ate major program. At least two-thirds of the total hours in the degree program must be at or above the 500 level and must include 501 (at each offering during residency), 504 and 3 semester hours at the 600 level. In the thesis option, 6 hours must be Thesis 500. A final examination is required in both programs.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those who demonstrate proficiency in conducting independent research. Students must have a broad foundation and understanding of the discipline; these should have been achieved in a comprehensive Master’s program. Course requirements for the degree shall be determined by the student’s faculty committee in accordance with specific interests and needs. The program must include 504, 515, 599, 9 hours of 600-level seminars, and (at each offering during residency) 501. A minimum of 12 hours must be earned in related fields outside the department. Competence in cartographic and quantitative techniques is required. Additional tools, including languages, will be required as appropriate to the student’s areas of research specialization. Examinations required for admission to candidacy include a written comprehensive; written examinations on two special fields and qualitative examination on the student’s program, the special fields, and the dissertation proposal. Also required is a final oral examination on the dissertation and on other aspects of the program as determined by the student’s doctoral committee.

MINOR IN ENVIRONMENTAL POLICY

The department participates in a program designed to give Master’s level graduate students an opportunity to develop an interdisciplinary specialization in environmental policy. See Economics for program description.

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 Geography is available to residents of the states of Alabama, Arkansas, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The Master’s program is also available to residents of Texas and Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

411 Computer Mapping and Geographic Information Systems (3) Concepts, management, and presentation of digital data for spatial analysis: cartographic data structures. Prereq: 310 and knowledge of computer languages or consent of instructor. 2 hrs and 1 2-hr lab.

412 Cartography (3) Cartographic techniques applied to design, compilation, and reproduction of maps and other graphics. Prereq: 310 or consent of instructor. 2 hrs and 1 2-hr lab.

413 Remote Sensing: Types and Applications (3) Principles of remote sensing with emphasis on sensors, their input, output, and applications. Prereq: 310 or consent of instructor.

415 Quantitative Methods in Geography (3) Geographical application of statistical techniques, point pattern analysis, and analysis of areal units. Prereq: Mathematical
633 Seminar in Physical Geography (3) Prereq: 533 or consent of instructor. May be repeated. Maximum 6 hrs.
635 Seminar in Biogeography (3) Prereq: 535 or consent of instructor. May be repeated. Maximum 6 hrs.
641 Seminar in Urban Geography (3) Prereq: 541 or consent of instructor. May be repeated. Maximum 6 hrs.
643 Seminar in Rural Geography (3) Prereq: 443 or consent of instructor. May be repeated. Maximum 6 hrs.
649 Seminar in Geography of Transportation (3) Prereq: 549 or consent of instructor. May be repeated. Maximum 6 hrs.
663 Seminar in Geography of the American South (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
673 Seminar in Geography of Latin American (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
677 Seminar in Biological Conservation (3) Conduct of original research. Prereq: 577 or consent of instructor. May be repeated. Maximum 6 hrs.

Geological Sciences
(College of Liberal Arts)

MAJOR DEGREES

Geology M.S., Ph.D.

Harry Y. McSween, Head

Professors:
Broadhead, Thomas W., Ph.D. .......... Iowa
Hatcher, Robert D., Jr. (Distinguished Scientist), Ph.D. .......... Tennessee
Kopp, Otto C., Ph.D. .................. Columbia
Labotka, Theodore C., Ph.D. ........ Caltech
McLaughlin, Robert E. (Emeritus), Ph.D. .......... Tennessee
McSween, Harry Y., Ph.D. .......... Harvard
Misra, Kula C., Ph.D. ........ Western Ontario
Taylor, Lawrence A., Ph.D. .......... Lough
Walker, Kenneth R. (Carden Prof.), Ph.D. .......... Yale
Walls, James G. (Emeritus), Ph.D. .......... North Carolina

Associate Professors:
Bryerly, Don W., Ph.D. .............. Tennessee
Clark, G. Michael, Ph.D. .......... Penn State
Delcourt, Paul A., Ph.D. .......... Minnesota
Dries, Steven G., Ph.D. .......... Wisconsin
Dunne, William M. (Liaison), Ph.D. .......... Bristol
McKinney, Michael L., Ph.D. .......... Yale
Williams, Richard T. II., Ph.D. .......... VPI&SU

Assistant Professors:
McKay, Larry D., Ph.D. .......... Waterloo
Mora, Claudia L., Ph.D. .......... Wisconsin

The Department of Geological Sciences offers both the M.S. and Ph.D. degrees in Geology. Persons interested in these programs should contact the Director of Graduate Admissions in the department.

For admission, an applicant must provide transcripts of previous university work, two rating forms or letters of recommendation, and GRE scores, including the subject exam in geology (or in another area if geology was not the area of previous university-level concentration). Students are not normally admitted under provisional or non-degree status.

Prerequisite for both degrees is a Bachelor's degree, including coursework in mineralogy, optical mineralogy, petrology, stratigraphy, paleontology, structural geology, and field geology. One year each of coursework in calculus and chemistry and one year of coursework in biology, physics, or statistics are also required. Applicants lacking any of these may be permitted, but the deficiencies must be removed within the first year without graduate credit. Substitutions may also be allowed.

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 555 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, 558.
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 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 geology 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 there is a body of geological literature, as approved by the student's dissertation committee.

GRADUATE COURSES

401 Quantitative Methods in Geology (3) Applications of calculus and differential equations to problems in earth sciences. Examples of density equation in hydrogeology; wave equation in geophysics; mechanical modeling and boundary conditions in structural geology and tectonics.

Preq: Thedynamic Earth or Earth, Life, and Time, 2 semesters of calculus.


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

421 Invertebrate Paleontology (4) Survey of invertebrate animal phylogeny and other aspects of invertebrate evolution. Prereq: Paleobiology or consent of instructor. 2 hrs and 1 2-hr lab.

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


450 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery. Prereq: 101-102. (Same as Geology 450). 2 hrs and 1-2 hr lab.

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


471 Fieldwork in Geophysics (2) Geophysical investigations applied to solution of problems in tectonics, hydrogeology, or environment. Summer field course off-campus. Requires full-time for 2 or more weeks. 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 plate tectonics, volcanism, paleo environments, geomagnetism, and isotopic systems of interior, and earth's temperatures. 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 metallurgy. Prereq: 310 and 330 or equivalents. Recommend: 310. 4 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 or 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/N/C only. E
555 Structure of the Southern and Central Appalachian (3) Structural development of Southern and Central Appalachians from proterozoic- early Paleozoic rift- rift platform margin through processes related to tectonic events producing accretionary elements that formed Appalachian through out the Paleozoic. Comparisons to similar orogens. Prereq: Structural Geology.

