic flows. Prereq: 525.

531 Fluid Mechanics (3) Derivation of equations governing flow of viscous fluid flows of conservation of mass, momentum, and energy; unsteady, compressible, and non-Newtonian fluids; fluid dynamics, vortex theory, boundary layer, turbulence, chaotic flows, wave propagation, and acoustics. Prereq: 210, 344, 522. Coreq: Mechanical Engineering 267, or equivalent.

532 Special Topics in Fluid Mechanics (3) Application of fluid mechanics to topics of current interest in mechanical engineering. Prereq: Consent of instructor.

542 Advanced Fluid Mechanics (3) Advanced theory and applications of fluid mechanics, including inviscid and turbulent flows with heat and mass transfer; transition and separation; boundary layer theory and solution techniques. Prereq: Consent of instructor. Sp

543 Advanced Topics in Fluid Mechanics (3) Advanced topics and applications in mechanics, dynamical systems, and control of fluid flows. Prereq: Mechanical Engineering 531 or equivalent.


560 Computer Aided Mechanical Design (3) Application of matrices and computational techniques in static and dynamic analysis and re-design of complex, three-dimensional, statically indeterminate structures. Prereq: 569 and 484 or consent of instructor.

567 Dynamics of Machine (3) Kinematics and kinet- ics: fixed, moving and rotating co-ordinate systems; linear and angular momentum; energy methods; compu- tational techniques derived from Lagrangian mechanics; variable mass; rigid body dynamics. Prereq: 363, 391.

569 Vibrations (3) Free and forced vibration of single and multiple degree of freedom systems linear and nonlinear. Prereq: Undergraduate vibrations course.


581 Rocket Propulsion I (3) Rocket propulsion mechanisms and determination of rocket engine performance; rocket nozzle design; rocket nozzle engine; ground testing; introduction to solid propellant rockets. Prereq: Consent of instructor.

582 Rocket Propulsion II (3) Solid propellant rocket performance, homogeneous and heterogeneous propellant chemistry and combustion system performance, thermal decomposition and gas phase reaction mechanisms; rocket engine design. Prereq: Consent of instructor.

584-85 Turbomachinery Systems I, II (3,3) Ideal cycle analysis of turbomachines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines, flow, materials, and component matching, transient operation, surge and rotating stall, engine control systems, structural considerations. Prereq: First year graduate standing and consent of instructor.


590 Selected Engineering Problems (2-6) Enrollment limited to students in problems program. Prereq: Consent of advisor. May be repeated. S/NC only.

595 Seminar (1) All phases of mechanical engineering. Reports on current research at UTK. May be repeated. S/ NC only.

598 Special Topics in Mechanical Engineering (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

610 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer, natural convection, multi-phase flow, high speed reacting and nonreacting flows, advanced boundary layer theories, combustion, perturbation and variational methods of analysis, heat exchanger theory and design, and heat transfer. Prereq: Consent of instructor. Maximum 9 hrs. Prereq: Consent of instructor.

611 Advanced Convection Heat Transfer, Fluid Mechanics and Mass Transfer (3) Stagnation point and high speed viscous boundary layer flows; problems in hypersonic and hypervelocity spaceflight; laminar and turbulent boundary layer heat transfer with surface melting, ablation, sublimation; effects of gas species recombinaiton; stagnation point heat transfer, Lee's integral solution for high speed boundary layers; heat flux scaling rules; mass transfer and radiation cooling techniques. Prereq: 512 and consent of instructor.


513 Advanced Radiation Heat Transfer (3) Radiation heat transfer in absorbing, emitting and scattering media, interaction of thermal radiation with conduction and convection. Prereq: 511, 512.


542 Advanced Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach, equilibrium of pure substances, metastable states. Non-equilibrium thermodynamics. Prereq: Consent of instructor.


Aerospace Engineering

NOTE: Not all the courses listed below are available at both the UT Knoxville and the UTSI campuses.

GRADUATE COURSES

422 Aerodynamics (3) Theory and design of aerodynamic systems for desired performance. Similarity, potential flow theory, viscous effects, compressibility effects. Subsonic, transonic, and supersonic airflow. Prereq: 370. Fall

423 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods. Prereq: 422 or Heat Transfer or consent of instructor. Sp

424 Astronautics (3) Propulsion, trajectories, guidance, control, and atmospheric reentry of space vehicle systems. Prereq: 362, Mechanical Engineering 332. Sp

425 Propulsion (3) Principles of propulsion devices; turbo-jet, ram jet and rocket engines. Prereq: 351. Fall

426 Introduction to Aerospace Design (2) Design process, synthesis, safety, reliability, tolerances, product liability, economic analysis, optimization, design standards, design studies. Individual design reports. Prereq: 351, 370, 363. Coreq: Mechanical Engineering 344. F

429 Aerospace System Design (4) Synthesis and design of aerospace systems, economics. Prereq: 426. F

499 Aerospace Engineering Laboratory (3) Designing, constructing, and testing experiments on aerodynamic ex- amines. Test standards and specifications. Analysis of data and formation of conclusions. Prereq: 345, 351, 3 labs. F

494-95 Selected Topics in Aerospace Science (1-4, 1-4) Current problems and topics in aerospace science. Prereq: Consent of instructor.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester while the student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511 Inviscid Flow (3) Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping and related theory. Prereq: Mechanical Engineering 531, Mathe- matics 425 or equivalent.

522 Viscous Flow (3) Equations of viscous fluid flow; laminar and turbulent flow; transition; separation; boundary layer theory; exact and approximate solutions. Prereq: Mechanical Engineering 531 or equivalent.

531 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments; representative experiments; hot wire anemometry and
527-28 Aerospace Ground Test Facilities (3,3) At-
free molecule and rarefied gas flow. Prereq: 512.

521-22 Aerodynamics of Compressible Fluids (3,3)
systems, vehicle performance characteristics, and tra-
control characteristics for subsonic to hypersonic speeds.

515-16 Air Vehicle Aerodynamics and Performance
applicable to aerospace vehicles, equations of motion,
omena; solution techniques. Prereq: 522.

544 Transonic Flow (3) Nature of flow at transonic
transition flight modes. High lift airfoils. Automatic con-
vected lift and jet vertical riser type aircraft. Vertical and
fixed flight control surfaces. Automatic control sys-

557 Aerospace Vehicle Flutter and Vibration (3)
aerodynamic loading. Self-excited instability. Deri-
ation of aerodynamic operator, forced response, static
and dynamic Eigenvaules of simplified structures. Appli-
cations to typical systems. Prereq: 557.

561 Fundamentals of Aeronautics (3) Generation,
propagation and absorption of sound in static and mov-
ing media. Prereq: Consent of instructor.

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

574 Space Engineering: Satellite Technology (3) Satellites and rockets (orbit, launch vehicles and launch-
ing), spacecraft structure, power systems, attitude control
tem, telescope, satellite, and instrumentation. Prereq: 512,

589 Measurement Science I (3) (Same as Nuclear
Engineering 598, Aviation Systems 588, Chemical Engi-
neering 588, Civil Engineering 588, Electrical and Com-
puter Engineering 588, Engineering Science and Me-
chanics 588, and Mechanical Engineering 588.)

595 Seminar (1) All phases of aerospace engineering,
issues on current research at UTK. May be repeated. S/

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

631 Magnetohydrodynamics I (3) Electromagnetic
flows, equations of single charged particle, statistical
description of plasma, Boltzmann equation, conduction
and diffusion in ionized gases, continuum magnetohy-
dynamic equations. Prereq or coreq: 512. Prereq:
Mathematics 561 or equivalent.

632 Magnetohydrodynamics II (3) Alfven and shock
waves, exact solution for magnetohydrodynamic chan-
nal flow, one-dimensional model of channel flow, engi-
neering applications of magnetohydrodynamics, propul-

645 Theory of Turbulence (3) (Same as Engineering
Science and Mechanics 465.)

651-52 Advanced Aerodynamics (3,3) Subsonic, tran-
sonic, supersonic, and hypersonic flows treated in gen-
eralized and unified manner with combined viscous-

derived models of several regimes of low speed flow. Fundamental assumptions, limitations of approx-

658 Advanced Viscous Flow Theory (3) Critical review
of significance to governing equations. Nature of bi-

division into academic years. Prereq: 512, continuum mechanics, and Mathematics 562.

690 Advanced Topics in Aerospace Engineering (3)
Prereq: Consent of instructor. May be repeated. Maxi-
mum 9 hrs.

Medical Biology

557 Aerospace Vehicle Flutter and Vibration (3)
aerodynamic phenomena. Structural and aerodynamic
properties. Stability criteria for airfoils operating in oscil-
ating stream. Two- and three-dimensional flow of wings,
control surfaces and empenages. Prereq: 423, 551.

558 Aerelasticity (3) Dynamics of elastic structures
under aerodynamic loading. Self-excited instability. Deri-

561 Fundamentals of Aeronautics (3) Generation,
propagation and absorption of sound in static and mov-
ing media. Prereq: Consent of instructor.

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

See Materials Science and Engineering

Microbiology

(College of Liberal Arts and College of Veterinary Medicine)

MAJOR

DEGREES

Microbiology ........................................ M.S., Ph.D.
Veterinary Medicine .............................. D.V.M.

Dwayne Savage, Head

Professors:

Beck, Raymond W. (Emeritus), Ph.D. Wisconsin
Becker, Jeffrey M., Ph.D. ....................... Cincinnati
Brian, D. A., D.V.M., Ph.D. ................. Michigan State
Monte, T.C., Ph.D. .............................. Maryland
Riggsby, W. Stuart (Liaison), Ph.D. ......... Yale
Rouse, B. T., Ph.D. ............................. Guelph
Savage, Dwayne C., Ph.D. ..................... California
Sayler, Gary S., Ph.D. ............................ Idaho
Stacey, G., Ph.D. ................................. Texas
White, D.C. (Distinguished Scientist), Ph.D. ......................... Rockefeller
Woodward, J. M. (Emeritus), Ph.D. ......... Kansas
Wust, Carl J., Ph.D. .............................. Indiana

Associate Professors:

Bemis, D. A., Ph.D. ............................... Cornell
Moore, R. N., Ph.D. ............................. Texas

Assistant Professor:

Hacker, David, Ph.D. ......................... Michigan State
Lampson, Bert C., Ph.D. ....................... Missouri
Villafane, Robert J., Ph.D. ..................... NYU

ADMISSION REQUIREMENTS

Students are expected to have completed an undergraduate program with a 3.0 or better GPA on a 4.0 system. Included in the undergraduate course credits should be (1) a full year of general biology, (2) one year of calculus, (3) two years of chemistry, including one year of organic, (4) one year of physics, and (5) an introductory course in microbiology. In many cases, deficiencies in requirements may be removed by taking appropriate courses during the first year of graduate study. The department also requires the general portion of the Graduate Record Examination. A satisfactory score on each part is 550 or higher with rare exceptions. Three letters of recommendation should be submitted by current or former faculty members.

Each new graduate student meets with an advisory committee chaired by the departmental Director of Graduate Studies to plan a program of study for the first or two semesters until a research advisor is selected. All first-year students participate in a laboratory rotation program during the first semester of study. This program allows the student to adjust smoothly to the research programs of the department, to develop a background of research procedures and concepts, and to facilitate the selection of a research professor. Usually the student selects a research professor toward the end of the laboratory rotation period. The major professor assists in the selection of and carrying out of a suitable research program and in the naming of a thesis or dissertation committee.

THE MASTER'S PROGRAM

The program leading to the M.S. is designed to provide the student with broad basic knowledge to permit the acquisition of technical competence in the fundamentals of research, and to encourage creative and independent thinking. Two to three calendar years are usually needed for the course of study that has the following requirements: (1) 30 hours including 6 thesis credits; (2) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F system; (3) a 3.0 GPA in courses taken in the department; (4) a complete course sequence in a laboratory rotation program; (5) coursework in at least five of the subdisciplines recognized by the department: microbial physiology, pathogenic bacteriology, virology, mycology, immunology, microbial genetics, microbial ecology, molecular biology, and applied microbiology; and (6) presentation of a research thesis and its oral defense.

THE DOCTORAL PROGRAM

The program leading to the Ph.D. is designed to develop the student's ability to pursue independent and original research in microbiology and allied fields, to teach both oral and written communication of the results of research to the scientific community, and to train effective teachers. Students may enter the program after receiving either a Bachelor's or Master's degree. Students who enter with a Bachelor's degree usually take the Ph.D. after four or five years; those with the Master's degree usually take three or four years to complete the degree. Departmental requirements are: (1) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F scale; (2) a 3.0 GPA in courses taken in the department; (3) satisfactory performance in at least one semester as a teaching assistant; (4) one semester of physical chemistry; (5) one course in statistics; (6) courses in at least five of the sub-disciplines listed in the Master's program; (7) satisfactory performance in a comprehensive examination that must be passed before admission to candidacy; and (8) the presentation of a research dissertation and its oral defense.

GRADUATE COURSES

410 Bacterial Physiology (3) Modern concepts of structure and function of bacterial cell. Prereq: Introduction to Microbiology. F

411 Bacterial Genetics (3) Transmission and expression of genetic information by bacteria. Prereq: Introduction to Microbiology. F

420 Medical Microbiology (3) Disease producing microorganisms including bacteria, rickettsia, chlamydia, and fungi. Prereq: Introduction to Microbiology. Sp

429 Medical Microbiology Laboratory (2) Laboratory exercises designed to accompany 420. Prereq: Introduction to Microbiology. Lab. F, Sp

430 Immunology (3) Principles of inflammation and immunity; immunoglobulin structure and theories of formation and diversity, complement, hypersensitivities, cell cooperation and recognition in immune mechanisms; soluble factors. Prereq: Biology 220. (Same as Zoology 430.) F

439 Immunology Laboratory (2) Laboratory exercises designed to accompany 430. Coreq: 430. (Same as Zoology 436.) F, Sp


449 Virology Laboratory (1) Laboratory procedures for isolation, handling, and culturing of animal viruses. Prereq: 310. Coreq: 440. F

470 Microbial Ecology (3) Physiological diversity and taxonomy of microorganisms from natural environments. Functional role of microorganisms in natural and simulated ecosystems. Prereq: 310. Sp

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E

510 Microbial Physiology (3) Topics in microbial physiology and metabolism. Prereq: 410. Biochemistry 410, or consent of instructor. May be repeated. Maximum 12 hrs.

520 Pathogenesis of Infectious Disease (3) Topics in pathogenesis: microbial factors and host responses. Prereq: 420, 430, or consent of instructor. May be repeated. Maximum 12 hrs.

530 Immunology and Immunocytochemistry (3) Topics in molecular and genetic aspects of immune response, immunocytochemistry, and immunopathobiology. Prereq: 420, 430, or consent of instructor. May be repeated. Maximum 12 hrs.

540 Molecular Virology (3) Topics in replication, assembly, and expression of viruses. Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hrs.

550 Microbial and Molecular Genetics (3) Topics in transmission and expression of genetic information at the molecular level. Prereq: 411. Biochemistry 410, or consent of instructor. May be repeated. Maximum 12 hrs.

570 Applied and Environmental Microbiology (3) Topics in applied and environmental microbiology that treat physiology, metabolism, and genetics of microorganisms: fermentations and natural and simulated ecosystems. Prereq: 470 or consent of instructor.