553 Ground Water Hydrology (3) (Same as Environmental Engineering 593.)

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

545 Sandstone Petrology/Physical Sedimentology (4) (Field and laboratory analysis of arenaceous clastic rock types; physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. Prereq: 410 or equivalent. 3 hrs and 1 lab.

552 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonates sediments and diagenesis of resistant rocks; field and laboratory analysis of sample material and preparation of scientific reports. 3 hrs and 1 lab.

550 Regional Geomorphology (3) Integrative approach to study of modern and ancient geomorphological regions stressing links and similarities across boundaries. Unique characteristics of major divisions, provinces, sections, and districts. May be repeated with consent of instructor. Maximum 6 hrs. (Same as Geography 555.)

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

557 Quaternary Paleoclimatology (3) Perturbation, process, and pattern within Quaternary ecosystems; climatic change and vegetational responses during last 2.5 million years. Prereq: Consent of instructor.


561 Aqueous Geochemistry (4) Introduction to and applications of equilibrium thermodynamics to earth surface environments; geochemistry of natural water, weathering reactions, and early sediment diagenesis. Prereq: Chemistry 120-30. 3 hrs and 1 lab or seminar.

563 Stable Isotope Geochemistry (3) Theoretical aspects of stable isotope fractionation and applications to geologic systems. Isotope exchange, variations in natural waters, diagentic, hydrothermal, and metamorphic systems. Prereq: General Chemistry or equivalent.


568 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, x-ray fluorescence, and atomic absorption spectrophotometry techniques. 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; recent literature. 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 ranges 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 Orogeny (4) Tectonic development of orogenic belts in context of newest 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 sub-surface features using reflected seismic waves. Energy sources, modes of wave propagation, field procedures, computer data processing, and pitfalls. Application to tectonic and environmental problems. Prereq: 470 or consent of instructor.

585 Contaminant Hydrogeology (3) Physical transport processes, isolopes and groundwater age dating, processes influencing inorganic, organic and microbial contaminants, sampling and monitoring methods, remediation of contaminated groundwater, aquifer porosity. Prereq: 485 or 535; 460 or 561; or Environmental Engineering 553 or equivalent; and consent of instructor.

586 Field and Laboratory Methods in Hydrogeology (3) Research methods. Measurement of hydraulic properties, drilling, sampling and instrumentation, tracer experiments. Formulating hypotheses and research plans. Prereq or coreq: 485 or 535; 365; and consent of instructor.

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

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

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

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

594 Field Problems in Geology (1-2) Literature study and seminars on specific regions of geologic interest, supplemented by extended field trip. 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. 3 credits.

600 Bachelor's Research and Dissertation (3-15) P/N only. E.

620 Seminar in Paleontology (3) may be repeated with consent of department. Maximum 9 hrs.

630 Seminar in Petrology (3) may be repeated with consent of department. Maximum 9 hrs.

640 Seminar in Sedimentary Geology (3) may be repeated with consent of department. Maximum 9 hrs.

650 Seminar in Geomorphology and Quaternary Geology (3) may be repeated with consent of department. Maximum 9 hrs.

660 Seminar in Geochemistry (3) may be repeated with consent of department. Maximum 9 hrs.

670 Seminar in Structural Geology (3) may be repeated with consent of department. Maximum 9 hrs.

675 Seminar in Geophysics (3) Advanced treatment of selected topics in geophysics. Prereq: 470 or consent of instructor.

680 Seminar in Economic Geology (3) may be repeated with consent of department. Maximum 9 hrs.

Germainic 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. (Emeritus), Ph.D.......Northwestern
Ritzehoff, Ursula C. (Emeritus),
Ph.D..............................Connecticut

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

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

Instructor:
Hoering, Peter, Ph.D...................Wisconsin

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 520 (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.

The coursework for Track II must be distributed as follows: (1) at least 45 hours in the first concentration; (2) at least 12 hours in the second concentration; and (3) at least 6 hours in a cognate field.

1. First Concentration: French or Spanish. It consists of 45 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 27 hours at the 500 level (exclusive of thesis hours), including French 584 (3) or Spanish 550 (3); French 512 (3) or Spanish 512 (3); and French 516 (2) or the appropriate Spanish course.
- 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 12 hours, with a minimum of 3 hours at the 500 level. Students are encouraged to take courses that complement the primary area of expertise in the first concentration, so that this second concentration will be a useful research tool for the dissertation and future professional activities. (Because Track II students will have taken 12 graduate hours instead of 18 hours in the second concentration, they will normally not be eligible to teach that language at institutions which follow SACs guidelines for college foreign language teaching.)

3. Cognate Field: Six hours must be in courses numbered 400 and above and in a field outside the candidate's 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.

4. Additional requirements for both tracks: A student must demonstrate competence in the languages of both the first and second concentrations by taking a test in each language. The test will include reading, writing, listening, and speaking, and should be completed by the time the student reaches 40 hours of study beyond the bachelor's degree. Standardized examinations that may be used for this purpose include applicable portions of either the National Teacher's Examination, the MLA Examination for Teachers and Advanced Students, or the proficiency standards of the United States Foreign Service Institute (FSI). If the student has not chosen a third language as his or her cognate area, basic competence (determined by a reading examination with translation into English administered by the department concerned) in a third language is required. If the student's first and second languages are Romance languages, the third language should be chosen from another language family.

A comprehensive examination on the language and literature of the first and second concentrations must be passed before the student may be admitted to candidacy. The candidate is required to defend his/her dissertation in an oral examination. Central emphasis is put on the doctoral dissertation as a final test of the candidate's scholarly qualifications.

Graduate Teaching Assistants in the program should have the opportunity and will be strongly encouraged to instruct at least two foreign languages, subject to staffing needs. Doctoral students are strongly encouraged to reside and study abroad and will be assisted in identifying potential sources of financial support (e.g., Fulbright, McClure, Rotary fellowships).

For additional courses, see Romance Languages.

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 Admissions Specialist 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 language examinations, and upper-division students desiring reading knowledge of the language. No credit for students having completed 502. May be repeated. Maximum 6 hrs. Undergraduate credit only.

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

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.
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.

530 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 9 hrs.

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

Health, Leisure, and Safety

(College of Education)

MAJORS DEGREES

Public Health ....................... M.P.H.
Recreation and Leisure Studies ............. M.S.
Safety Education and Service ........... M.S., Ed.S.
Health Promotion and Health Education ....... M.S.
Health Education ........................ Ed.D.
Education ................................ Ph.D.

Charles B. Hamilton, Head

Professors:

Gorski, June, Dr.P.H. ..................... UCLA
Hamilton, Charles B. (Liaison), Dr.P.H. ...... Oklahoma

Hayes, Gene E. (Liaison), Ph.D. ............... North Texas State
Kirk, Robert H., H.S.D. .................. Indiana
Neuens, James (Adjunct), Ph.D. ................ Illinois
Rackett, Ian R., Ph.D. ....................... Brown
Wallace, Bill C. (Liaison), Ed.D. .............. Northern Colorado

Associate Professors:

Haughton, Betsy (Adjunct), Ed.D. .......... Columbia
Krick, Ken L., Ph.D. ......................... Indiana
New, John C., Jr. (Adjunct), D.V.M. ........ Texas A&M
Pursley, R. Jack, Ph.D. ...................... Iowa

Assistant Professors:

Aldrich, Tim E. (Adjunct), Ph.D. .............. Texas
Blackmon, James T., Ed.D. .................. Tennessee
Biant, Mary Dale, Ph.D. ...................... Indiana
Ellison, Jack S. (Liaison), Ed.D. ............. Tennessee
Levin, Barbara (Adjunct), M.D. ............. California(San Francisco)
Pressey, Velma W., Ed.D. .................... Tennessee
Zemel, Paula C. (Adjunct), Ph.D. ............. Wayne State

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, the Master of Public Health; the Master of Education; and the Doctor of Philosophy 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 nophonthesis 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 specializations 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 Admissions Specialist 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 services/products. (Same as Public Health 400.) Sp

405 Alcoholism and Alcohol Education (3) Problems of alcoholism. Focus on treatment and community resources. (Same as Public Health 405.) Sp

465 Aging and Health (3) Aging process in health and safety problem. Various types of institutional and delivery systems. F

466 Death, Dying and Bereavement (3) Aspects of dying, death and handling of personal effects. Medical, financial, physical, legal and social implications of death. F, Sp

470 Sex Education As It Relates to Human Sexuality (3) Exploration of human and sexuality. Trends, issues, and content of sex education. E

475 Women's Health (3) Factors influencing women's health and safety problem. Various types of institutional and delivery systems. F

501 Health Promotion and Health Education Program Development (3) Theories and principles of health promotion program development; methodology, market, 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 in concentrated period of time. May be repeated. Maximum 12 hrs.

570 Special Topics (1-3) For graduate students, special topics in advanced in-depth discussion of educational health counseling techniques, materials, and health care facility. Sp

590 Research Methods in Health (3) Basic research techniques in variety of health field. Development of research skills and problem identification in research topic. (Same as Public Health 590.) F

592 Directed Independent Studies (1-3) Individualized study of health and safety issue. Special assignment to instructor before registration. May be repeated. Maximum 12 hrs. E

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

601 Internship/Research in Safety and Health (3-5) (Same as Safety 601.)

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

620 Advanced Research Techniques in Health (3) Advanced theories and techniques of research design and methodologies in health discipline. Prereq: 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 individual. (Same as Public Health 650.) Sp

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

Graduate study with a major in Public Health leads to the Master of Public Health (M.P.H.). Three professional preparation concentrations are available: (1) community health education, (2) health planning/administration, and (3) 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 the intercollegiate Graduate Statistics Program.

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. Preference for admission to degree status shall be given to those with a minimum undergraduate grade-point average of 2.6 and with at least one year of professional experience in a health-related occupation. No provisional students will be admitted. 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 36 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 concepts, theories, and skills in an actual work setting. Students must complete all assigned prerequisite coursework during 24 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 component of the curriculum. Approval must be received from the Public Health Academic Program Committee and is contingent on consent of major advisor, formal written proposal by the student, and completion of an additional research methods 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 interdepartmental/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 Admissions Specialist 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/professor 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 of enrollment in graduate studies.

GRADUATE COURSES

400 Consumer Health (3) (Same as Health 400.)
140 Health in the Work Environment (3) Fundamental activities in field of industrial hygiene aimed at reducing health problems for workers. Workplace health hazards and problems of concern to nurses, medical staff, management, engineers and others in industrial health and safety fields. Permission of instructor. May not be taken for credit by occupational health concentration majors.
480 Special Topics (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
502 Registration for Use of Facilities (0-15) 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.
505 Continuing Education in Public Health (1-3) Selected learning activities and experiences in specialized 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 to program accomplishing 4 hrs. (Same as Nutrition 509, Nursing 509, Physical Education 509 and Social Work 509.) S/NC only.
510 Environmental and Occupational Health (2) Complexities of person and 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.
513 Industrial Hygiene Instrumentation and Sampling (3) Instruments and methods for evaluating industrial environment for personal exposure to chemical and physical stressors affecting worker's health. Lecture, demonstration, and lab. Prereq: 511, MPH (OEHS) major, and consent of department.
514 Industrial Toxicology and Occupational Exposure (3) Principles of biological, chemical and physical toxic mechanisms, portals of entry, physiologic and biochemical responses. Occupational exposure assessment, physical factors and environmental conditions that influence exposure characterization, statistical aspects of sampling, and transport of contaminants into general environment.
520 Public Health Policy and Administration (3) Administrative considerations of community-based health care programs and public health practice. Public health formulation, political environment and governmental involvement in health, legal responsibilities, and management concepts and techniques. F
521 Organization Theory and Health Care Delivery (3) Administrative and Organization theory related to health facilities; organization and operation of community hospital. Case discussion and problem-solving exercises; managerial functions and skills.
523 Management in Extended Care Settings (3) Managerial concepts and theoretical foundations essential to supervision and administration of domiciliary health services programs. Management and operation of health services programs for patients and clients in settings which provide activities of daily living and special psychosocial environmental needs. Programs for home health services, comprehensive medical rehabilitation, nursing homes, congregate living centers and similar type health programs. Prereq: 521 or consent of instructor.
525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health care services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply techniques. Prereq: 520 or consent of instructor.
530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputers, applications and interpretation of vital statistics and introductory research methodology. Prerequisite: first course in epidemiology. Prereq: Introductory statistics or consent of instructor.
540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of health problems. Historical origins of discipline, hypothesis formulation, research design, data analysis and interpretation. Prerequisites: epidemiology, biostatistics or consent of instructor. Maximum 6 hrs.
550 Principles and Practices of Community Health Education (3) Theoretical foundations for community health education; opportunities for skill development in varied 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.
560 Theories and Techniques in Health Planning (4) Overview of health planning concepts and methodologies; systems development, planning, evaluation, and socialization. Principles of planning: formulation and conceptualization of problem, planning, evaluation and implementation. Health problems in planning, community planning, population groups, appropriate designs, and programs for addressing needs. F
562 Group Processes in Health Planning (3) Application of group process techniques in health planning. Techniques of group processes, group decision making, and techniques to encourage innovation and creativity in health planning groups.
Recreation and Leisure Studies