575 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 575, Environmental Engineering 575, and Agricultural Engineering 575.)
Microbiology - Veterinary Medicine

See Veterinary Medicine for program description.

Music

(College of Liberal Arts)

MAJOR                      DEGREES
Music                        M.M.

Kenneth A. Keeling, Sr., Head

Professors:
Ball, Charles H., Ph.D. .................. Peabody
Bitzas, George C., M.M. ................. Converse
Brock, John P. (Liaison), M.M. .......... Alabama
Carter, W. J. (Emeritus), D.M.A. ...... Eastman
Coker, J., M.A. .......................... Sam Houston
Combs, F. M., M.A. ........................ Missouri
 DeVine, George F. (Emeritus), Diploma ......................................................... Schurz
Dorn, W. (Emeritus), M.A. .................. Columbia
Fred, Herbert W. (Emeritus), Ph.D. ....... North Carolina
Holtford, A. G. (Emeritus), M.M. ........ Northwestern
Huber, Calvin R., Ph.D. ................... North Carolina
Julian, W. J., Ph.D. ........................ Northwestern
Lennon, J. A., D.M.A. ...................... Michigan
Keeling, Kenneth A., Sr., D.M.A. ...... Michigan
Meacham, John J., M.M. .................. Northwestern
Moore, M. C., Ph.D. .......................... Iowa
Pederson, D. M., Ph.D. ...................... Iowa
Starr, W. J. (Emeritus), M.M. ........... Eastman
Stutzerberger, D. R., D.M.A. .......... Maryland
Tips, A. W., Ph.D. ........................... Michigan
VanVactor, D. (Emeritus), M.M. .... Northwestern

Associate Professors:
Adams, Fay, M.M. ......................... Tennessee
Bommelje, W., M.M. ........................ Tulsa
Carter, P. S., M.M. .......................... Colorado
Horodysky, P., M.M. .......................... Manhattan
Hough, Don, M.M. .......................... Tennessee
Hough, Dolly C., M.M. ..................... Tennessee
Jacobs, K. A., D.M.A. ...................... Stanford
Johnson, A. E., D.M.A. ..................... Stanford
MacMorran, W. S., M.M. ................. Wisconsin
Mceless, D. K., M.A. ....................... Columbia
McDaniel, Walter H. (Emeritus), M.S.  .. Tennessee
Michalopulos, L. W., M.A. ............... Columbia
Mintz, J., Ed.D. .............................. Columbia
Scarlatt, William P., M.M. ............... Louisiana State
Searle, S. M., M.M. .......................... Tennessee
Sparks, J. R., M.S. .......................... Tennessee
Teachey, J. C., D.M.A. ..................... Florida State
Young, S. E., Ph.D. .......................... North Carolina

Assistant Professors:
Boling, M. E., M.M. .......................... Tennessee
Brown, Donald R. ........................... Tennessee
Dubbert, T. S., M.M. ....................... Yale
Erwin, A. Y., M.M. .......................... Southern Cal
Hawthorne, W., Ph.D. ..................... Cincinnati
Leach, C. F., M.M. .......................... New Mexico
Root, Patricia, M.A. ........................ Washington State
Sperl, G. R., M.M. ............................ Indiana

The Department of Music offers the Master of Music degree with concentrations in accompanying, choral conducting, composition, instrumental conducting, jazz, music education, musicology, performance (organ, piano, strings, voice, winds, and percussion), piano pedagogy and literature, sacred music, string pedagogy, and theory. Applicants must have completed an undergraduate degree approximately equivalent in music requirements to those required in degrees conferred by UT Knoxville, appropriate to the applicant's prospective area of concentration on the Master's level. Applicants who plan to pursue the concentration in music performance or music education are required to audition before the appropriate area faculty committee. Applicants for admission to the program in composition must submit scores and tape recordings of representative works. Applicants for the concentration in jazz must audition in jazz improvisation and jazz piano proficiency and interview with members of the faculty in this area. Other applicants are required to have an interview with members of the faculty of the prospective area of concentration. All applicants are required to take the Diagnostic Examinations in music theory an music history/literature. These examinations are given by the Department of Music at the beginning of each semester.

THE MASTER'S PROGRAM

A minimum of 30-33 semester hours of coursework is required for the Master of Music degree. These hours are specifically distributed according to the area of concentration. All concentrations require coursework in music history/literature and music theory and allow for elective courses. Specific curricula are available from the department.

The graduate recital is given in lieu of thesis by students with concentrations in performance, pedagogy, jazz, and accompanying. A performance project is given in lieu of thesis by students with concentrations in choral conducting, instrumental conducting, and sacred music. A thesis is required of students in composition, musicology, and theory.

All concentrations require a written and oral final examination.

Concentration in Music Education

The concentration in music education is designed for persons who hold a Bachelor's degree in Music or Music Education and certification to teach music in the public schools. Students seeking initial certification should consult the requirements for the Master of Science degree in the College of Education.

The program requires 510 and 520; 9 hours of music education electives at the 500 level; 6 hours of Thesis 500; 6 hours of 500-level courses in music theory or history; 2 hours of applied music at either the 400 or 500 level; 2 hours of music ensemble at the 500 level; and 3 hours of electives at the 500 level.

A three credit research problem and three extra hours coursework in Music Education may be substituted for Thesis. If a larger thesis problem is desired, the thesis credit may be increased to 9 hours, and 3 hours of Music Education electives may be dropped.

Diagnostic tests in theory, ear training, and music history will be required.

Music Education

GRADUATE COURSES

500 Thesis (1-15) P/NC only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Foundations of Music Education (3) Historical, philosophical, and aesthetic bases. Prereq: Consent of instructor.

520 Research in Music Education (3) Definition of research problems, data collection and analysis, and research report writing. Application of knowledge of research techniques to analysis of existing research literature in music education. Prereq: Consent of instructor.

530 Advanced Band Literature and Conducting (3) Reading, conducting, and interpreting band scores suit-
able for school, college, and community bands; contemporary and standard band literature. Prereq: Consent of instructor.


555 Administration and Supervision of School Music (3) Problems of supervision, research, and in-service education, teacher preparation, guidance. Prereq: Consent of instructor.

560 Psychology of Music Teaching (3) Research on musical perception and cognition and its application to teaching of music. Definition and measurement of musical ability. Prereq: Course in general psychology and 1 yr of music theory or consent of instructor.

562 Seminar in Music Education (3) Class investigation and individual reporting of pertinent topics and issues in music education. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

563 Special Topics in Music Education (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

564 Special Problems in Music Education (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Music Ensemble

GRADUATE COURSES

501 Woodwind Choir (1) May be repeated.

503 Small Jazz Ensemble (1) May be repeated. Maximum 12 hrs.

504 Jazz Ensemble (1) May be repeated.

505 Studio Orchestra (1) May be repeated. Maximum 12 hrs.

506 Trombone Choir (1) May be repeated.

509 Tubas Ensemble (1) May be repeated.

510 Percussion Ensemble (1) May be repeated.

511 Marimba Choir (1) May be repeated.

514 Brass Choir (1) May be repeated.

515 Chamber Music Ensemble (1) May be repeated. Maximum 12 hrs.

520 UT Singers (1) May be repeated.

530 Chamber Singers (1) May be repeated.

532 Collegium (1) May be repeated.

534 Saxophone Choir (1) May be repeated.

540 Opera Theatre (1) May be repeated.

550 Concert Band (1) May be repeated.

552 Campus Band (1) May be repeated.

554 Varsity Band (1) May be repeated.

556 Laboratory Band (1) May be repeated.

559 Marching Band (1) May be repeated.

570 Symphony Orchestra (1) May be repeated.

580 Concert Choir (1) May be repeated.

582 University Chorus (1) May be repeated.

583 Men's Chorale (1) May be repeated.

589 Women's Chorale (1) May be repeated.

599 Accompanying (1) May be repeated.

Music History

GRADUATE COURSES

410 Music History Genre (3) Topics vary. May be repeated. Maximum 6 hrs.

420 History of Opera (3) Dramatic, vocal, and orchestral elements in opera of Italian, French, and German schools, 1650-present.

430 Symphonic Literature (3) Literature for orchestra. From Baroque to present, evolution of symphony.

440 Music of North America (3) Folk and art music of U.S. and Canada from colonial times to present.

450 Composer Seminar (3) Life and works of single composer. Subjects vary.

460 Music Aesthetics (3) Nature of music and musical experience, sense perception and emotions, music, and role of artist in society. Aesthetic viewpoint of individuals and historical eras through selected writings.

480 Music in Christian Worship (3) Hymnody, liturgies, and liturgical music.

490 Church Music Methods and Administration (3)

510 Music Bibliography (2) Bibliographic methodology in music.

520 Music Research (1) Principles of research methodology applied to writing of research proposal and project.

530 Music in the Middle Ages (3) Gregorian and medieval chant, secular monophony, and rise of polyphony.

540 Music in the Renaissance (3) From 1400 to 1600. Mass, motet, chaconnes, madrigal, and other vocal and instrumental forms and genres.

550 Music in the Baroque Period (3) From c. 1600 to 1750; rise of opera and oratorio, sacred and secular cantatas, instrumental forms, performance practice.

560 Music in the Classic Period (3) Evolution of classical style from pre-classic music to music of Haydn, Mozart, and early Beethoven.

570 Music in the Romantic Period (3) Nineteenth-century musical styles from Beethoven to post-romantics.

580 Music in the Twentieth Century (3) From 1890, Debussy, to present, Stockhausen and others.

590 World Music (3) Attitudes and techniques of ethnomusicology. Survey of world music cultures. Interview and transcription projects.

593 Independent Study (1-15) See page 32. Prereq: Consent of department head.

Music Instrumental

GRADUATE COURSES

490 Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of different styles to conductor's art; musical analysis and practice in conducting. Prereq: Music Education 320 or equivalent.

570 Advanced Suzuki Pedagogy (2) Study of pedagogy, procedures and literature utilized by Shinichi Suzuki in Japan. Prereq: 495 or consent of instructor. May be repeated. Maximum 4 hrs.

580 Band Literature (3) Band literature and origins of band, its important expanded cultivation during past century in United States and Europe.

582 Instrumental Conducting Performance (1) Jury performance; conducting band or orchestra in public.

583 Practicum for instrumental Conductors (1) Intern experience in choral music. S/NC only.

584 Practicum for instrumental Conductors (1) Intern experience in field other than area of major interest. S/NC only.

595 Instrumental Conducting Seminar (3) Rehearsal and performance problems and techniques allied to score reading and preparation. Particular attention to individual problems. Prereq: 490 or equivalent.

Music Jazz

GRADUATE COURSES

410 Advanced Improvisation (3) Further development of individual skills and solving individual problems in jazz improvisation. Prereq: 210 and 220.

420 Jazz Pedagogy (1) Methods and materials relating to teaching of jazz, designing and administering jazz programs, and rehearsal techniques for jazz ensembles. Prereq: Studio music and jazz major or consent of instructor.

520 Seminar in Jazz (3) Topics vary.

Music Keyboard

GRADUATE COURSES

420-30 Piano Literature I, II (3, 3) 420--From 1750 to middle 19th century; 430--Middle 19th century to present.

460-70 The Organ and Its Literature I, II (3, 3) Development of organ and organ literature from Middle Ages to present; problems of style and interpretation; pedagogical literature and methods; organ design. Prereq or coreq: Music History 220 and consent of instructor.

485-95 Suzuki Piano Method I, II (2, 2) Psychology, procedures, and literature of Suzuki piano method. Must be taken in sequence. Prereq: Consent of instructor.

520 Piano Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hrs.

531-41 Recital Project (2, 2) Preparation and accomplishment of full recital for accompanying concentration only. 531--Vocal recital, 541--Instrumental recital. Prereq: Consent of instructor.

540-50 Advanced Piano Pedagogy I, II (2, 2) 540--Evaluation and study of methods and materials for teaching piano at all levels. Supervised laboratory teaching. Prereq: 440, 450, or consent of instructor. 550--Introduction and principles of Kodaly, Orff, Suzuki, Dalcroze Eurhythmic, and class piano teaching. Prereq: 440, 450 or consent of instructor.

560 Organ Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hrs.

Music Performance

GRADUATE COURSES

All performance courses require an audition and consent of instructor. May be repeated. Maximum 8 hrs toward M.M. degree.
403 Flute (1-4)
405 Oboe (1-4)
410 Bassoon (1-4)
415 Clarinet (1-4)
420 Saxophone (1-4)
425 Horn (1-4)
430 Trumpet (1-4)
435 Trombone (1-4)
440 Baritone (1-4)
445 Tuba (1-4)
450 Percussion (1-4)
455 Voice (1-4)
460 Violin (1-4)
465 Viola (1-4)
470 Cello (1-4)
475 String Bass (1-4)
476 Electric Bass (1-4)
478 Guitar (1-4)
480 Piano (1-4)
485 Harpsichord (1-4)
490 Organ (1-4)
494 Composition (1-3)
495 Composition with Electronic Media (1-3)
496 Composition for Media (2)
499 Improvisation (1-2) May not be used toward applied music requirement.
503 Flute (1-4)
505 Oboe (1-4)
510 Bassoon (1-4)
515 Clarinet (1-4)
520 Saxophone (1-4)
525 Horn (1-4)
530 Trumpet (1-4)
535 Trombone (1-4)
540 Baritone (1-4)
545 Tuba (1-4)
550 Percussion (1-4)
551 Accompanying and Coaching (1-4)
555 Voice (1-4)
560 Violin (1-4)
565 Viola (1-4)
570 Cello (1-4)
575 String Bass (1-4)
576 Electric Bass (1-4)
579 Guitar (1-4)
580 Piano (1-4)
585 Harpsichord (1-4)
590 Organ (1-4)
594 Composition (1-3)
595 Composition with Electronic Media (1-3)
599 Improvisation (1-4)

**Music Theory**

**GRADUATE COURSES**

430-40 Counterpoint I, II (3,3) 430--Study of species counterpoint in modal and tonal styles, works of Palestinia and J.S. Bach. Prereq: 220. 440--Writing of contrapuntal forms of 18th century and fugue; analysis of works from 18th through 20th centuries. Prereq: 430.

450 Choral Arranging (2) Analysis of scores and writing of arrangements for choruses. Prereq: Theory IV or consent of instructor.

**Music Voice**

**GRADUATE COURSES**

510 Vocal Literature Seminar (3) Topics vary. May be repeated. Maximum 6 hrs.

520 Music Theatre Performance Techniques (1) Improvisation, movement, and basic techniques for dramatic vocal performance. Prereq: Vocal major or consent of instructor. May be repeated for credit. Maximum 2 hours.

530 Opera Performance (2) Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.

540 Opera Production (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

550-60 Advanced Vocal Pedagogy, I, II (2,2) 550--Study of vocal production, examination of different methods. 560--Study of teaching materials. Prereq: Consent of instructor.

570 Vocal Chamber Music Performance (2) Prereq: Consent of instructor.

580-85 Choral Literature, I, II (2,2) 580--Choral music from middle ages to present with consideration of historical development of major choral genres. 585--Choral music from middle ages to present with consideration of historical development of major choral genres.

590 Advanced Choral Conducting (3) Expansions and continued refinement of conducting technique; development of choral rehearsal skills. Prereq: Consent of instructor.

594 Project in Choral Conducting Performance (1-3) Public performance, critical document; recording project. Prereq: Consent of instructor. May be repeated.