Graduate study with a major in Recreation and Leisure Studies leads to the Master of Science. Professional preparation 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 Sports Related Facilities (3) Principles for operationalizing modern facility maintenance systems and management strategies. Cost tracking, inventory systems, specialized maintenance techniques, safety guidelines, management and maintenance management 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 recreation organizations, 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, management considerations, and research in commercial recreation and tourism. Prereq: 110, junior 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 only. E

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, developmental features of leisure 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 and nature of philosophy; concepts of leisure, recreation, play, work, and other, history of field, and relationships of leisure to contemporary society and to professional practice. Prereq: Consent of instructor. Sp

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

521 Facilitation Techniques in Therapeutic Recreation (3) Role of leisure and recreation services in clinical and non-clinical settings; application of life-style planning, self-awareness, values clarification and awareness training in therapeutic recreation, relationship of leisure education to therapeutic recreation. Prereq: 520 or consent of instructor. 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. Finance, revenue generating techniques, 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 decisions, process of cost analysis, and basic design and maintenance of recreation and sport related facilities. Prereq: Consent of instructor. Sp

590 Graduate Internship (1-6) Required of all graduate students. Minimum 100 clock hrs for each 2 hrs credit. Requires work experience, evaluation by agency and university and written paper. E

591 Directed Study in Leisure & Recreation (1-6) Detailed study of theme, issue, or concern. Designed to meet needs of individual students. May be repeated. Maximum 6 hrs. E

592 Special Topics in Recreation & Leisure Studies (1-6) May be repeated. Maximum 6 hrs. E

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 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 Admissions Specialist in the Office of Graduate Admissions and Records.
History
(College of Liberal Arts)

MAJOR DEGREES

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

Russell Buhite, Head

Professors:
Bergeron, Paul H., Ph.D. ....................... Vanderbilt
Buhite, Russell, Ph.D. ......................... Michigan State
Chmielowski, Edward V., Ph.D. ............. Harvard
Cobb, James C., Ph.D. ......................... Georgia
Finger, John R., Ph.D. ......................... Washington
Graf, Leroy 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
Borriss, W. Wayne, Ph.D. .................... Harvard
Fleming, Cyntia S., Ph.D. ................... Duke
Johnson, Charles W., Ph.D. ................. Michigan
Mudowny, John, Ph.D. ....................... Yale
Pinckey, Paul J., Ph.D. ....................... Vanderbilt
Utley, Jonathan Q., Ph.D. ................. Illinois

Assistant Professors:
Brummet, Palmira 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
Wakeman, Rosemary, Ph.D. ................. California (Davis)

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 I 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 examination followed by an 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 or does not take the examination when required will be dropped 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 the 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 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-hour 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 exam 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 on the dissertation in its 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 degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. F.

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


532 Topics in Modern Europe (3) Reading seminar: secondary sources on movements and trends that are multinational in focus. Focus varies. May be repeated. Maximum 15 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 19th- and 20th-century United States. 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, social impact of war and naval strategy in foreign policy. 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 College of Liberal Arts.

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

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

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/NCO only.


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.


658 Seminar in United States Regional and Local History (3) Research seminar in primary sources culminating in scholarly paper in regional and local history. Focus varies. May be repeated. Maximum 15 hrs.

Home Economics (College of Human Ecology)

MAJOR DEGREE

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 that will develop 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 evaluation, Graduate Record Examination (GRE) scores for the general section or Miller's Analog 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 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 human activity (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.

Human Economics Education (College of Human Ecology)

MAJOR DEGREE

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.

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 Admissions Specialist in the Office of Graduate Admissions and Records.
**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.
6. 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 522, ID 570 and RCS 550.
4. HRA 530 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, Jesse Harris Building.

**Core Experience**

Students must complete a core experience of at least three semester hours taken from at least three different departments including nine hours of supervised experience (outside the 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. Practicum, 2 hours required. Students should register under practicum experiences in the "home" department of the supervising faculty.
3. Human Ecology 585, 1 hour required. Cross-listed with participating departments.
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 Admissions Specialist in the Office of Graduate Admissions and Records.

**GRADUATE COURSES**

**500 Thesis (1-15) S/NC 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 database searches.

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**Human Performance and Sport Studies**

(Contains Education)

**MAJORS**

**DEGREES**

<table>
<thead>
<tr>
<th>Major</th>
<th>Degree</th>
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<tbody>
<tr>
<td>Human Performance and Sport Studies</td>
<td>M.S., Ed.D.</td>
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<tr>
<td>Education</td>
<td>Ph.D.</td>
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</tbody>
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**Professors:**

- Capen, Edward K. (Emeritus), Ph.D. Iowa
- Hooley, Edward T., Ph.D. Wisconsin
- Kozar, Andrew J. (University Prof.), Ph.D.
- Lay, Nancy E., Ph.D. Florida State
- Liebman, W. P., Ph.D. Ohio
- Mead, B. J., Ph.D. Purdue
- Morgan, W. J., Ph.D. Minnesota
- Paul, Joan (Liaison), Ed.D. Alabama
- Phillips, Madge M. (Emeritus), Ph.D. Iowa
- Watson, Helen B. (Emeritus), Ph.D. Michigan
- Wrigley, C. A., Ph.D. Michigan

**Associate Professors:**

- Bassett, David R., Jr., Ph.D. Wisconsin
- Bissett, Patricia A., Ed.D. North Carolina Greensboro
- DeSmet, James R., Ed.D. North Carolina Greensboro
- Jones, Ralph E., Ph.D. Toledo
- Kelley, D. R., Ed.D. Georgia State
- Nampey, Thomas, M.D. Washington (St. Louis)
The following retention policy applies to all graduate students seeking a degree in the Department of Human Performance and Sport Studies:

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 major status revoked.

MINOR IN GERONTOLOGY

Graduate students in the Department of Human Performance and Sport Studies may pursue a minor in gerontology. This interdepartmental/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 a tuition-free basis. The Master's program in Human Performance and Sport Studies is available to residents of Georgia (concentration in motor behavior only). Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

Human Performance and Sport Studies

GRADUATE COURSES

405 Sociology of Sport (3) (Same as Sociology 405.)
411 Adapted Physical Education (3) Developmental disabilities, childrehandicaps, and invarient characteristics of specific syndromes germane to motor development/programming for those with special education needs.
423 Readings in Physical Education (2) Review of current and classic literature in physical education.
480 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. 3 hrs and 1 lab. (Same as Zoology 490.)
500 Thesis (1-15) P/NP only. E
501 Special Project (3) Culminating experience for non-these major. Research study suitable for publication, or practicum requiring special written work. Prereq: 532.
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N option: E
509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 599, Nursing 599 and Social Work 599.)
511 Administrative/Supervisory Processes in Physical Education (3) Organizational concepts, management strategies, and specialized studies related to physical education programs at all levels.
512 Application of Theory to Curricular/Methodological Decision in Physical Education (3) Application of current principles and theories to educational situations for development of curriculum and lessons in physical education. Various methodological approaches.
514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues.
515 Social Theories of Sport (3) Liberal, democratic, and Marxist social theories of sport. (Same as Sociology 594.)
528 Motor Behavior: A Theoretical Perspective (3) Motor behavior from information processing perspective. Overview of current research that supports theoretical bases. Prereq: Undergraduate course in general psychology or consent of instructor.
531 Biomechanics of Human Performance (3) Human movement; teaching, coaching, and sports medicine. Prereq: 422 or equivalent.
532 Seminar in Research Techniques in Physical Education (3) Evaluates, compares, and contrasts research techniques in physical education with considerations for and experiences in appropriate research design, and analysis procedures and proposal development.
533 Psychology of Sport (3) Social psychological factors influencing human behavior in sports context; discussion of contemporary theory, research, and methodology. Prereq: General psychology course or consent of instructor.
534 Motor Behavior and Skill Acquisition (3) Topical explanation and application of principles of human movement behavior to acquisition and performance of skills; discussion of current research and methodology.
535 Sport Administration (3) Development of knowledge and analytic skills desirable for middle and upper level managers/administrators in sport business/organization.
541 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated.
542 Sociological Aspects of Sport and Physical Education (3) Social and cultural factors influencing sport and physical education. Pertinent issues and research applications. Prereq: Consent of instructor. (Same as Sociology 542.)
544 Theories of Physical/Movement Education (3) Integration of various theoretical perspectives to physical education/movement education within cultural context; research and field work.
553 Advanced Adapted Physical Education (2) Curriculum development and teaching methodologies in programming for child with special education needs. Prereq: 411 or consent of instructor. Coreq: 554.
554 Advanced Adapted Physical Education Practicum (1) Curricula and methodologies implemented in lab in school for handicapped. Coreq: 553.
555 Motor Assessment and Programming for the Child with Special Education Needs (3) Criterion and norm-referenced tests used in development of individualized education programs for child with special physical education/motor development needs. Testing protocols which permit interpretation at basic level which measure symptoms of dysfunction; efficacy of remediation theories based or related to testing protocols. Evaluation of motor skill in exceptional children and
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, 606 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: New 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. 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; Social Work 585; Sociology 585.
- Psychology 511, 522, 610; Management/Psychology 625, 626, 627, 638; Psychology 505, 550, 551, 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). A Master's candidate must pass a final oral examination.

In addition to course requirements, a Master's student must complete a comprehensive examination in general psychology within no more than two years by attaining a
score of 530 (or 85th percentile) on the Subject GRE (Psychology-81).

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.

THE DOCTORAL PROGRAM

Any student in the doctoral program may be required to prepare a Master's thesis by the Industrial and Organizational Psychology Committee. This policy will be implemented by the committee at such time as a review of the student's record suggests that additional data on the qualifications for pursuing a Ph.D. are required.

A dissertation is required with a minimum of 24 semester hours of Management or Psychology 600.

The doctoral degree can be completed with a minimum of 54 semester hours in the major as follows:

Management 567-68 or Psychology 517-18, Psychology 557, Statistics 537-8.

A minimum of five doctoral seminars (15 hours) selected from: Management 610; Management/ Psychology 625, 626, 627, 638; Psychology 620, 624. (Five doctoral seminars are viewed as the absolute minimum; more are recommended. Statistics 671 and Psychology 605 are also recommended.)

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 outside of their dissertation may register for Management 525, 526 (Maximum 6 hrs per term; courses may be repeated) or Management/ Psychology 990.

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.

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 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 Admissions Specialist in the Office of Graduate Admissions and Records.

Industrial Engineering

(College of Engineering)

MAJOR

DEGREE

Industrial Engineering

C. H. Aiken, Head

Professors:

Bontecou, J. A., Ph.D. .......... Ohio State

Claycombe, W. W., Ph. D. .......... VPI

DePorter, Elden L., Ph. D. .......... VPI

Doult, Dan C. (Emeritus), PE, M.S. Tennessee

Emerson, H. P. (Emeritus), PE, S.B. .......... MIT

LaFerre, R. M. (Emeritus), PE, M.S. .......... Georgia Tech

Loveless, Howard L. (Emeritus), PE, M.S. .......... NC State

Schmitt, Harold W., Ph. D. .......... Texas

Snider, John N., Ph. D. .......... Ohio State

Associate Professors:

Aikens, C. H., Ph.D. ................ Tennessee

Halley, M. L. (UTSI), Ph.D. .......... Texas Tech

Hungerford, J. C., Ph.D. .......... Ohio State

Hutchinson, D. H., Ph.D. .......... Tennessee

Kirby, K. E., Ph.D. .......... Florida

Parkinson, E. L. (UTSI), Ph.D. .......... Tennessee

Professor:

Goodman, Marvin K. (Emeritus), PE, M.S. .......... Tennessee

Jackson, D. F., Ph.D. .......... Tennessee

Sawhney, Rup S., Ph.D. .......... Tennessee

The Department of Industrial Engineering offers a graduate program leading to the Master of Science degree with major 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 with a specialization in industrial engineering.

THE MASTERS 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 background 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 30 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 33 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


402 Production System Planning and Control (3) Theory and application of forecasting systems, regression and time series models, independent demand inventory models, development of safety stock, coverage of all modules of Manufacturing Resource Planning (MRP) systems; master production scheduling, resource requirements planning, bill of material and inventory file structures, material requirements planning, capacity planning, shop floor and purchase order control. Overview of just-in-time inventory concepts and MRP's role in manufacturing automation. Prereq: 301.

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, banking, 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.


521 Informational Systems I (3) Systems engineering approach to design, development, implementation, and evaluation of systems of information. Informational aspects of IE systems. Data structures and database management systems. Prereq: 402 or 403 and senior standing.