595 Choral Conducting Seminar (3) Score reading and preparation; problems of interpretation, performance practices, and conducting techniques. Prereq: 590 or consent of instructor. May be repeated.

**Nuclear Engineering**

(430-40 Counterpoint I, II (3,3) 430--Study of species counterpoint in modal and tonal styles, works of Palestinia

**MAJOR DEGREES**

Nuclear Engineering ...................... M.S., Ph.D.

Thomas W. Kerlin, Head

Professors:

Dodds, H. L., PE, Ph.D. ............... Tennessee
Kerlin, T. W. (Liaison), Ph.D. .......... Tennessee
Mihalco, J. T., Ph.D. ................. Tennessee
Miller, L. F., PE, Ph.D. ........ Texas A&M
Perez, R. B., Ph.D. ................. Madrid
Stevens, P. N., PE, Ph.D. ........ Northwestern
Uhrig, R. E. (Distinguished Prof.), PE, Ph.D. ........ Iowa
Upadhyaya, B. R., Ph.D. .......... California

Associate Professors:

Groer, P. G., Ph.D. ..................... Vienna
Katz, E. M., PE, Ph.D. ............... Tennessee
Scott, T. H., PE, Ph.D. .............. Florida

Assistant Professor:

Ruggles, A. E., Ph.D. ............... Rensselaer

The Department of Nuclear Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees. Students may elect a traditional nuclear engineering M.S. or Ph.D. program (focusing on fission energy or fusion energy) or a radiation protection engineering concentration at the Master's level.

The radiation protection engineering concentration prepares students for careers in the radiation safety field (health physics). The program is designed for graduates of undergraduate programs in engineering, physics, biology and chemistry.

**THE MASTER'S PROGRAM**

A graduate program leading to the Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before he/she enters the program.

The student must complete 24 semester hours of coursework approved by the student's advisory committee that includes the following:

1. A major consisting of a minimum of 12 semester hours of graduate courses in nuclear engineering. This must include at least one of the following two-semester sequences: 511, 512; 551, 552; 563, 564; 571, 572.

2. A minor of 6 semester hours of elective courses in mathematics, statistics or computer science.

3. Six semester hours in either nuclear engineering or a related field. The M.S. candidate must also demonstrate research or design capability. This requirement may be satisfied by a thesis project or engineering practice projects as described below:

**Thesis** - The student performs independent research on a topic approved by the graduate committee. He/she submits a thesis on this research. The student must pass an oral examination on the thesis and all graduate coursework. The student must enroll for six semester hours of NE 500 (Thesis).

**Engineering Practice** - The student performs independent research on two to four separate topics approved by his/her graduate committee. Each project is similar to a thesis project but smaller in scope. The student performs independent research on a topic approved by the graduate committee. He/she submits a report, in thesis format, on each project. The student must then pass an oral examination on his/her engineering practice reports and all graduate coursework. The student must enroll for six semester hours of NE 598 (Nuclear Engineering Practice).
THE DOCTORAL PROGRAM

Students in the field of nuclear engineering desiring to study for the Doctor of Philosophy must have a Bachelor of Science or Master of Science from a recognized university, with a major in engineering or physics. All candidates will be required to demonstrate general competence in a comprehensive examination in the areas of engineering science, mathematics, physics, and nuclear engineering.

Specific course requirements for the Ph.D. in Nuclear Engineering include:

1. A minimum of 48 semester hours beyond the Bachelor's degree, exclusive of credit for the M. thesis or Nuclear Engineering Practice.
2. A minimum of 24 semester hours in doctoral research.
3. A minimum of 30 semester hours in nuclear engineering courses numbered 500 and above (or the equivalent), with at least 9 semester hours of 600-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 12 semester hours in mathematics, computer science, or statistics courses beyond nuclear engineering undergraduate requirements numbered 400 or above.
5. A minimum of 6 semester hours in courses numbered 500 and above from a department other than nuclear engineering. The choice depends on the student's overall program and should expand his/her knowledge in a given field.
6. A reading knowledge of one foreign language may be specified by the student's doctoral committee.

The comprehensive examination is prepared by the nuclear engineering faculty and consists of 12 hours of written examinations. All past examinations are filed in the library, and students are encouraged to review them. Students are invited to take the comprehensive examination after completing approximately 30 semester hours of coursework. A student who fails the written part of the examination must take and pass the examination the next time it is offered to remain in the Ph.D. program. Registration for NE 600 is not permitted until the written examination is passed. The comprehensive examination is completed with a successful oral defense of the dissertation proposal. A candidate must successfully defend, in an oral examination, all work presented for the degree—all coursework and the dissertation.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Nuclear Engineering is available to residents of the states of Alabama, Kentucky, Mississippi, or South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

400-level courses in nuclear engineering may be used for graduate credit. However, students must recognize that at least two-thirds of the minimum required hours (30) in a Master's degree program must be taken in courses numbered 500 or above.

GRADUATE COURSES

403 Nuclear Engineering Laboratory (3) Cross-section measurement, diffusion properties of neutrons, critical loading experiment, control rod calibration, statistical weight, shielding, xenon poisoning, dynamics and control of experiments. Prereq: Nuclear Engineering Laboratory or equivalent. Coreq: 471, 405.

404 Nuclear Fuel Management (3) Variety of topics relative to nuclear fuel cycle. Mining and milling, fuel fabrication, in-core fuel management, reprocessing and waste disposal. Economic and regulatory issues. Prereq: 470.


406 Radiation Shielding (3) Types of radiation sources, fundamentals of gamma ray and neutron attenuation, biological effects, approximate methods of shield design, discrete ordinates, and Monte Carlo. Prereq: Physics 232.

421 Introduction to Nuclear Criticality Safety (3) Fundamentals of nuclear criticality safety; criticality accident; safety standards; overview of experiments, computational methods, and applications. Prereq: Introduction to Nuclear Engineering.

463 Introduction to Fusion Energy I (3) (Same as Electrical and Computer Engineering 463.)

464 Introduction to Fusion Energy II (3) (Same as Electrical and Computer Engineering 464.)

470 Nuclear Reactor Theory I (3) Fundamentals of reactor physics relative to core sections, kinematics of elastic scattering, reactor kinetics, reactor systems and nuclear data. Analytical and numerical methods applicable to general criticality problems, eigenvalue searches, perturbation theory, boundary group diffusion equations. Prereq: Introduction to Nuclear Engineering.

471 Nuclear Reactor Theory II (3) Thermal spectrum computational methods: heterogeneous effects in fast and thermal spectra; considerations in reactor core design; equations that relate thermal and neutron variables; power distribution calculations and reactivity control methods. Prereq: 470.

494 Special Topics in Nuclear Engineering (3) Problems related to recent developments and practice. Prereq: Senior standing or consent of instructor. May be repeated. Maximum 6 hrs.

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

502 Registration for Use of Facilities (3-15) Required project. Prereq: 571 or consent of instructor.

505 Management of Radioactive Materials (3) Techniques for enrichment, fabrication, storage, reprocessing, and waste disposal. Economic and regulatory issues. Prereq: 571 or consent of instructor. (Same as Engineering Science and Mechanics 576.)

511-12 Transport Processes in Nuclear Engineering (3,3) Rheology of Newtonian and non-Newtonian fluids; integral and system conservation equations for single- and multi-component fluids, in-depth development of differential conservation equations for mass, energy, entropy, and momentum; exact and approximate solutions of conservation, projection and boundary layer analysis; numerical analysis of friction and heat transfer.

521 Nuclear Systems Dynamics and Control (3) Introduction to state variable methods for system dynamics and control analysis and application of these methods to nuclear plant dynamics, simulation and control problems.


541 Reactor Fuel Management (3) Topics related to in-core fuel management. Applicable topics in reactor physics, fuel depletion, isotopic inventories, reactor control analysis and numerical methods. Prereq: 491.


543 Selected Topics in Nuclear Criticality Safety (3) Criticality safety computational and experimental methods: irradiation fabrication, reprocessing, and transport applications; overview of safety practices and regulatory requirements. Prereq: 421 or consent of instructor.

550 Nuclear Instrumentation (3) Physics and electronics associated with radiation detection, methods of data analysis, applicability of particular instrument measurements and fundamentals of nuclear instrumentation operation.

551 Radiation Protection (3) Interactions of photons, neutrons, and charged particles, surfaces, applications of matter and mechanisms of energy loss; methods of radiation detection, internal and external radiation dosimetry; chemical and biological effects of radiation; regulation and standards. Prereq: Nuclear Engineering and Differential Equations I or equivalents.

552 Radiation Monitoring and Dose Assessment (3) Methods for work-area and environmental monitoring; dose assessment; pathways analysis; risk projections and regulations. Prereq: 551.

561 Plasma Diagnostics I (3) (Same as Electrical and Computer Engineering 561.)

562 Plasma Diagnostics II (3) (Same as Electrical and Computer Engineering 562.)

563 Plasma Engineering (3) Integration of plasma physics models, fusion engineering design criteria, and fusion technology into design of future plasma experiments and reactors. Particle, momentum, and energy balance equations. Simulation of various fusion reactor plasmas. Prereq: 464 or consent of instructor. (Same as Electrical and Computer Engineering 564.)

564 Fusion Technology (3) Engineering problems associated with fusion reactor design; vacuum and magnetic systems; materials and irradiation; plasma heating, fueling and impurity control; review of major design studies. Prereq: 563. (Same as Electrical and Computer Engineering 564.)


572 Nuclear System Design (3) Design and analysis of a nuclear system, interface with non-nuclear aspects of system design: system reliability and economics; class project. Prereq: 571 or consent of instructor.

573 Applied Artificial Intelligence (3) Symbolic methods for artificial intelligence and their application to engineering problems. Prereq: Consent of instructor. (Same as Engineering Science and Mechanics 573.)

575 Expert Systems in Engineering (3) Application of expert systems in engineering: logic and rationale, developing expert systems, programming, advanced topics. Prereq: 575 or consent of instructor. (Same as Engineering Science and Mechanics 575.)

577 Neural Networks in Engineering (3) Neural network technology for use in intelligent systems; rationale for neural computing, structure of neural computing systems, programming. Prereq: Consent of instructor. (Same as Engineering Science and Mechanics 577.)

581 Reactor Shielding (3) Application of analytic/deterministic solutions of Boltzmann transport equation to shield design problems. Spherical harmonics, moments method, discrete ordinates, adjoint calculations, coupled analysis, and fast reactor shield design. Prereq: 405 or equivalent.


585 Process System Reliability and Safety (3) Qualitative and quantitative methods: system reliability and safety, Fault tree analysis and associated dependent failure analysis. (Same as Chemical Engineering 585.)

586 Measurement Science I (3) Principles of measurement, introduction to measuring devices. Prereq:
Nursing

(College of Nursing)

MAJOR

Nursing .................. M.S.N., Ph.D.

Joan E. Uhl, Dean
Mildred M. Fenske, Associate Dean and Director of M.S.N. Program
Sandra Thomas, Director of Ph.D. Program

Professors:
Allgood, Martha R., Ph.D. New York
Goodfellow, Dale H., Ph.D. Peabody
Mozingo, Johnie N., Ph.D. Walden
Thomas, Sandra P., Ph.D. Tennessee
Uhl, Joan, Ph.D. Utah

Associate Professors:
Davis, Mitzi M., Ph.D. Tennessee
Droppleman, Patricia G., Ph.D. Tennessee
Fenske, Mildred M. (Liaison), Ph.D. Vanderbilt
Jolly, Mary Lue, Ed.D. Kentucky
McGuire, Sandra, Ed.D. Tennessee
Overton, Helen, Ph.D. Maryland
Sharp, Theresa G., Ed.D. Tennessee
Shoffner, Dava, Ph.D. Tennessee
Tuck, Inez, Ph.D. North Carolina (Greensboro)

Assistant Professors:
Bowen, Sheila, Ph.D. Tennessee
Kollar, Mary, Ph.D. Tennessee
Witherington, Carol, Ph.D. Tennessee

THE MASTER’S PROGRAM

The College of Nursing offers the Master of Science in Nursing degree with concentrations in adult health nursing, parent-child nursing, mental health nursing, family nurse practitioner, and nursing administration.

Admission Requirements

1. Meet requirements for admission to The Graduate School.
2. Hold a Bachelor’s degree in Nursing or complete the equivalent of an upper division undergraduate major in nursing in addition to meeting all M.S.N. degree requirements.
3. Have an undergraduate GPA of 3.0 or higher or a GPA of 3.0 for courses in the undergraduate major.
4. Complete the General portion of the Graduate Record Examination. NOTE: A strong performance on this examination may compensate for a GPA lower than 3.0.
5. Complete Graduate Program Data Form.
6. Submit three Graduate School Rating Forms from individuals familiar with the applicant’s current work performance or academic aptitude.

Special Requirements

1. Each student must hold professional liability insurance.
2. Registered nurses must be licensed to practice nursing in Tennessee.
3. Non-registered nurse students must have completed 8 semester hours of chemistry or microbiology and anatomy and physiology course, and 12 semester hours of behavioral science courses.

Thesis and Non-Thesis Options

1. Those who already hold a Master's or doctoral degree may apply up to 6 semester hours from that degree to meeting MSN program requirements. To apply these hours to MSN, the courses used must be relevant to the program requirements. To apply these hours to MSN, the courses used must be relevant to the program requirements.
2. If a student achieves a final grade of “D” or “F” for any required undergraduate nursing course, he or she will not be permitted to repeat the course and will be required to withdraw from the program.
3. If the clinical performance of any student is characterized by unethical, unprofessional or unsafe behavior, or behavior that places the client in jeopardy, the student will be required to withdraw from the program.

Requirements for Second Master’s Degree

1. Those who already hold a Master’s or doctoral degree may apply up to 6 semester hours from that degree to meeting MSN program requirements. To apply these hours to the MSN degree, the following criteria must be met:
a. The courses used must be relevant to the MSN.
Admission Requirements
disciplines in health-related research of mutual
educators, and/or administrators in current and
scholars capable of integrating research, theory,
University of Tennessee, Memphis College of
degree with a major in Nursing. This is a
601-2 Theory Construction & Analysis I, II
GRADUATE COURSES
605-6 Nursing Research Seminar
600 Dissertation
Core 12
Concentration 12
Research 6
THE DOCTORAL PROGRAM
The College of Nursing offers a doctoral program leading to the Doctor of Philosophy degree with a major in Nursing. This is a cooperative program offered jointly with The University of Tennessee, Memphis College of Nursing. Students may complete all or part of the program at either site. The dissertation must be completed in its entirety at one site.

The doctoral program prepares nursing scholars capable of generating new research, theory, and practice into their roles as researchers, educators, and/or administrators. Specifically, the graduate of this program should be able to:

1. Analyze, test, refine, extend, and expand the theoretical basis of nursing practice.
2. Conduct nursing research that generates and advances nursing as a discipline.
3. Provide leadership as nurse researchers, educators, and/or administrators in current and emerging health care settings.
4. Collaborate with members of other disciplines in health-related research of mutual concern.
5. Analyze, develop, and recommend health care policy at various levels.

Admission Requirements
1. Meet requirements for admission to The Graduate School.
2. Hold a Master's degree in nursing from a program accredited by the National League for Nursing.
3. Have a minimum cumulative grade-point average of 3.3 on a 4.0 scale.
4. Have a cumulative score of at least 1000 on the verbal and quantitative sections of the GRE.
5. Participate in three college level instructors and/or professor or above, four of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. Two of the faculty members must be from an academic unit other than nursing. The committee should be formed under the chair's first year of doctoral study.