522 Senior Industrial Engineering Problems Analysis (3) Application of industrial engineering to field assignments in local organizations. Problem definitions, analysis and presentation. Prereq: 402, 403, and 405.


440 Total Quality Management (3) Philosophy of continuous improvement in organizations: management, implementation issues, definition, identification, and analysis of systems as compared to process analysis and improvement; flowcharts, pareto diagrams, cause and effect diagrams, and seven new tools: data collection and control strategies: capability analysis; quality of design; components of variation; measurement issues; issues relevant to computer management of quality in short-run environments; use of classical statistical tools: correlation and experimental design to improve system value. Lab. Prereq: Quality Control or consent of instructor.

500 Thesis (1-15) PNP only. E

501 Design Project (1-3) Enrollment limited to industrial engineering students planning to graduate. May be repeated. Maximum 6 hrs. S/N/C 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/N/C only.


518 Advanced Engineering Economy (3) Application of engineering economic analysis in complex decision situations. Inflation and price changes; uncertainty evaluation using nonprobabilistic techniques; capital financing and project allocation; maintenance and replacement, investor-owned utilities, and public works projects; probabilistic risk analysis using computer simulation and decision analysis; and other advanced topics. Prereq: Probability and Statistics for Scientists and Engineers I and 405, or equivalent. (Same as Engineering Management 518.)


522 Optimization Methods in Industrial Engineering (3) Classical optimization theory, undimensional and non-dimensional search techniques, Lagrangian relaxation, separable programming, linearization techniques, quadratic programming, and dynamic programming. Prereq: 201 or 207.

523 Linear Programming and Extensions (3) Simplex and dual simplex methods, parametric and post-optimal analysis, use of LP software, integer programming techniques, branch and bound and cutting plane algorithms, network problems, transportation problems, 380 or 385.


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 Industrial Engineering (3) Manufacturing and management techniques applied to capital budgeting, advanced topics in multiple attribute decision analysis, Bayesian analysis of sequential decision making, and applications in complex decision analyses. Prereq: 518, 323.


Engineering Management

GRADUATE COURSES

501 Capstone Project (3-6) Application-oriented project to show competence in major academic area. Prereq: Enrollment in engineering management. May be repeated. Maximum 6 hrs. S/N/C 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/N/C only.

516 Statistical Methods in Industrial Engineering (3) (Same as Industrial Engineering 516.)

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

531 Motivation and Culture in Engineering Management (3) Motivational theories and practice to improve individual and organizational capabilities. Success in meeting goals, improving creativity/innovation, and leadership and personal interrelationship skills. Improvement through organizational structure, policy, and work design. Prereq: 533 or consent of instructor.

532 Productivity and Quality Engineering (3) Productivity and quality measures defined and used to analyze current comparative position of important sectors of American industry with respect to national and international competition. Study of management theorists and systems which promote or inhibit productivity or quality improvements.

533 Theory and Practice of Engineering Management (3) Manager's perspective; business definition; strategic planning and management; marketing and competition in global economy; finance; organization; systems thinking; production control; corporate culture and leadership in new organization; and quality, empowerment, and learning organizations. Principle application to work settings and case studies.


535 Management of Technology (3) Creativity and innovation; incorporation of advanced technology equipment; application of systems thinking; new methods in business and manufacturing organizations; justifying technology; assimilating and maintaining change; changing management roles; and impacts of new technologies. Prereq: 539 and Industrial Engineering 516.

536 Project Management (3) Development and management of engineering-technology projects. Project proposal preparation: resource and cost estimating; project planning, organizing, and controlling: network diagrams and other techniques. Role of project manager: team building, conflict resolution, and contract
critical factors: Black feminism, violence, concepts of masculinity, family, white males, white females, homosexuality, nationalism, and athletics.

483 African-American Women in American Society
(Same as African and African-American Studies 483.)

483 African-American Women in American Society
(Same as Women's Studies 483.)

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.)
485 Special Topics in Language (3) (Same as English 485.)

Urban Studies
GRADUATE COURSES
401 The City in the U.S. (3) (Same as Planning 401.)
441 Urban Geography (3) (Same as Geography 441.)
464 Urban Ecology (3) (Same as Sociology 464.)

Women's Studies
GRADUATE COURSES
400 Topics in Women's Studies (3) Content varies. May be repeated.
422 Women Writers in Britain (3) (Same as English 422.)
425 Women's Health (3) (Same as Health 425.)
434 Psychology of Gender (3) (Same as Psychology 434.)
466 Rhetoric of the Woman's Rights Movement to 1930 (3) (Same as Speech Communication 466.)
476 Rhetoric of the Contemporary Feminist Movement (3) (Same as Speech Communication 476.)
483 African-American Women in American Society (3) (Same as African and African-American Studies 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
Bowie, Dorothy, Ph.D. ..................... Wisconsin
Cade, Dozier C. (Emeritus), Ph.D. .............. Iowa
Crook, James A., Ph.D. ........................ Iowa
Everett, George A., Ph.D. ..................... Iowa
Haskins, Jack B. (Emeritus), Ph.D. ........ Iowa
Lange, John L. (Emeritus), M.A. ............... Iowa
Leier, B. Kelly (Emeritus), Ph.D. ............... Southern Illinois
Littmann, Mark, Ph.D. ...................... Northwestern
Miller, M. Mark, Ph.D. ....................... Michigan State
Singletary, Michael W., Ph.D. .... Southern Illinois
Tucker, Willis C. (Emeritus), M.S. .... Kentucky

Associate Professors:
Caudill, C. Edward, Ph.D. ........ North Carolina
Heller, Robert B., M.A. ................. Syracuse
Lancarelli, Susan M., Ph.D. ........ Tennessee
Morrow, Jerry L., Ph.D. ..................... Toledo
Puett, Sammie Lynn, M.S. ............... Tennessee

Interdisciplinary Programs
(College of Liberal Arts)
The College of Liberal Arts offers a series of interdisciplinary undergraduate majors and minors through its Interdisciplinary Programs. These programs include African and African-American Studies, American Studies, Ancient Mediterranean Civilizations, Asian Studies, Cinema Studies, Comparative Literature, Latin American Studies, Linguistics, Medieval Studies, Russian and East European Studies, 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
450 Issues and Topics in African-American Studies (3) Problems, topics, issues, and individuals. May be repeated. Maximum 6 hrs.
452 Black African Politics (3) (Same as Political Science 452.)
461 African Prehistory (3) (Same as Anthropology 461.)
473 Black Male in American Society (3) Development of historical images, myths and stereotypes. Impact of
Assistant Professor:
Foley, Daniel, M.S. ............. Northwestern

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 operation of world mass communications channels and agencies. Comparative analysis of media, media practices, and flow of news worldwide. Print and broadcast systems in terms of relevant social, political, economic, and cultural factors. Relation of communications to international affairs and understanding. Sp

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 material, understanding 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.

420 Print Media Management (3) Current business practices among print news media, especially newspapers. Problems in management and production and outlook for new technologies. Prereq: 6 hrs mathematics and/or accounting and senior standing. Sp

430 Public Affairs Reporting (3) Reporting and writing about courts, governments, and public agencies. Event-oriented journalism of politics and public affairs. Prereq: 300, E.

433 Advanced Editing (3) Sensitivity to language and editing skills. Headline writing, layout, and production. Prereq: 203.

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

450 Writing About Science, Technology, and Medicine (3) Writing workshop to analyze successful science writing and write series of articles for general public based on scientific journals, news conferences, technical meetings, and interviews. Prereq: Consent of instructor. (Same as Library and Information Science 450). 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 interviews of experts in environmental science and reporting. Examines publications 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, Isaac Asimov, and Richard Selzer. Analysis of literary qualities in quest to understand why some science writing succeeds. Prereq: Consent of instructor.


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

480 Journalism in the High School (3) Functions and methods of high school publications. Problems related to staff selection, content of publications, copy, layout, photography, printing, and business. Prereq: Course work in communications.

490 Advanced Photojournalism (3) Advanced principles and techniques of black-and-white photography, introduction to color photography. Prereq: 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. Prereq: Communications 200. E

535 Publications Management (3) Problems in management of production, marketing, and design. Techniques of writing, editing, and presenting comprehensive articles and other material; regional and specialized magazines. Individual editorial projects. Prereq: 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 information between institutions and organizations and their publics. Measurement and evaluation of effectiveness of communication programs. Prereq: Consent of instructor.

580 Seminar in Visual Communication (3) Behavioral aspects of communication with images. Theory of psychological effect in color, shape, texture, and other design elements. Prereq: 205 or Advertising 350 or Broadcasting 430 or equivalent.

590 Communications and International Development (3) Relationship between mass communications and development of nations. Role of mass communications media in "Third World" regions of globe. Communications as facilitator of international cooperation.

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

598 Internship (3) Professional work in journalism supervised by editor or manager with faculty approval. No retroactive credit for previous work experience. Prereq: Completion of core curriculum.

## Law

(Province of Law)

### DEGREES

**MAJOR**

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>J.D., J.D.-MBA, J.D.-M.P.A.</th>
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<tr>
<td>Professors:</td>
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<tr>
<td>Best, Reba, M.L.S.</td>
<td>Florida</td>
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<tr>
<td>Blaise, Douglas A., J.D.</td>
<td>Georgia</td>
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<tr>
<td>Cohon, Neil P., LL.M.</td>
<td>Harvard</td>
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<tr>
<td>Cook, Joseph G., LL.M.</td>
<td>Yale</td>
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<tr>
<td>Dessem, Lawrence, J.D.</td>
<td>Harvard</td>
</tr>
<tr>
<td>Gray, R. Macdonald (Emeritus), LL.M.</td>
<td>George Washington</td>
</tr>
<tr>
<td>Hardin, Patrick, J.D.</td>
<td>Chicago</td>
</tr>
<tr>
<td>Hess, Amy M., J.D.</td>
<td>Virginia</td>
</tr>
</tbody>
</table>

**J.D.**

- North Carolina
- Pennsylvania
- Michigan
- Illinois
- Michigan
- Washington
- New York
- Michigan
- Alabama
- New York
- Florida
- Virginia
- North Carolina
- Pennsylvania
- Harvard
- Duke
- Michigan
- Duke
- Vanderbilt
- Yale
- Texas
- Illinois
- Duke

The College of Law offers the Doctor of Jurisprudence degree program; a dual program with the College of Business Administration leading to the J.D. and the Master of Business Administration degree; and a dual degree program with the Department of Science, College of Liberal Arts, leading to the J.D. and Master of Public Administration. 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
sneers 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 and 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 Law will award a maximum of nine (9) semester hours toward the J.D. degree for acceptable performance in approved graduate-level 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.

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.

Except while completing the first year courses in the College of Law, students are encouraged to maximize the integrative facets of the dual program by taking courses in both colleges each year.

**Awarding of Grades**

For grade recording purposes in the College of Law for graduate law 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 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 B 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 towards their J.D. degree for courses taken in other departments of the University except for those taken in conjunction with the dual 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 enroll in 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. An applicant's LSAT score may be substituted for the Graduate Record Examination (GRE) 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 by 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 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 will show the actual grade assigned by the instructor without conversion.

**POLICY FORGRADUATE 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/NC grade only. If a 2.0 or above is earned in a course of 3.00 credit units, the course 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
801 Civil Procedure I (3) Binding effect of judgments, selecting proper court (jurisdiction and venue), ascertaining applicable law, and federal and state practice.


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

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

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

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

807 Torts I (3) Intentional torts, including battery, assault, false imprisonment, infliction of emotional distress, conversion and trespass; products and premises; owner defenses to intentional torts; negligence, including standard of care and proof of negligence; immunity and limitations on duties; causes 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; non-tort alternatives for recovery; personal injury; law reform; defamation, invasion of privacy, and wrongful legal proceedings; misrepresentation, injurious falsehood, misappropriation of chattels, and interference with contract; constitutional torts.

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

810 Property (4) Introductory course treating issues of ownership, possession, and title in the areas of landlord-tenant relations; estates in land and future interests; construction and development; property rights and duties; zoning; and adverse possession; and statutes of limitations. Special focus on real estate law.

811 Constitutional Law I (3) Judicial review, limits on judicial power; national legislative power; regulation of commerce; property; and individual rights; natural rights; immunity and separation of powers; state taxation and regulation of commerce; intergovernmental immunities.

812 Evidence (4) Rules regulating introduction and exclusion of oral, written and demonstrative evidence at trials and other proceedings, including relevance, 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) Introduction to major computerized legal data base retrieval systems. Legal research techniques applied throughout year. May be taken beginning spring of first year after completion of first draft of appellate brief in Legal Process I. Must be completed satisfactorily prior to the end of second year of law study. Prereq: Completion of first draft of appellate brief in 816. S/N only.

818 Income Tax I (4) What is income; whose income is it; when is it income; how is it taxed (capital gains and losses, maximum and minimum tax); deductions and credits, rates (corporate, estate, and trust).