MINOR IN GERONTOLOGY
Graduate students in the College of Nursing may pursue a specialized minor in gerontology. This interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to the Office of Graduate Admissions for specific requirements.

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some persons to complete certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Nursing is available to residents of the states of Alabama or Arkansas. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES
500 Thesis (1-15) P/NP only. E
501 Nursing Research: Methods, Design, and Analysis (3) Methodology, design, and data analysis issues and their interrelationships in planning, implementation, and evaluation of nursing and health-related research. Investigations of computer applications to data analysis. Prereq or coreq: Graduate level statistics course. 510. F, S, Sp, Su
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
503 Holistic Nursing: Wellness (3) Examination of philosophy of holistic nursing and major paradigms for nursing assessment, diagnosis, and intervention. Exploration and application of principles of health promotion, education, and innovative strategies for achievement of wellness. Roles of health habits, genetic, psychological factors, and culture in lifestyle diseases. F
504 Holistic Nursing: Illness (3) Exploration, analysis, and application of principles of holistic nursing of clients with acute and chronic physiological disease; mind-body influences and interactions. Prereq: Nursing Assessment and Wellness Promotion and Physiological Principles or equivalents. Prereq or coreq: 503. F
505 Advanced Clinical Pharmacology (3) Pharmacological agents utilized to treat common, recurrent health problems; indications, contraindications, side and interactive effects of commonly prescribed drugs. Prereq: 301 or equivalent or consent of instructor. F
509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 509, Physical Education 509 and Social Work 509.)
510 Theoretical Foundations of Nursing (3) Historical evolution of nursing science; examination and critical analysis of nursing's metaparadigm and selected conceptual models, philosophies, and theories; contemporary ethical theories and application to nursing practice dilemmas. F, Sp, Su
520 Nursing Resource Management (3) Selected organizational, conflict management, decision-making, leadership, professional, technological, and other theories, principles, and concepts applicable to advanced clinical nursing practice. Prereq or coreq: 503. F, Sp
530 Adult Health Nursing I (6) Exploration and application of advanced nursing physiological, and psychosocial theories to nursing care and management of clients and their families who are experiencing episodes of acute and chronic illnesses and related crises; role of clinical nurse specialist in helping clients and families achieve optimal wellness. Prereq: 504. Prereq or coreq: 501, 520. 2 hrs and 4 labs. Sp
531 Adult Health Nursing II (6) Further emphasis on role of clinical nurse specialist in providing and managing nursing care for acutely and chronically ill adults across life span; exploration, application, and analysis of selected advanced management, supervisory, organizational, and leadership theories and techniques to health-related concepts and research to implementation of clinical nurse specialist role. Prereq: 530. 2 hrs and 4 labs. F
533 Directed Study in Technical Nursing Education (3) Philosophy, history and contemporary issues in technical nursing and nursing education; teaching strategies for adult learner in community college, design and evaluation of selected topics. Prereq: Graduate student or consent of instructor. Su
540 Family Nurse Practitioner I (6) Exploration and application of holistic nursing theories to nursing management of common health problems of individuals and their families; opportunities for clinical practice in role of nurse practitioner in variety of settings. Prereq: 504. Prereq or coreq: 501, 520. 2 hrs and 4 labs. Sp
541 Family Nurse Practitioner II (6) Continuation of 540. Seminar and clinical practicum: management of chronic health problems in all developmental life settings; role refinement and exploration of major issues in delivery of holistic primary nursing care; clinical experiences in variety of settings. Prereq: 540. 2 hrs and 4 labs. F
550 Parent Child Nursing (16) Exploration and application of interdisciplinary, advanced parent-child nursing, psychological, developmental, environmental, cultural, and other theories, principles, and concepts to child-bearing or child-bearing families in acute care or community settings; family wellness promotion and interventions designed to recognize and respond to threats to wellness of mothers, neonates, children, and adolescents. Prereq: 504. Prereq or coreq: 501, 520. 2 hrs and 4 labs. Sp
551 Parent Child Nursing II (6) Continuation of 550. Seminar and clinical practicum designed to facilitate further development of specialized knowledge and skills used for advanced practice. Role refinement of clinical nurse specialist in nursing management of women and/or child-bearing or child-bearing families in community, hospital, or other health care setting. Prereq: 550. 2 hrs and 4 labs. Sp
552 Parent Child Nursing Field Work and Seminar (5) Seminar and intensive clinical practicum designed to facilitate further development of specialized knowledge and skills utilized for advanced practice. Role refinement of clinical nurse specialist in nursing intervention for pregnant and parenting women and/or child-bearing or child-bearing families in community, hospital, or other health care setting. Prereq: 550. 2 hrs and 4 labs. Sp
560 Mental Health Nursing I (6) Exploration and application of advanced theories of therapeutic nurse-patient intervention to clients experiencing mental health problems. Options for clinical practice with clients of various age groups in acute care or community facilities. Prereq: 504. Prereq or coreq: 501, 520. 2 hrs and 4 labs. Sp
561 Mental Health Nursing II (6) Continuation of 560. Groups and families with mental health problems. Seminar and clinical practicum designed to focus on ad-
583 Directed Clinical Practice (1-9) Additional opportunities. Prereq: Consent of instructor. May be repeated. Considerations and research methodologies in nursing reflect synthesis or comprehensive analysis, or other project results may be suitable for publication and/or presentation; project may be an initial endeavor that culminates in scholarly paper presentation.

581 Directed Research (3) Exploration of theoretical and applied principles and theories as applied to instruction of undergraduate nursing students, staff development, and patient education. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F, Sp.

577 Special Topics (1-3) Topic is determined by faculty teaching experience in collegiate nursing program or graduate nursing students, staff development, and patient education. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F, Sp.

580 Nursing Project (3) Research-oriented, student-initiated endeavor that culminates in a scholarly paper suitable for publication and/or presentation; project may take the form of a creative project or an individual endeavor targeted at the synthesis or comprehensive analysis of a problem in nursing.

582 Directed Clinical Practice (1-9) Additional opportunities for advanced nursing practice. Objectives to be developed collaboratively by student and faculty. Prereq: Enrollment in or completion of graduate level courses in clinical nursing. Maximum 9 hrs. S/NC or letter grade. E


593 Independent Study (1-3) Prereq: Consent of instructor. May be repeated. Maximum 8 hrs. F, Sp.

600 Doctoral Research and Dissertation (3-15) F/NC only. E


605-06 Nursing Research Seminar I, II (2, 2) Selected topics pertaining to dissertation proposal process, research experience, and defense. Prereq: Completion of core courses. F, Sp.

607 Qualitative Nursing Research (3) Exploration and analysis of philosophical bases, theoretical implications, methodologies, and data analyses of qualitative nursing research. F

608 Quantitative Nursing Research (3) Exploration and analysis of philosophical bases, theoretical implications, methods, and data analyses of quantitative research. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. S/NC or letter grade. E

610 Nursing Science Seminar (2) Critical Analysis and synthesis of literature in selected focus area within nursing science. Prereq: Admission to doctoral program in nursing or consent of instructor. F

511 Advanced Nursing Seminar (2) Exploration of historical and current issues of interest to doctorally prepared nurse. Sp

512 Health and Nursing Policy/Planning (3) Policies affecting nursing education and practice; health policies and political processes; interactions between health professionals, consumer groups, and government in health policy development and health planning activities. F

513 Nursing Management of Complex Systems (3) Contemporary organizational and management theories and techniques needed for effective leadership in nursing education, practice, research, and entrepreneurial settings. F

514 Nursing Preceptorship (3) Individually-designed preceptorship, field, or internship experiences in variety of administrative, educational, research, or clinical practice settings. Prereq: 581, 601, 602, 607, 608, 611. Sp

Nutrition
(College of Human Ecology)

MAJORS

DEGREES

Nutrition ........................................ M.S.
Foodservice and Lodging Administration ........................................ M.S.
Human Ecology ........................................ Ph.D.

Michael B. Zemel, Head

Professors:

Beauchene, Roy E. (Emeritus), Ph.D. ........................................ Kansas State
Carruth, Betty Ruth, Ph.D. ........................................ Missouri
Quinton, H. W., Ed.D. ........................................ Duke
Sachan, Dileep S., Ph.D. ........................................ Illinois
Smith, John T. (Emeritus), Ph.D. ........................................ Missouri
Zemel, Michael (Liaison), Ph.D. ........................................ Wisconsin

Associate Professors:

Allam, Youssri, Ph.D. ........................................ Tennessee
Brooks, M. D. (Memphis), M.S. ........................................ Alabama
Haughton, B., Ed.D. ........................................ Columbia
Karlstad, M. P. D. ........................................ Loyola
Nayem, T., M.D. ........................................ Washington (St. Louis)
Skinner, Jean D., Ph.D. ........................................ Oregon State
Stevens, Pete, Ph.D. ........................................ Michigan State

Assistant Professors:

Bailey, James W., Ph.D. ........................................ Iowa State
Chencharick, Janet (Memphis), M.S. ........................................ Maryland
Costello, Carol, Ph.D. ........................................ Tennessee
McGrath, M. (Liaison), M.S. ........................................ Purdue
Powell, J. A. (Memphis), M.P.H. ........................................ North Carolina
Whelan, Jay, Ph.D. ........................................ Penn State
Zemel, Paula, Ph.D. ........................................ Wayne State

Instructor:

Jones, K., MBA ........................................ East Texas State

Master of Science programs are available in Nutrition and in Foodservice and Lodging Administration. Within the Nutrition program, a student may choose a concentration in nutrition science or public health nutrition. A graduate degree combined with an approved pre-professional practice experience (AP4) beyond the baccalaureate degree qualifies the graduate to apply for the Registration Examination to become a Registered Dietitian (R.D.). Students may request more information from the department about the AP4 program. Students may also select an interdisciplinary minor in gerontology.

ADMISSION REQUIREMENTS

A final file for review includes the Graduate School application file, completed departmental application form, Graduate Record Examination (GRE) scores for the general section, and three Graduate School Rating Forms completed by individuals who can attest to the applicant's potential for graduate education. Forms may be obtained from the Graduate Office, University of Tennessee, Knoxville, 37996-1900.

Admission into any of the graduate programs in the department is dependent on completion of undergraduate courses that give the necessary background for success in the graduate program. For programs in Nutrition, essential undergraduate courses include: general and organic chemistry, physiological chemistry, physiology, statistics and advanced nutrition. For the Master's program in Foodservice and Lodging Administration, undergraduate courses in foodservice and lodging administration, quantity food production, cost control, marketing, and personnel development are essential. Applicants to all programs with related work experience may be given preference.

THE MASTER'S PROGRAM

Students may choose a thesis or non-thesis option in Nutrition or Foodservice and Lodging Administration. Attendance at HRA 537 (Foodservice and Lodging Administration) or NTR 540 (Nutrition) is required every semester.

Nutrition
Thesis Option: The program consists of a minimum of 33 hours with at least 18 hours of coursework in the department. NTR 511, 512, 540, 541 and 3 hours of graduate level statistics are required. Students in public health nutrition must take 511, 512, 513, 514, 515, and 541 and the minor in public health. Six hours of Thesis 500, and 8 hours outside the department are required. A minimum of 22 hours at the 500 or 600 level is required.

An oral comprehensive examination is required upon completion of the thesis.

Non-Thesis Option: The program consists of a minimum of 36 hours with at least 20 hours of coursework in the department. NTR 511, 512, 540, 541, 2 hours from 542-544 and 3 hours of graduate level statistics are required. Students in public health nutrition must take 511, 512, 513, 514, 515, and the minor in public health. Six hours in one area outside the department are required. A minimum of 24 hours at the 500 and 600 level is required.

A written comprehensive examination is required for completion of the program.

Foodservice and Lodging Administration
Thesis Option: The program consists of a minimum of 33 hours with at least 16 hours of coursework in the department. HRA 537, 546, NTR 541, and 3 hours of graduate-level statistics are required. Six hours of Thesis 500 are required. Six hours outside the department are recommended. A minimum of 22 hours at the 500 and 600 level is required.

An oral comprehensive examination is required upon completion of the thesis.

Non-Thesis Option: The program consists of a minimum of 36 hours with at least 20 hours of coursework in the department. HRA 537, 546,
NTR 541 and 3 hours of graduate-level statistics are required. Six hours in one area outside the department are required. A minimum of 24 hours at the 500 and 600 level is required.

A written comprehensive examination is required for completion of the program.

THE PH.D. CONCENTRATIONS

Nutrition Science

The nutrition science concentration enables students to study the science of nutrition from the cellular level to the application of nutritional principles by people in a changing environment. The doctoral program emphasizes human nutrition, nutritional epidemiology, experimental nutrition, and intermediary metabolism. Cognate areas may include anthropology, biochemistry, chemistry, communications, education, food technology, human development, physiology, public health, sociology, statistics, and/or toxicology.

Minimum requirements include:
1. Sixteen hours including 4 hours at the 600 level (exclusive of dissertation);
2. NTR 511, 512, 541, and 2 hours from either 542-544;
3. Four hours of NTR 540, attendance required every semester;
4. Professional seminar, HE 610;
5. Six hours of statistics;
6. Six hours in a cognate area;
7. Nine hours at the 600 level;
8. Students without college teaching experience are required to take the fall semester teaching seminar for GTAs and NTR 548 comprising a faculty-supervised problem in college teaching.

Consumer Environments

Students enrolled in the Ph.D. program with a concentration in consumer environments are provided with a foundation of coursework relevant to understanding the consumer in the designed environment and management of facilities. From this base, students in food-service and lodging administration focus on areas of specialization in foodservice systems and in lodging administration to further theory and the application of theory in the field. For further information on consumer environments, concentration under Human Ecology.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Foodservice and Lodging Administration is available to residents of the states of Arkansas, Kentucky, South Carolina, or West Virginia. The M.S. program in Nutrition is available to residents of Arkansas, South Carolina, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records. For the Ph.D., see Human Ecology.

Nutrition

GRADUATE COURSES

413 Experimental Food Science (3) Individual and group laboratory experimentation in food science; microcomputer applications. Prereq: Science of Food, Plant and Soil Science 471. 1 hr and 2 labs. F

414 Nutrient-Drug Interactions (2) Nutrient effects on efficacy and toxicity of drugs; drug effects on absorption and metabolism of nutrients. Prereq: Fundamentals of Nutrition or equivalent. Sp, A

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

508 Culture, Food, and Nutrition (3) Food-related behavior of individuals and groups in United States. Sociocultural, economic, and technological influences. Nutrition and food surveys, public policy. Prereq: Nutrition for Educators or Advanced Nutrition or consent of instructor. F, A

509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nursing 509, Physical Education 509 and Social Work 509.)

511 Advanced Physiological Chemistry (4) Bioenergetics, flux control and hormonal interrelationships. Prereq: Advanced Nutrition or equivalent. F


513 Community Nutrition I (3) Orientation to community; assessment of nutrition problems, needs, and resources; functional roles of public health nutritionist. Concurrent field experiences. Prereq: Advanced Nutrition or consent of instructor. F

514 Community Nutrition II (3) Planning, implementation, and evaluation of public health nutrition programs. Concurrent field experiences. Prereq: 513 or consent of instructor. Sp

515 Field Study in Community Nutrition (1-12) Personal participation in and evaluation of state or regional community nutrition programs. Location of in-depth study to be selected in consultation with instructor. Prereq: 513, 514 and consent of instructor. S/NC only. Su

516 Maternal and Child Nutrition (3) Nutrition principles related to growth and development during pregnancy, infancy, and childhood to age 5; high risk conditions; Prereq: Advanced Nutrition or consent of instructor. F

517 Childhood and Adolescent Nutrition (3) Application of nutrition principles to school age children; effects of diseases on growth and health maintenance; nutritional assessment and counseling for nutrition. Prereq: Advanced Nutrition or consent of instructor. Sp, A

518 Nutrition and Aging (3) Nutritional problems of adults; nutritional requirements, dietary intakes; affects of nutrition on biological aging. Prereq: Advanced Nutrition or consent of instructor. Su

520 Nutritional Ecology (2) Examination of issues in natural, political, physical, and social environments that impact availability of food and nutrients in U.S. food supply. F, A

521 Physiological Basis for Diet and Disease (2) Altered nutrient needs as result of metabolic changes that occur in selected disease states. Prereq: Nutrition in Disease or consent of instructor. Sp

522 Nutrition Counseling (2) Individual eating habits and disorders, evaluation strategies for effectiveness of helping process. Prereq: Nutrition in Disease or consent of instructor. F, A

524 Nutrition Education: Principles, Implementation, and Evaluation (3) Conceptual models, principles, application, and evaluation models in nutrition education research. Prereq: 506 or consent of instructor. Su, A

527 Nutrition in Mental Retardation and Developmental Disorders (1-9) Interdisciplinary diagnosis and development of behaviorally-handicapped child; role of nutritionists; clinical experiences and lectures. Child Development Center, UT, Memphis. Prereq: Consent of department head. E

540 Seminar in Nutrition (1) May be repeated. S/NC only. E

541 Research Methods (1) Basic principles of planning, conducting, and interpreting nutrition and foodservice systems administration research. Prereq: 6 graduate hrs in nutrition and food system administration and statistics. Sp

542 Advanced Experimental Nutrition (2) Application of research principles to individual projects using experimental animals. Prereq or coreq: 541. Sp

543 Human Metabolic Research Methods (2) Application of research principles to conducting and interpreting metabolic study. Prereq or coreq: 541. Sp

544 Food and Nutrition Survey Methods (2) Project for assessment of food consumption, nutrient intake, nutritional status, and sociocultural economic parameters in populations. Prereq or coreq: 541. Sp

547 Field Experience (3-9) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of Instructor. S/NC only. E

548 Directed Study in Nutrition (1-3) Advanced study in nutrition. Prereq: Consent of Instructor. May be repeated. Maximum 6 hrs. E

549 Special Topics (1-3) Recent advances in nutrition or food systems administration. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

602 Advanced Topics in Nutrition Science (1-3) Comprehensive individual study and group discussion of topics related to current problems in nutrition. Prereq: 512 or consent of instructor. May be repeated. F

603 Current Trends in Food and Sociocultural Change (2) Critical evaluation of research. Prereq: 508 or consent of instructor. F, A

Hotel and Restaurant Administration

GRADUATE COURSES

421 Foodservice Systems Design and Equipment (3) Physically; design; physical systems analysis; equipment selection and purchase. Prereq: Quantity Food Procurement, Production and Service with lab or consent of instructor. F, A

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

530 Computer-Assisted Foodservice and Lodging Management (3) Application of computer technology to foodservice and lodging industry; inventory, cost accounting, production, nutrient analysis, rooms management, and sales planning and analysis. Prereq: Quantity Food Procurement, Production and Service, Microcomputer Applications or consent of instructor. F, A

531 Advanced Financial Management (3) Financial planning, operations and evaluation techniques used in foodservice and lodging management; development budgeting, accounting systems and financial reports. Prereq: Food and Lodging Cost Control or consent of instructor. F

532 Advanced Human Resource Management (3) Identifying labor needs; development and maintenance of work forces. Prereq: Food and Lodging Personnel Development or consent of instructor. F

533 Advanced Food Production and Delivery Systems Management (3) Analysis of food production and delivery systems; application of quantitative methods and models to optimize decisions. Prereq: Quantity Food Procurement, Production and Service or consent of instructor. F

534 Special Topics in Foodservice and Lodging Administration (1-3) Lecture/discussion format. Contemporary developments and trends in industry. Prereq: Consent of instructor. May be repeated. E

535 Directed Study in Foodservice and Lodging Administration (1-3) Problems selected for study by
student with guidance of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

537 Seminar in Foodservice and Lodging Administration (1) May be repeated. S/NC only. Sp

542 Advanced Hotel Administration (3) Strategic management of hotel organizations. Theoretical and applied literature on formulation and implementation of strategy; external and internal factors relevant for business and corporate level decisions. Consideration of role of marketing in hotel firms. Analysis of industry and case studies. Prereq: 501, 532. E

544 Experimental Study of Quantity Food Production (3) Design and preparation of food products applicable to foodservice industry. Market research, sensory evaluation, production techniques, and microbiological evaluation of food. Prereq: Quantity Food Procurement, Production and Service with lab, or Observation, Hospitality Sales and Marketing, 542 and Nutrition 413, or equivalents. E

546 Foodservice and Lodging Administration Research Methods (2) Application of research methods to foodservice and lodging. Prereq or coreq: Nutrition 541. Sp

547 Field Experience (3-9) Experience in food- or lodging-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. S/A only. E

555 Foodservice and Lodging Law (3) Management organization and policy as imposed or granted by law. Legal research to determine legal principles at state and federal levels which impact industry. Prereq: Hospitality Law or equivalent, or consent of instructor. E

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

610 Advanced Topics in Lodging Administration (1-3) Individual study and group discussion of topics related to current problems. Prereq: 542 or consent of instructor. E

620 Advanced Topics in Foodservice Administration (1-3) Individual study of group discussion of topics related to current problems. Prereq: 533 or consent of instructor. E

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**Ornamental Horticulture and Landscape Design**

( College of Agricultural Sciences and Natural Resources)

**MAJOR**

Ornamental Horticulture and Landscape Design............................................. M.S.

G. Douglas Crater, Head

Professors:

- Callahan, L. M., Ph.D. Rutgers
- Crater, G. Douglas, Ph.D. Ohio State
- Graham, E. T., Ph.D. Penn State
- Gresshoff, Peter M. (Rachelle Chair of Excellence), Ph.D. Australian National
- McDaniel, G. L., Ph.D. Iowa State
- Williams, Don B., Ph.D. Penn State

Associate Professors:

- Augé, Robert M., Ph.D. Washington State
- Day, J. W., Ph.D. Mississippi State
- Rogers, S. M., M.A. Georgia
- Trigiano, R., Ph.D. NC State
- Witte, Willard T. (Liaison), Ph.D. Maryland

Assistant Professor:

- Starnan, Terri W., Ph.D. Texas A&M

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The Department of Ornamental Horticulture and Landscape Design offers the Master of Science with concentrations in floricultural science and technology, nursery science and technology, turfgrass science and technology. Various interests may be emphasized in any of these commodity areas, including micropropagation, innovative production and maintenance systems, computer-aided management systems, and the molecular biology, genetics, histology, and stress physiology of ornamentals.

For admission, the student must have a B.S. in ornamental horticulture, turfgrass science, or a related agricultural or basic science discipline. Undergraduate transcripts must be evaluated by the department for prerequisite requirements, if any. Graduate research assistanships are available on a competitive basis. For further information, contact the department head.

**THE MASTER'S PROGRAM**

**Thesis Option**

1. A thesis is required. A Master's committee of no fewer than 3 faculty members will be selected. Prior to research for the thesis, a proposal must be approved by the Master's committee. Registration for 6 hours of Thesis 500 is required.

2. In addition to the thesis requirement, a minimum of 24 hours of graduate credit is required. Not more than 10 hours of the minimum 30 hours can be below the 500 level. The academic program must be approved by the Master's committee which may require additional course work if the student's progress or background indicates such need.

3. All students are required to include 510 Research Methods and 2 hours of 500 Seminar in their program and are expected to attend this course and participate in discussions each semester enrolled.

4. Twelve hours of coursework in the major must be at the graduate level, exclusive of Thesis 500.

5. An oral examination covering the thesis and coursework is required.

**Non-Thesis Option**

1. A Master's committee of no fewer than 3 faculty members will be selected.

2. Thirty-four hours of graduate coursework are required of which 22 hours must be at the 500 level or above.

3. All students are required to include 2 hours of 590 Seminar in their program and are expected to attend this course and participate in discussions each semester enrolled.

4. Twelve hours of coursework in the major must be at the graduate level.

5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 32 hours of approved graduate work.

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**GRADUATE COURSES**

410 Nursery Management and Production (3) Modern management methods as applied to retail and wholesale nurseries and landscape contracting firms. Methods of producing liners, container and field-grown woody ornamental plants. Prereq: 220, 330, and Plant and Soil Science 210, or consent of instructor. 2 hrs and 1 lab. Sp

440 Advanced Turfgrass Management (4) Principles and scientific basis of turfgrass culture: adaptation, ecology, physiology, soil fertility, and grass nutrition; climatic influences on grass culture; physiology of clipping and water management; design, construction, and management of golf courses; and physiological influences of pest infestation and control measures. Prereq: 340 or consent of instructor. 3 hrs and 1 lab. Sp

451 Plant Tissue Culture (3) (Same as Botany 451.)

460 Professional Practices in Landscape Construction and Management (2) Professionalism, salesmanship, proposals, bidding, estimating, specification, and contract management in landscape services industry. Interaction with industry representatives through special presentations. Prereq: 350 or consent of instructor. F

480 Advanced Landscape Design (4) Comprehensive application of landscape design skills. Design applications involving site layout, landscape grading, applied landscape construction, planting design, analysis, programming, design, detailing, estimating, and specifying applicable to a variety of landscape projects. Prereq: 280, 350, and 380, or consent of instructor. 1 hr and 2-3 hr labs. Sp

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

501 Special Topics in Ornamental Horticulture and Landscape Design (1-3) Topics to be assigned. May be repeated. Maximum 6 hrs. Prereq: Consent of instructor. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E


550 Microtechnique (3) Methods of investigating histostucture, histochemistry, physiology, and histological structures of ornamental and crop plants, light microscopy. Prereq: 8 hrs biological science, 8 hrs chemistry, and consent of instructor. 1 hr and 2 labs. Su

570 Physiology and Development of Ornamental Plants (3) Basic and applied physiology of ornamental plants related to growth and development in production and utilization. Critical review of literature and discussion of juvenility and phase change, flowering, photoperiodism, thermoperiodism, vernalization, cold acclimation, hardiness, dormancy, growth regulators, environmental stress, and post-harvest consideration. Prereq: Botany 321 and consent of instructor. Sp

580 Ornamental Plant Nutrition (3) Applications of nutrition principles and analyses in production of ornamental crops. Comprehensive study of functional roles of nutrients essential to plant growth; critical evaluation of recent developments in nutrient sources and formulations, foliar fertilization and analysis, and nutrient uptake and water relations of ornamental plants grown in containers and in the field. Prereq: Botany 321, Plant and Soil Science 311 and consent of instructor. F, A

590 Seminar (1) Current literature and developments. May be repeated. Maximum 3 hrs. E

593 Problems in Ornamental Horticulture and Landscape Design (1-3) Independent study. Current topic related to technology and science. May be repeated. Maximum 6 hrs. E

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**Pathobiology**

( College of Veterinary Medicine)

**MAJOR**

Veterinary Medicine............................................. D.V.M.

David O. Slauson, Head

Professors:

- Edwards, D. F., D.V.M. Georgia
- McGavin, M. D., Ph.D. Michigan State
- Patton, S., D.V.M. Ohio State
- Powell, H. S. (Adjunct), D.V.M. Georgia

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MAJOR

Philosophy

George G. Brenkert, Head

Professors:

Aquila, Richard E., Ph.D. Northwestern
Brenkert, George G., Ph.D. Michigan
Cebik, L.B., Ph.D. Nebraska
Davis, John W. (Emeritus), Ph.D. Emory
Edwards, Rem B., Ph.D. Emory
Graber, Glenn C., Ph.D. Michigan
Postow, Betsy C., Ph.D. Yale
Van de Vate, Dwight Jr., Ph.D. Yale

Associate Professors:

Bennett, James O., Ph.D. Tulane
Bohstedt, Kathleen Emmett (Liazon), Ph.D. Ohio State
Cohen, Sheldon M., Ph.D. Northwestern
Lavin, Michael, Ph.D. Stanford
Noit, John E., Ph.D. Ohio State
Osborne, Martha Lee, Ph.D. Tennessee

Assistant Professors:

Baylis, Francoise, Ph.D. Western Ontario
Hamilin, H. Phillips, Ph.D. Georgia

The Department of Philosophy offers graduate study leading to the Master of Arts and Doctor of Philosophy. The M.A. program includes thesis and non-thesis options and offers concentrations in medical ethics and in religious studies. The Ph.D. program also has a concentration in medical ethics. Detailed information may be obtained from the Director of Graduate Studies in Philosophy.

THE MASTER'S PROGRAM

The department offers both a thesis and a non-thesis option. The course requirements for an M.A. with thesis are 30 hours, including 6 hours in Philosophy 500. Of non-thesis hours, at least two-thirds must be in courses at or above the 500 level. The specific number and distribution of courses will be determined by the student's faculty committee.

THE DOCTORAL PROGRAM

Specific requirements for doctoral students in Philosophy include a minimum of three academic years of graduate study involving at least 48 semester hours in coursework (normally 16 semester hours of medical ethics only), a Ph.D. in medical ethics (equivalent, exclusive of credit for thesis and dissertation) of which no fewer than 30 hours shall be in courses numbered over 500 and no fewer than 6 hours shall be in courses numbered over 600. The specific number and distribution of courses will be determined by the student's faculty committee.

Students must demonstrate a reading knowledge of one foreign language, normally a living language in which there exists a significant body of philosophical literature. (In special circumstances relating to the area of dissertation research, the Graduate Committee may approve a language not satisfying these conditions.) This may be done by passing the doctoral language examination given by the appropriate department, if available, or by passing French 332 or German 332 with a B or better. Bi- or multilingual (normally, foreign) students, whose native language (other than English) is one in which there is a significant body of philosophical literature, are exempted from the foreign language requirement. Students receiving the Ph.D. with concentration in medical ethics are also exempted.

CONCENTRATIONS

Medical Ethics

The department has an M.A. and Ph.D. program of graduate study with a concentration in medical ethics. Detailed information concerning the program may be obtained from either the Director of Graduate Studies in Philosophy or the Director of the Medical Ethics Program.

Religious Studies

The department has an M.A. program of graduate study with a concentration in religious studies. Details concerning the program may be obtained from either the Director of Graduate Studies in Philosophy or the Department of Religious Studies.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.A. and Ph.D. programs in Philosophy are available to residents of the states of Alabama, Kentucky (concentration in medical ethics only), Maryland (concentration in medical ethics only), or West Virginia; the Ph.D. program to residents of Arkansas (concentration in medical ethics only), Louisiana, or Mississippi; and the M.A. program to residents of Oklahoma (concentration in medical ethics only). Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

400 Special Topics (3) May be repeated when topic varies. Maximum 6 hrs. 411 Modern Religious Philosophies (3) (Same as Religious Studies 411)
546 Clinical Residency in Medical Ethics (3-12) Open only to students concentrating in medical ethics. Prereq: Consent of Medical Ethics Committee. May be repeated. Maximum 20 hrs. S/NC only.

553 Philosophical Topics in Literature and the Arts (3) Aesthetics, criticism, art and society. May be repeated. Maximum 9 hrs.

560 Philosophy of Natural Sciences (3) Nature of subject matter and method of science. May be repeated. Maximum 9 hrs.


570 Philosophy of Religion (3) Examination of central problems. May be repeated. Maximum 9 hrs.

575 Topics in Metaphysics and Epistemology (3) May be repeated. Maximum 9 hrs.

577 Philosophy of Mind (3) Relation of mental to physical and of role of words in discourse for mental activities, thinking and feeling. May be repeated. Maximum 9 hrs.

590 Social and Political Philosophy (3) Philosophical problems concerning social and political life: family, state, freedom, justice; major theoretical responses: anarchism, social contract, Marxism. May be repeated. Maximum 9 hrs.

591 Foreign Study (1-15) See page 32.

592 Off-Campus Study (1-15) See page 32.

593 Independent Study (1-15) See page 32.

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

620 Topics in the History of Ancient and Medieval European Philosophy (3) May be repeated. Maximum 9 hrs.

622 Topics in the History of Modern Philosophy (3) May be repeated. Maximum 9 hrs.

624 Topics in the History of 20th-Century Philosophy (3) May be repeated. Maximum 9 hrs.

640 Topics in Value Theory (3) May be repeated. Maximum 9 hrs.

646 Topics in Medical Ethics (3) Prereq: Consent of Medical Ethics Committee. May be repeated. Maximum 9 hrs.

675 Topics in Metaphysics and Epistemology (3) May be repeated. Maximum 9 hrs.

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**Physics and Astronomy**

(College of Liberal Arts)

**MAJOR DEGREES**

Physics ........................................ M.S., Ph.D.

William M. Bugg, Head

Professors:

Bingham, C. R., Ph.D. .................. Tennessee

Blass, W. E., Ph.D. .................. Michigan State

Bottcher, C., Ph.D. .................. Belfast

Breazeale, M. A. (On Leave), Ph.D. ................. Michigan State

Bringing, M., Ph.D. .................. Oregon

Bugg, W. M., Ph.D. .................. Tennessee

Burgdoerfer, J., Ph.D. .......... Frie Universitat Berlin

Callcott, T. A., Ph.D. .................. Purdue

Childers, R. W., Ph.D. ............. Vanderbilt

Christophorou, L. G., Ph.D. .......... Manchester

Colglazier, E. W., Ph.D. .......... Cal Tech

Condo, G. T., Ph.D. .................. Illinois

Crater, H. W. (UTSI), Ph.D. ........ Yale

Deeds, W. E. (Emeritus), Ph.D. .......... Ohio State

Duckett, K. E., Ph.D. .......... Tennessee

Fox, K., Ph.D. .................. Michigan

Gailar, N. M. (Emeritus), Ph.D. .......... Ohio State

Georgiou, S., Ph.D. ............. Manchester

Guirdy, M. W., Ph.D. ........... Tennessee

Hendler, T. H., Ph.D. .......... Rutgers

Harris, E. G. (Distinguished Prof.), Ph.D. ........ Tennessee

Hart, E. L. (Liaison), Ph.D. .......... Cornell

Jacobson, H., Ph.D. .......... Yale

King, D. T. (Emeritus), Ph.D. ........... Bristol

Lewis, J. W. L. (UTSI), Ph.D. .......... Mississippi

Macek, J. (Distinguished Scientist), Ph.D. .......... Rensselaer

Mahan, G. D. (Distinguished Scientist), Ph.D. ...... California

Mason, A. A. (UTSI), Ph.D. .......... Tennessee

McGregor, W. K. (UTSI), Ph.D. .......... Tennessee

Nielsen, A. H. (Emeritus), Ph.D. .......... Michigan

Obenshain, F. E. Jr., Ph.D. .......... Pittsburgh

Painter, L. R., Ph.D. .......... Tennessee

Pegg, D. J., Ph.D. ............... New Hampshire

Plummer, E. W., Ph.D. .......... Cornell

Quinn, J. J., Ph.D. .......... Maryland

Riedinger, L. L., Ph.D. .......... Vanderbilt

Ritchie, R. H., Ph.D. .......... Tennessee

Rusk, W. R. (Emeritus), M.S. .......... Tennessee

Sandiner, W., Ph.D. .......... Freiburg

Sellin, I. A. (Chancellor's Research Scholar), Ph.D. .......... Chicago

Shih, C. C., Ph.D. .......... Cornell

Strayer, M. R., Ph.D. .......... MIT

Thompson, J. R., Ph.D. .......... Duke

Thomson, J. O. (Emeritus), Ph.D. .......... Illinois

Ward, B. F. L., Ph.D. .......... Princeton

Wheeler, G. W. (Emeritus), Ph.D. .......... Yale

White, J. W. (Emeritus), Ph.D. .......... North Carolina

Associate Professors:

Barnes, F. E., Ph.D. .......... Caltech

Elston, S. B., Ph.D. .......... Massachusetts

Ferrill, T., Ph.D. .......... Clemson

Muehlhausen, J. W. (UTSI), Ph.D. .......... Tennessee

Sheit, S. Y., Ph.D. .......... Maryland

Sorenson, P. S., Ph.D. .......... Copenhagen

Assistant Professors:

Canright, G., Ph.D. .......... Tennessee

Daunt, S. J., Ph.D. .......... Queens

Harmatz, R., Ph.D. .......... Ohio State

Menzel, R. (UTSI), Ph.D. .......... Tennessee

Read, K. F., Ph.D. .......... Cornell

Sanders, A. J., Ph.D. .......... Tufts

Stioplis, G., Ph.D. .......... Cal Tech

Research Professors:

Kamichkov, I., Ph.D. .......... ITEP (Russia)

Zhang, J., Ph.D. .......... Lanzhou

Research Associate Professors:

Du, Yuan-Cai, Ph.D. .......... Beijing

McCorlke, D. L., Ph.D. .......... Tennessee

Research Assistant Professors:

Davis, L. (UTSI), Ph.D. .......... Auckland

Faldas, H., Ph.D. .......... Tennessee
Instructors:
Fairman, R. C., B.A. .................................. Earlham
Riedinger, T., M.S. .................................. Vanderbilt

Graduate programs leading to the Master of Science and the Doctor of Philosophy are offered in a number of concentration areas: atomic and low temperature physics, biophysics, chemical physics, elementary particle physics, health physics, heavy ion atomic physics, molecular spectroscopy, nuclear physics, plasma physics, condensed matter physics, theoretical physics, and ultrasonics.

Departmental graduate programs leading to the M.S. and Ph.D. are also available at The University of Tennessee Space Institute, Tullahoma, where opportunities for study and research are available in quantum optics and laser physics, atomic and molecular spectroscopy, fluid physics, and theoretical physics. For additional information, contact the department head.

ADMISSION REQUIREMENTS
A student who enrolls in The Graduate School with the intention of attaining an advanced degree in Physics will have completed an undergraduate major in Physics or its equivalent. Physics 311-12, 321, 431-32, and 461-62-63 or 411-12 constitute the minimum courses prerequisite to graduate study. A student who intends to present Physics as a graduate minor will have completed an undergraduate minor in Physics or its equivalent. Physics 311 and 431-32 constitute the minimum coursework prerequisite to a minor in Physics.

All first-year graduate students are required, for advising purposes only, to take a qualifying examination in undergraduate physics during the fall semester registration period.

THE MASTER’S PROGRAM

Thesis Option
This program is designed primarily for students intending to go into industrial or governmental laboratories as physicists. The course requirements include 24 semester hours of physics courses, of which at least 12 semester hours are taken from Physics 511-12, 521-22, 531-32, 541-42, or 571-72. Each candidate must present an acceptable thesis, 6 hours of 500, and pass an oral examination on course material and thesis.

Non-Thesis Option
This program is designed primarily for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking the nonthesis option must apply to the department’s graduate committee for permission to enroll under this program. The requirements are the satisfactory completion of 30 hours of coursework composed of 18 semester hours from Physics 511-12, 521-22, 531-32, 541-42, and 571-72; 6 semester hours in a minor field; and 6 semester hours from other courses numbered above 400 (preferably of advanced laboratory nature.) At least 20 hours must be taken at the 500 level or above. In addition, the candidate must pass a written examination administered by his/her committee.

THE DOCTORAL PROGRAM
All students are expected to take Physics 521-22, 531-32, 541-42, 551, 561, 571-72, and 611. Physics 601-02 are normally required of students specializing in atomic physics; Physics 521-22 of students specializing in elementary particle physics; Physics 626-27 of students in elementary particle physics; Physics 663-64 of students in plasma physics; Physics 661-82 of students in health physics; Physics 671-72 of students in solid state physics; and Physics 681-82 of students specializing in molecular spectroscopy. Students specializing in chemical physics may substitute Chemistry 572 for Physics 551 and should complete at least 6 semester hours chosen from Chemistry 560, 670.

The courses Physics 531-32, 571-72, 521-22, 541-42, 561 constitute the core curriculum. They are the usual basis for the departmental comprehensive examination which is normally taken by a well-prepared student after two years of graduate study.

A reading knowledge of one foreign language in which there exists a significant body of literature is required. For research 302 with a grade of A or B may be substituted for the corresponding language examination.

The dissertation topic will be chosen with reference to one of the fields in which research facilities can be made available either at The University of Tennessee laboratories in Knoxville; The University of Tennessee Space Institute at Tullahoma, Tennessee; the Oak Ridge National Laboratory, Oak Ridge, Tennessee; or at other research facilities used by the University faculty.

Astronomy

GRADUATE COURSES

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

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

Physics

GRADUATE COURSES

411-12 Introduction to Quantum Mechanics (3,3) Fundamental principles of quantum mechanics and methods of calculation. Solution of Schrodinger equation for simple systems. Application to atomic, molecular, nuclear, and condensed matter physics. Must be taken in sequence. Prereq: 232 or equivalent; Mathematics 435.

421 Modern Optics (4) Transmission of light in uniform, isotropic media; reflection and transmission at interfaces; mathematics of wave motion and interference effects. Rudiments of Fourier optics and holography. Prereq: 431. or Fundamentals of Physics: Wave Motion, Optics, and Modern Physics, or Honors: Mechanics and Heat, and consent of instructor. 3 hrs. and 2 labs.

425 Principles of Nondestructive Testing (3) (Same as Engineering Science and Mechanics 425.)


461-62 Modern Physics Laboratory (3,3) 461 - Introduction to fundamental and modern techniques in experimental physics, and to theory and practice of measurement and data analysis. Selected experiments in nuclear, atomic, molecular and solid state physics, and modern optics. Prereq: Electronics Laboratory and either Relativity and Structure of the Atom or 411. 462 - Advanced experiments and experimental techniques in modern physics; experimental team work. thorough quantum mechanical interpretation of results and preparation of scientific reports. Prereq: 461. 6 hrs lab per week.

471-72 Health Physics (3,3) Radioactivity, interaction of electromagnetic radiation with matter, radiation quantities and units, point kernel and extended sources, x-rays and gamma rays, neutron activation, interaction of charged particles with matter, stopping power, range-energy relations, counting statistics, shielding, dosimetry, waste disposal, criticality prevention, radiation biology and ecology. Prereq: Consent of instructor.

490 Senior Seminar (1-3) Topic of current interest. May be repeated with consent of department. Maximum 6 hrs.

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

501 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prereq: Consent of department and research director. May be repeated with consent of department. Maximum 18 hrs. S/NC only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

505 Physics of Fluids (3) Fluid physics, overview of fluid mechanics and associated computational techniques; general description of laminar and turbulent flows; viscous, supersonic and hypersonic flows; continuum, transonic, and hypersonic aerodynamics; sound propagation, flow, nozzle flow and sonic orifice expansion flows; reacting and nonreacting flowfields; shock-tube physics; and an introduction to the method of characteristics and Monte Carlo computational techniques.

506 Experimental Methods (3) Principles, real operational behavior, and hazards of laser types, radiation detectors, photomultiplier tubes, image intensifiers, image converters, image dissectors, streak cameras, and fast-framing cameras; high-vacuum systems including cryogenic-based devices, data acquisition techniques including synchronous and digital electronics methods and micro-computer data analysis and registration methods.

507 Contemporary Optics (3) Topics in geometrical, physical, Fourier, and nonlinear optics and introductory laser physics. Extensive use of computer in calculations and design of practical and sophisticated optical systems.

508 Laser Physics (3) Mode analysis, stable and unstable resonators; rate equations and population inversion, saturation, relaxation oscillations, fluctuations and noise, laser stability; quantum theory of laser, photon coherence; mode-locking, Q-switching and frequency stabilization; specific laser types: semiconductor and solid-state, excimer, copper vapor and dye lasers.

511-12 Theoretical Physics (3,3) Classical theoretical physics, with limited use of mathematics. Prereq: 312, 432, advanced calculus, differential equations, and vector analysis.

521-22 Quantum Mechanics (3,3) Fundamental principles of quantum mechanics, particle, harmonic oscillator, hydrogenion, angular momentum, electron spin, particles in electric and magnetic fields, perturba-

531 **Classical Mechanics** (3) Classical particle dynamics. Lagrange's and Hamilton's equations, moving coordinate systems, normal coordinates, rigid body motions. Prereq: 531.

532 **Advanced Classical Mechanics** (3) Variational principles, canonical transformations, Hamilton-Jacobi theory, nonlinear mechanics, elasticity, fluid mechanics. Prereq: 531.


556 **The Theory of Relativity** (3) Geometry of spacetime, relativistic electrodynamics, particle mechanics and continuum mechanics, Einstein's field equations, Schwarzschild solution to the test of general relativity. Prereq or coreq: 531 and 542.


573 **Numerical Methods in Physics** (3) Numerical methods for solution of physical problems, use of digital computers, analysis of errors. Prereq: 571-72 or consent of instructor.

574 **Group Theory for Physicists** (3) Introduction to abstract group theory, discrete and continuous groups, representation theory, Noether's theorem, symmetries and degeneracies, application of group-theoretical methods to atomic physics, solid-state physics, and particle physics. Prereq: 571-72.

591 **Foreign Study** (1-15) See page 32.

592 **Off-Campus Study** (1-15) See page 32.

593 **Independent Study** (1-15) See page 32.

594 **Special Problems** (3) Especially assigned theoretical or experimental problems. May be repeated. Maximum 9 hrs. E


600 **Doctoral Research and Dissertation** (3-15) P/NF only. E


505 **Laser Spectroscopy** (3) Application of lasers to spectroscopy of atomic and molecular systems; review of classical multipole radiations; atomic dipole and J-J coupling and Zeeman effects, spontaneous emission of atomic systems and oscillator strengths, selection rules of dipole and quadrupole transitions, radiative transfer and formation of spectral lines. Study of saturated absorption spectroscopy, resonance fluorescence, and strong field effects. Hartle effect, optical double resonance, optical pumping and hyperfine spectroscopy. Prereq: 521, 541, 550.

606 **Nonlinear Optics** (3) Nonlinear optical susceptibilities, wave propagation in nonlinear media, sum-frequency and difference frequency generation, harmonic generation, parametric amplification and oscillation, stimulated Raman processes, two- and multi-photon processes, four-wave mixing and phase conjugation, transient coherent optical free induction decay, optical breakdown and nonlinear effects in plasmas. Prereq: 522.

508 **Quantum Electronics and Electro-Optics** (3) Electromagnetic propagation in anisotropic and periodic media, generation, and detection in electro-optic effects. Effects and devices, acousto-optical effects and devices, guided waves, phase conjugate optics, picosecond and femtosecond optical switching and electronics, and optical computers and processors. Prereq: 605.

510 **Quantum Optics** (3) Quantum theory of emission and absorption of radiation; frequency-dependent susceptibility; coherence theory; field quantization and coherent photon states; interaction of radiation with atoms, photons, and molecules. Prereq: 521.

611 **Advanced Quantum Mechanics & Field Theory** (3) Second quantization; quantization of electromagnetic field, emission, absorption, and scattering of light, bremsstrahlung, pair creation and annihilation, quantum field theory methods in condensed matter physics, and quantum optics. Topics vary according to instructor. Prereq: 522 and 542 or equivalent. Prereq or coreq: 521 or consent of instructor.

512 **Advanced Topics in Quantum Field Theory** (3) Renormalization, loop expansion, anomalous magnetic moment, gauge theories, electroweak theory, quantum chromodynamics, grand unified theories, and advanced topics in laser physics and quantum optics. Topics vary according to interest of students, instructor and present state of physics. Prereq or coreq 561 or consent of instructor.

521-22 **Nuclear Structure** (3,3) General properties of nucleus, two-body scattering problems; saturation and symmetry properties of nuclear forces; theory of light nuclei, nuclear spectroscopy, special nuclear models; theory of nuclear reactions; theory of beta-decay. Prereq: 571-72.

626-27 **Elementary Particle Physics** (3,3) Survey in elementary particle physics covering experimental methods, conservation laws, invariance principles, and models of interactions. 627—Advanced topics: quark models, electroweak interactions, and unification of elementary forces. Prereq: 522.

641 **Advanced Topics in Classical Theory** (3) To meet special needs of students. Advanced dynamics and hydrodynamics, electromagnetic theory; statistical mechanics, or theory of equilibrium problems. Prereq: 532, 542, 551. May be repeated with consent of department. Maximum 9 hrs.

642 **Advanced Topics in Quantum Theory** (3) To meet special needs of students. Angular-momentum theory, electron-electron theory of atomic spectra, molecular structure and valence theory, theory of radiation, electric and magnetic susceptibilities, high energy processes, scattering and collision processes, or theory of fields. Prereq: 522. May be repeated with consent of department. Maximum 9 hrs.

643 **Computational Physics** (3) Developing computer algorithms for solving representative problems in various fields of physics, celestial dynamics in astrophysics, boundary value problems in electrodynamics, electromagnetic and nuclear structures, band structure on solid state physics, transport problems in statistical mechanics, Monte Carlo simulation of liquids, fitting and interpretation of data, correlation analysis, or optimization strategy. Prereq: 522, 531, 542, and 572.

661-62 **Collision Interactions** (3,3) Interaction of electromagnetic radiation and charged particles with atoms or molecules or free particles, scattering, ionization, transport and capture, collective excitations, Cerenkov radiation, and stopping power. Prereq: 522.

663 **Advanced Plasma Physics** (3) (Same as Electrical and Computer Engineering 663.)


**681-82 Molecular Spectroscopy** (3,3) Spectroscopic methods of determining molecular properties, theoretical and experimental aspects of infrared, Raman, and electron energy and charge transfer, group theoretical methods and selection rules in gases and condensed phases, normal coordinates and potential functions, vibration—rotation interaction theory, intensities, frequencies and line shapes of molecular transitions. Prereq: 552 and 542 or consent of instructor.

**Planning**

(College of Architecture and Planning)

**MAJOR**

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<th>DEGREE</th>
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<td>Planning</td>
<td>M.S.P.</td>
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James A. Spencer, Director

Professors:

Johnson, David A., Ph.D. .......... Cornell
Kenney, Kenneth B., Ph.D. ..... North Carolina
Prochaska, J. M., M.U.P. ... Michigan State
Shouse, Walter L. (Emeritus), M.C.P. ..... Harvard
Spencer, James A. (Liaison), M.C.P. ..... Ohio State

Associate Professors:

Bowen, George E., M.A. ..... George Washington
Fisher, Patricia, Ph.D. .......... Florida State

Assistant Professor:

Anderson, Annette, M.P.A. ... Missouri (Kansas City)

Research Associate Professor:

Putnam, Sandra, Ph.D. .......... Brown

Research Assistant Professor:

Newson, Theodore, Ph.D. .......... Penn State

The Graduate School of Planning offers a program of studies leading to the professional degree of Master of Science in Planning. The degree is the normal route for entry into professional positions in urban and regional planning or related positions. Graduates are candidates for positions in regional, city, county, and metropolitan planning agencies; in local, state, and federal agencies concerned with physical, economic, and administrative planning; in private business and organizations dealing with development problems; and in private consulting.

The Master of Science in Planning program is accredited by the Planning Accreditation Board, a joint undertaking of the American Institute of Certified Planners and the Association of Collegiate Schools of Planning.

**THE MASTER'S PROGRAM**

**Admission Requirements**

Applicants are to submit an application for admission to The Graduate School, two letters of reference from faculty familiar with their prior academic work, and a statement describing personal career objectives. If the applicant has prior work experience in planning, a reference
Degree Requirements

The M.S.P. requires completion of at least 48 hours of graduate credit, at least 30 of which must be in planning. The following courses are the core curriculum required of all students: 510, 511, 515, 520, 521, 523, 530, 531, 532, 540, and 545.

Students should plan to enter the program in the fall term to take the core courses in the proper sequence. Each student is required to develop an area of concentrated competence beyond the core curriculum. After selecting the area of concentration, usually by the end of the second semester, the student takes a minimum number of courses or hours from a prescribed set of courses in the subject area. Further enhancement of the concentration is gained by taking additional elective courses in the subject and by focusing the thesis or major paper on the subject. Concentration courses are drawn from the planning curriculum and from other departments in the University. Concentrations are available in land use planning, information systems in planning, economic development planning, real estate development planning, transportation planning, environmental planning, historic preservation planning, and international planning.

Students have the latitude to propose an alternate specialization consisting of at least 9 hours of coursework, subject to approval of a faculty committee. Each student is required to demonstrate competence in individual research. This may be done in one of two ways:

Thesis Option—Complete a thesis for 6 hours credit;

Non-Thesis Option—Complete a major study with acceptable documentation. To be eligible for the major study option, the student must have completed at least 12 hours of graduate coursework in planning with at least a 3.5 cumulative grade-point average. The student meeting these criteria may present a proposal to his/her committee for a major study that will include at least 6 hours of subsequent coursework. The proposal shall justify the selection of the topic, describe the approach to the study, and describe the nature of the final product. The topic will normally be expected to reinforce or complement the student's concentration. Student academic progress is monitored by the faculty. A student failing to maintain an acceptable grade-point average may be placed on probation or dismissed from the program.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S.P. program is available to residents of the states of Arkansas, Kentucky, South Carolina, or West Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

401 The City in the U.S. (3) Development and character of U.S. cities. Contemporary issues and selected case studies. (Same as Urban Studies 401.)

402 Survey of Planning (3) History of city development and of planning: U.S. experience in urban and other levels of planning. State of the art, process, comprehensive plan, implementation role. Planning issues in society. Not for credit for M.S.P. degree.

446 Housing (3) Nature and demand for housing in U.S. and abroad. U.S. experience. Private market processes and public influences. Problems of change in housing supply, impact of technology, and governmental programs to improve supply and quality of housing.

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


502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or student is expected to use University library.

510 Fundamentals of Planning (2) History of planning, structure and development of urban areas, operations of contemporary planning, trends and issues.

511 Graphic and Oral Communications in Planning (1)

515 Theory of Planning (2) Analysis of nature and objectives of planning process; role of planner and planning function in public decision-making. Prereq: 510 or consent of instructor.

520 Planning Research Methods (3) Research techniques in subject areas associated with city and regional planning. Research tools, data collection and analysis as basis for planning and decision-making.

521 Computers in Planning (3) Basic computer concepts, hardware and software, use of mainframe and microcomputers in planning and government.

523 Statistics for Planners (3) Applications of basic descriptive and inferential classical and non-parametric techniques in planning research. Data organization and display, measures of location, dispersion and association; data transformations; some basic probability theory; selected one and two sample tests; correlation and regression analysis. Prereq: 520 or consent of instructor.


526 Library Research for Planning (1) Survey of publications of interest to planners, resources and research techniques. Use of facilities and collections of library.

530 Planning Analysis and Forecasting (3) Methods of quantitative analysis and modeling in urban and regional studies. Population, employment, and economic base studies, forecasting techniques. Coreq: 520 or consent of instructor.

531 Urban and Regional Analysis (3) Past, present and possible future patterns of urban and regional structures drawing on contemporary theories, models, and empirical research.

532 Planning Methods (6) Preparation of comprehensive plans for urban areas or regions. Development of baseline data and forecasts, formulation of alternative plans and strategies, and development of plan implementation programs. Extensive laboratory experience. Prereq: 510, 520, 530 and 531 or consent of instructor.

537 Planning and Transportation (3) (Same as Civil Engineering 568.)

539 Urban and Site Design (6) Principles of design of urban subdivisions and some components of physical community, shopping centers, institutional complexes, central business districts. Problems of reviewing alternative designs against each other or written regulations. Extensive laboratory experience.

539 Planning for Historic Preservation (3) Planning for preservation, restoration, and conservation of historic buildings, areas and sites as related to comprehensive planning process. National, state, and local government role in preservation, designation of sites, legislative needs, financing and administrative organizations.

540 Legal Aspects of Planning (3) Legal basis for planning and guiding community development. Legal tools of planning. Prereq: 510 or consent of instructor.

545 Planning and Property Development (2) Process of urban physical growth and change; functioning of private sector real estate development and its relationship to planning. Partnership roles of public and private sectors in urban development and redevelopment. Prereq: 510 or consent of instructor.

547 Negotiation (1) Methods, strategies, techniques and skills useful to planners in mediation, negotiation, and dispute resolution concerning urban planning and development.

548 Tourism Planning (3) Planning of tourist resources and programs within a geographic region. Tourist planning models. Relationships among tourists, tourism development and planning of tourist attractions and services. Application of techniques in selected area.

549 Local Fiscal Planning and Capital Improvements (3) Fiscal planning and capital improvements programming in plan implementation. Tax and expenditure limitations, infrastructure financing, municipal bond market, alternative revenue sources: development fees, exactions, intergovernmental aid. Evaluation of fiscal policies.


551 State and Regional Planning (3) Theory and practice of planning at state, sub-state, and metropolitan levels.

552 Development Planning in the Third World (3) Seminar on urban and regional development in Third World nations. Population growth, settlement patterns, economic development, land framework of integrated resource management. (Same as Ecology 552.)

555 Environmental Planning (3) Role of planners and planning in maintenance of balance between natural and built environment. (Same as Ecology 555.)

560 Policy Analysis and Strategic Planning (3) Models of policy making process and role of strategic planning and applied decision making. Quantitative and qualitative approaches, evaluative research and program evaluation, and impact assessment.

590 Practicum (3) Prereq: Consent of instructor. S/NC or letter grade.

591 Special Topics (1-3) Prereq: Consent of instructor.

592 Readings in Planning (1-3) Prereq: Consent of instructor. May be repeated.

593 Problems in Planning (1-3) Prereq: Consent of instructor.

595 Environmental Assessment and Sustainable Development in Third World Countries (3) (Same as Ecology and Botany 635.)

Plant and Soil Science

(University of Tennessee Science, College of Agriculture and Natural Resources)

DEGREES

MAJOR

Plant and Soil Science M.S., Ph.D.

John E. Foss, Head

Graduate Faculty:

Allen, Fred L., Ph.D. Minnesota
Bell, Frank F. (Emeritus), Ph.D. Iowa State
Addresses of Associate Professors

- Ammons, J. T., Ph.D. .... West Virginia
- Dayton, D. E., Ph.D. .... NC State
- Krueger, W. A., Ph.D. .... Illinois
- Lee, S. Y. (Adjunct), Ph.D. .... Wisconsin
- Lessman, Gary M., Ph.D. .... Michigan State
- Lewis, R. J., Ph.D. .... NC State
- Logan, Joanne, Ph.D. .... Nebraska
- Miller, R. D., Ph.D. .... Kentucky
- Reich, V. H., Ph.D. .... Iowa State
- Sams, C. E., Ph.D. .... Michigan State
- West, D. R. (Liaison), Ph.D. .... Nebraska
- Wyatt, J. E., Ph.D. .... Florida

Assistant Professors

- Essington, M. E., Ph.D. .... California (Riverside)
- Mueller, Thomas C., Ph.D. .... Georgia
- Mullen, M. D., Ph.D. .... NC State
- Newton, D. (Adjunct), M.S. .... Kentucky
- Wilson, G. V., Ph.D. .... Arkansas

The Department of Plant and Soil Science offers graduate programs leading to the Master of Science and the Doctor of Philosophy. Concentrations in Development, Manufacturing, and Marketing of Horticultural Commodities and in Soil and Water Conservation are offered in soil science, plant breeding and genetics, and crop physiology and ecology. For further information, contact the department head.

THE MASTER'S PROGRAM

Thesis Option

This option requires writing a thesis based on original research. Six hours of 500 Thesis courses are required. Prior to conducting research, the student must develop a detailed written thesis proposal. In addition to the thesis hours, a minimum of 24 hours of graduate coursework is required, of which at least 12 must be taken in courses numbered 500 or above. The student's advisory committee may require additional coursework if the student's progress or background indicates such need. Each student is required to take 1 hour of 501 and 2 hours of 503.

The student's advisory committee consists of the major professor, who acts as chairperson of the committee, and a minimum of two other faculty members. The advisory committee approves the student's coursework and the report on participation in a research program for 593. Students are required to take a written comprehensive examination integrating the coursework.

The doctoral program

A minimum of 72 hours beyond the Bachelor's degree, exclusive of credit for Thesis 500, is required. Of this number, 24 hours must be Doctoral Research and Dissertation 600. A minimum of 26 hours must be completed in courses numbered above 500 exclusive of doctoral research and dissertation, of which 18 must be in courses numbered above 500. A minimum of 9 hours of graduate coursework taken during the doctoral program must be outside the department in one or more cognate areas.

The student and the major professor identify a doctoral committee composed of at least four faculty members holding the rank of assistant professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be from outside the department. The committee must approve all coursework applied toward the degree, certify the student's mastery of the major field and any cognate fields, direct the research, and recommend the dissertation for approval and acceptance by The Graduate School.

GRADUATE COURSES

411 Soil Microbiology (3) Soil microbial populations and roles in nutrient cycling and carbon transformations. Inorganic and organic substrates, decomposition of residues, dynamics of soil organic matter. Prereq: Intro to Soil Science and Introduction to Organic Biochemistry or Organic Chemistry or consent of instructor. 2 hrs and 1 lab. F.A

412 Soil Genesis, Classification, and Mapping (3) Soil genesis and formation concerning and describing morphology of agricultural and forest soils; chemical and physical properties; classification; mapping. Two Saturday trips. Prereq: 210 or consent of instructor. 2 hrs and 1 lab. Sp

413 Soil Chemistry (3) Principles concerning structure and chemical properties of soil materials; solid fraction as related to exchange, chemical equilibria, soil acidity, and weathering. Nutrient availability and water waste disposal. Prereq: 311 or consent of instructor. F

414 Soil, Land Use, and the Environment (3) Soil as environmental component and soil properties affecting land use, including resource mapping, weathering, nutrient availability, and disposal. Prereq: 210 or consent of instructor. Sp.A

415 Soil-Water Relations (3) Physical relationships among solid, liquid, and gaseous phases of soil systems. Relationships of soil properties to processes governing transport of water, and chemicals in soil. Prereq: Introduction to Soil Science. 2 hrs and 1 lab. F.A

431 Crop Physiology and Ecology (3) Principles of plant physiology and ecology as applied to crop production. Effects of environmental factors on physiological processes. Prereq: 230, Botany 321. 2 hrs and 1 lab. F.A

432 Bioclimatology (3) Solar energy budget; interactions between local, regional, and global climate processes and biological systems; quantification of macro- and micro-climates; microclimate adjustments and their modification; automatic monitoring station data; detection, analysis, and synthesis; biological responses to climate stresses; climate variation and change and their effects on biological systems. Prereq: 1 yr physical or biological science, junior standing, 2 hrs and 1 lab. F.A

433 Agricultural Pesticides (3) Regulation of pesticide development, manufacture, transportation, marketing, and use. Structure, mode of action, degradation, and environmental impact of pestidies used in agriculture, forestry, and related areas. Prereq: 1 yr biological sciences and 1 semester chemistry. 2 hrs and 1 lab. Sp

434 Postharvest Biology and Technology (3) Principles, methods, and techniques related to maintenance of quality of horticultural commodities. Postharvest handling, harvesting, storage facilities and techniques, quality evaluation and biological and physiological mechanisms related to maturation, ripening, and senescence. Graduate credit requires a 2 hr short project in addition to regular class assignments. Two Saturday field trips. Prereq: 1 yr biological science. 2 hrs and 1 lab.

453 Principles of Plant Breeding (3) Genetic principles and techniques used in crop improvement. Prereq: Biology 220 or equivalent. 2 hrs and 1 lab. F.A

471 Statistics for Biological Research (3) Application of statistics to interpretation of biological research. Notation, descriptive statistics, probability, distributions, confidence intervals, and chi-square tests, analysis of variance, mean separation procedures, linear regression, and correlation. Prereq: Mathematics 121 or equivalent. F

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

501 Seminar Preparations (1) Application of speaking, writing, and organizational skills in preparation and presentation of scientific material to general audiences. Preparation of abstracts for presentations. Required of all entering graduate students during their first year of graduate study. F,Sp

502 Registration for Use of Facilities (1) Required for the first time not other than a graduate student during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/U only. E

503 Seminar (1) Presentations and discussion of current scientific material. May be repeated. Maximum 3 hrs. F.Sp


512 Pedology (3) Physical and chemical weathering processes, factors of soil formation, soil forming proc-
Political Science

(College of Liberal Arts)

MAJORS

Political Science ...................................................... M.A., Ph.D.
Public Administration ........................................... M.P.A., J.D.-M.P.A., M.S.S.W.-M.P.A.

Michael Gant, Head

Professors:

Carlisle, D. H. (Emeritus), Ph.D ........................................... North Carolina
Gant, Michael M., Ph.D .................................................. Ohio State
Gorman, Robert A., Ph.D ............................................ New York
Iredell, Vernon R., Ph.D .................................................. Chicago
Lyons, William, Ph.D .................................................... Oklahoma
Plass, Hyram, Ph.D ....................................................... Utah
Robinson, Nelson M. (Emeritus), Ph.D ........................................... Syracuse
Smith, T, Alexander, Ph.D .................................................. Ohio State
Stephens, Otis H. (Distinguished Prof.), Ph.D ........................................... Johns Hopkins
Ungs, Thomas D., Ph.D .................................................... Iowa
Welborn, David M., Ph.D ................................................ Texas

Associate Professors:

Cunningham, Robert B., Ph.D ........................................... Indiana
Evans, Gail C., Ph.D ....................................................... Columbia
Foltz, David H. (Liaison), Ph.D ........................................ Tennessee
Freeland, Patricia K., Ph.D ................................................. Wisconsin (Milwaukee)
Petersen, Robert L., Ph.D ................................................... Yale
Scheib, John M., Ph.D (Liaison), Ph.D ........................................... Florida

Assistant Professors:

Houston, David J., Ph.D ................................................ SUNY (Binghamton)
Nowinski, Anthony J., Ph.D ........................................... Kansas
Richardson, Lillard, Ph.D ................................................ Texas
Salinger-McBride, Jan., Ph.D ............................................... California (Santa Barbara)
Zhong, Yang, Ph.D ....................................................... Kentucky

The Department of Political Science offers the M.A., M.P.A., and Ph.D. The department also offers a dual program with the College of Law. Inquiries concerning all programs should be directed to the departmental office.

ADMISSION REQUIREMENTS

Three departmental recommendation forms must be submitted to The Graduate School, at least two of which must be completed by instructors at the institution most recently attended. In addition, scores on the general portion of the Graduate Record Examination must be submitted.

THE MASTER OF ARTS PROGRAM

A Bachelor's degree or its equivalent is required for admission. Normally an overall average of 3.0 is also required together with an average of 3.2 in the last two years of political science or social science. In addition, a composite score of at least 1100 on the verbal and quantitative parts of the GRE is normally required.

Students pursuing the Master of Arts degree may follow one of two options:

Thesis Option: (30 hours) Coursework, preparation of a thesis, and an oral examination on coursework and the thesis, is required. At least 12 of these hours must be in political science, with 6 in the field of methodology (Political Science 510 and 512), and 3 hours in the 600-level research seminar in the student's first field of interest.

Non-Thesis Option: (36 hours) Coursework, plus a written comprehensive examination on all coursework is required. At least 12 of these hours must be in political science, with 6 in the field of methodology (Political Science 510 and 512), and 3 hours in the 600-level research seminar in the student's first field of interest.

THE MASTER OF PUBLIC ADMINISTRATION PROGRAM

The M.P.A. program is intended to prepare students for public service careers by acquainting them with management principles, analytical tools, and the ethical dilemmas they will face as public administrators. It consists of a total of 36 semester hours, including a core program, an elective specialization, and a recommended internship.

Applicants for admission to the program must have a Bachelor's degree or its equivalent. Normally, an average overall of 3.0 and an average of 3.2 in the last two years of political science or social science courses is required. In addition, a composite score of at least 1100 on the verbal and quantitative parts of the GRE is normally required.

The M.P.A. is a non-thesis program. Specific requirements include the following:

1. Core - 21 hours.
   b. General perspectives - elective courses (3 hours). 556 Policy Analysis; 558 The Politics of Administration.
   c. Analytical skills (6 hours). 512 Quantitative Political Analysis; 514 Research and Methodology in Public Administration.
   d. Management skills (6 hours). Choose two of the following: 560 Public Budgeting and Finance; 562 Public Management; 564 Human Resources Management in Public Organizations.
2. Specialization - 9 hours.
   a. General government, public health, budgeting and finance, natural resources, program evaluation, criminal justice, public relations, personnel, and others.
3. Recommended internship with a public agency - 6 hours.

Internships are arranged in consultation with the coordinator of the M.P.A. program. Possible specializations include general government, public health, budgeting and finance, natural resources, program evaluation, criminal justice, public relations, personnel, and others.

4. A written final examination, which may be followed by an oral examination, is required.

DUAL J.D.-M.P.A. PROGRAM

The College of Law and the Department of Political Science in the College of Liberal Arts offer a coordinated dual degree program leading to the J.D. and the M.P.A. The student must complete a minimum of 120 semester hours of graduate work, including 36 semester hours of political science, 33 semester hours of law, and 33 semester hours of pharmacy. The student must also complete the University's core curriculum requirements.

Students must be admitted to both the College of Law and the Department of Political Science. The student must complete the requirements for both degrees within the time limits established by each institution. The student must successfully complete the first year of the J.D. program and maintain a minimum GPA of 2.5 in the first-year courses to continue in the program.

The student must also maintain a minimum GPA of 3.0 in political science courses and a minimum GPA of 3.0 in law courses. The student must complete 36 semester hours of political science courses, including 12 hours at the 600 level, and 33 semester hours of law courses, including 12 hours at the 600 level. The student must also complete 33 semester hours of pharmacy courses.

The student must complete the University's core curriculum requirements and the requirements for both degrees within the time limits established by each institution. The student must successfully complete the first year of the J.D. program and maintain a minimum GPA of 2.5 in the first-year courses to continue in the program.

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rather than the five years that otherwise would be required. Students pursuing the dual degree program should plan to complete coursework or an internship for one summer term in addition to taking normal course loads for four academic years.

Admission
Applicants for the J.D.-M.P.A. program must make separate application to, and be independently accepted by, the College of Law for the J.D. degree and the Department of Political Science and The Graduate School for the M.P.A. degree. Applicants must also be accepted by the Dual Degree Committee. All applicants must submit a Law School Admission Test (LSAT) score, which is normally required for admission to the M.P.A. program. Application may be made prior to or after matriculation in either the J.D. or the M.P.A. program, but application to the dual program must be made prior to entry into the last 29 semester hours required for the J.D. degree and prior to entry into the last 15 hours required for the M.P.A. degree.

Curriculum
A dual degree candidate must satisfy the requirements for both the J.D. and the M.P.A. degrees, as well as the requirements for the dual program. The College of Law will award a maximum of 9 semester hours of credit toward the J.D. degree for successful completion of approved graduate level courses (500 or 600 level) offered in the Department of Political Science. The M.P.A. program will award a maximum of 9 semester hours of credit toward the M.P.A. degree for successful completion of approved courses offered in the College of Law. All courses for which such cross-credit is awarded must be approved by the J.D.-M.P.A. coordinators in the College of Law and the Department of Political Science. All candidates for the dual degree must successfully complete Administration Law (Law 821) and are encouraged to take Local Government (Law 824). An internship is strongly recommended for students in the dual degree program, as it is for all M.P.A. candidates, but an internship is not required.

During the first two years in the dual program, students will spend one academic year completing the required first year of the College of Law curriculum and one academic year taking courses solely in the M.P.A. program. During those first two years, students may not take courses in the opposite area, without the approval of the J.D.-M.P.A. coordinators in both academic units. In the third and fourth years, students are strongly encouraged to take both law and political science courses each semester.

Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit toward either the J.D. or the M.P.A. degree for courses taken in the other program except as such courses qualify for credit without regard to the dual program.

Awarding of Grades
For grade recording purposes in the College of Law and the Department of Political Science, grades awarded in courses in the other unit will be converted to either Satisfactory or No Credit and will not be computed in determining a student’s GPA or class standing. The College of Law will award a grade of Satisfactory for an approved M.P.A. course in which the student earns a grade of B or higher and a grade of No Credit for any lower grade. The Political Science Department will award a grade of Satisfactory for an approved law course in which the student earns a grade of 2.3 or higher and a grade of No Credit for any lower grade. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

DUAL M.S.S.W.-M.P.A. PROGRAM
The Department of Political Science and the College of Social Work offer a dual degree program leading to the conferral of both the Master of Science in Social Work and the Master of Public Administration degrees. In this program, the M.P.A. and M.S.S.W. degrees can be earned on a full-time basis in five consecutive terms rather than seven to eight terms.

Admission
Applicants for the M.S.S.W.-M.P.A. program must be admitted to the College of Social Work and to the Department of Political Science. In addition, applications from dual degree students must be reviewed and approved by the dual degree committee that is responsible for overseeing the program. It is anticipated that some students may apply to the dual degree program before they matriculate in either the M.S.S.W. or the M.P.A. program. Students already enrolled in one program will also be permitted to apply, but must do so prior to the end of the first year of study.

Curriculum
Students in the dual degree program are required to take a set of core courses from each curriculum, but the program is designed to be flexible, providing students the opportunity to develop special areas of competence. For the dual degree program, a minimum of 65 hours are required (35 hours must be in social work and 30 hours must be in public administration). Admission to candidacy will be completed separately for each degree.

A comprehensive examination is required in each discipline for students receiving the dual degrees. A faculty committee from Public Administration and one from Social Work will write and grade the respective examination. Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit toward either the M.P.A. or the M.S.S.W. degree for courses taken in the other program. As such courses qualify for credit toward a degree independent of the dual degree program.

Financial Aid
Students may apply for financial aid to both the College of Social Work and the Department of Political Science. Normally, students will not receive funding from both programs concurrently.

THE DOCTORAL PROGRAM
The Ph.D. program prepares students for careers in college teaching, as well as careers in other occupations related to service in the public or private sectors. Applicants for admission to the program should normally have completed a Master’s degree in political science or a related field with a 3.0 GPA (3.5 for international students) and have earned a composite score of at least 1100 on the verbal and quantitative parts of the Graduate Record Examination.

Students admitted to the program must complete 72 hours of coursework beyond the Bachelor’s degree, must successfully pass written and oral comprehensive examinations in three broad subfields of political science, and must pass a final oral examination on the dissertation.

In addition, students must satisfy a research tool requirement. This requirement may be satisfied either by demonstrating competency in one foreign language, or by completing 12 hours of coursework, numbered 500 or above, in empirical methodology.

In addition to the total hours required for the degree, the following requirements must also be met:
1. At least 60 hours must be in political science courses.
2. At least 48 hours in political science courses must be in courses numbered 500 or above.
3. Completion of Political Science 510 and 512.
4. At least 6 hours must be earned in political science courses numbered above 600, exclusive of dissertation hours.
5. A total of 24 hours must be earned by writing the dissertation.

GRADUATE COURSES
430 United States Constitutional Law: Sources of Power and Restraint (3) Analysis of judicial review, constitutional powers of President and Congress, federalism, sources of regulatory authority, and constitutional protection of political and economic rights.
431 U.S. Constitutional Law: Civil Rights and Liberties (3) Analysis of current issues in civil rights and liberties including: first amendment freedoms, equal protection, privacy and rights of accused.
442 Administrative Law (3) Legal dimensions of administrative power and procedures, and constitutional controls over administrators.
452 Black African Politics (3) Recent evolution and current political environment of Black African nations. (Same as Afro-American Studies 452.)
454 Government and Politics of China and Japan (3) Examination of the political setting, structure and political processes in China and Japan.
455 Latin American Government and Politics II (3) Selected topics on Latin American political dynamics, consideration of leading theoretical explanations. (Same as Latin American Studies 455.)
459 Government and Politics of the Soviet Union (3) Origins and development of Soviet political system, and study of selected policy areas.
461 Policy Making in Democracies (3) Comparative approach to theory and process of making public policies.
463 Contemporary Middle East Politics (3) Governments and movements in Middle East, their characteristics, bases, and interrelationships.
470 International Law (3) Nature and development of international law and compliance. Function of international law in context of international conflict.
475 Ancient and Medieval Political Thought (3) Survey of major ancient and medieval thinkers from Socrates to Marsilio of Padua.
476 Modern Political Thought (3) Survey of major western political thinkers from Machiavelli to Marx.
500 Thesis (1-15) P/NP only, E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or...