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

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

824 Local Government (3) Distribution of power between state and local governmental units; sources of authority for local governmental units; creation of local boundaries; home rule; problems created by fragmentation of local units; financing of local services; programs on local government finance and decision-making.

825 Business Associations (4) Legal problems associated with formation, operation, and dissolution of corporate firms; legal rights and duties of shareholders; directors and officers; and purchasers of corporate securities in connection with federal securities laws.

826 Antitrust (3) Federal antitrust laws; monopolization, price fixing, group boycotts, and other restraint of trade practices; generally, government enforcement techniques and private treble damage suits.

827 Business Planning Seminar (2) Selected topics from business planning and transactions. Prereq: 822, 826. May be repeated.

828 Advanced Business Associations Seminar (2) Selected topics from business planning and transactions. Prereq: 822, 826. May be repeated.

830 Securities Regulation (3) Basic structure of federal securities laws. Legal problems associated with raising capital by new and existing enterprises; government and private remedies for misconduct by issuers and underwriters; corporate transactions by promoters, officers, directors and other insiders; regulation of securities; litigation under Rule 10b-5 and other antifraud provisions; and provision of legal and other professional services in connection with securities transactions.

832 Tax Planning Seminar (2) Selected problems on corporate and tax aspects of business planning and transactions. Prereq: 816. S/N only.

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

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

837 Criminal Law Theory (3) Theoretical foundations of criminal law. Prereq: 809.

839 Criminal Law Seminar I (3) Seminar and colloquium on advanced problems in criminal law and administration of justice. Prereq: 809.

840 Criminal Law Seminar II (3) Seminar and colloquium on advanced problems in criminal law and administration of justice. Prereq: 809.

841 Criminal Law Seminar III (3) Seminar and colloquium on advanced problems in criminal law and administration of justice. Prereq: 809.

842 Civil Procedure Seminar (2) Seminar and colloquium on advanced problems in civil procedure. Prereq: 806, 818, 822.

847 Jurisprudence Seminar (3) Seminar and colloquium on advanced problems in jurisprudence. Prereq: 809.

848 Civil Rights Actions (3) Litigation to vindicate constitutional rights in private actions against the government and its officials, as well as rights protected by other civil rights laws and other constitutional provisions. Prereq: 809. S/N only.

849 Civil Rights Actions II (3) Litigation to vindicate constitutional rights in private actions against the government and its officials, as well as rights protected by other civil rights laws and other constitutional provisions. Prereq: 809. S/N only.


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

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

857 Criminal Law Theory (3) Theoretical foundations of criminal law. Prereq: 809.

859 Criminal Law Seminar I (3) Seminar and colloquium on advanced problems in criminal law and administration of justice. Prereq: 809.

862 Family Law (3) Survey of laws affecting informal and formal family relationships: premarital disputes; marriage; separations and divorces; adoption; temporary and permanent removal of children from their parents by the state; juvenile court procedures.


865 Environmental Law Seminar (2) Seminar and colloquium on environmental law. Prereq: 809.

866 Environmental Law Seminar I (2) Seminar and colloquium on environmental law. Prereq: 809.

868 Environmental Law Seminar II (2) Seminar and colloquium on environmental law. Prereq: 809.

869 Natural Resources Law (3) Nature of interests; conveyancing, royalties, grants and reservations, leases, and taxation of natural resources.

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

875 Empirical Studies of Legal Institutions (3) Social, economic and organizational factors that affect behavior of lawyers, judges, and other actors in legal institutions. Empirical studies of subject involvement, structure and organization of bar; factors that affect filing, processing and disposition of claims in civil justice systems; and factors that affect process of case dispositions in criminal prosecutions; plea bargaining process. Factors that sometimes cause "law in action" to operate differently than "law on the books."

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

878 Law and Economics (3) Relationship between legal and economic thought, use of economics in legal decision making and legal criticism.

881 Law and Language (3) Systematic study of literature on and application of legal thought and to accurate, fluent, and creative legal composition.

883 Law, Language, and Reality (3) Intermediate level jurisprudence course. Law as the mind's attempt to define, direct, and administer human activity; exploration, through methods of cognitive psychology, of ethical values underlying formal legal reasoning and legal concepts.

886 Public International Law (3) Law creating processes and doctrines, principles and rules of law that regulate international behavior of states and other entities in international system.
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 educate people to live, work, and flourish in an information society through excellence in teaching, research, and public service in library and information science. The goals and objectives of the school are:

1. To prepare students to understand the nature of information and the role of the library and other information agencies in the management of information resources, and the facilitation of information transfer. Students will demonstrate:
   - Knowledge of the generation, production, management, dissemination, and uses of information.

2. To develop the roles of various organizations/institutions in promoting the flow of information.

3. To understand the role of the librarian/information professional as mediator between information resources and their users.

4. To understand the roles of various tools and technologies in facilitating access to information.

5. To understand the structure and content of information resources in various formats and subjects.

6. To understand the theoretical and practical evolution of information sciences and technologies and their relationship with other disciplines.

7. To develop competence in creating, managing, and accessing information in a variety of formats.

8. To provide services to the state, region, and nation in association, consulting, and continuing education activities which will promote the development and improvement of information systems and services such that the school's contributions reach beyond its immediate academic programs. The school will provide:
   - Continuing education for information professionals and, on a selective basis, to persons outside the information field.

   - Advisory services to libraries and other types of organizations.

   - Leadership for professional associations.

   - To conduct basic and applied research which promotes the generation of new knowledge, services, and technology. The school will encourage:
     - Research which strengthens its instructional and public service programs.
     - The use of a variety of research methods.
     - Sharing the results of its research.

   - Increased research quality and productivity.

ADMISSION REQUIREMENTS

Applicants to the GSLIS program must have taken a minimum undergraduate grade-point average of 3.0 or a satisfactory graduate degree grade-point average for admission as a potential candidate for the M.S.L.S. degree.

The verbal and quantitative aptitude portions of the Graduate Record Examination (GRE) are required of all applicants unless a graduate degree has been completed prior to application for admission. Applicants should take the GRE at least one semester in advance of application for admission and are expected to score in the 50th percentile or above on the verbal portion of the GRE.

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 42 semester hours of graduate courses, 15 hours 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 36 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.

Core Curriculum

The core curriculum is a 15 semester hour sequence of five courses required of all students: 490, 520, 530, 560, 580. These courses address the evolving information environment; foundations of information sciences and technologies; information resources selection, acquisition, and evaluation; information content representation; information access and retrieval. The core curriculum includes a non-credit electronic information and communications laboratory experience required of students during the first semester: 504.

The 15 hour core is prerequisite to all elective courses for students enrolled in the M.S.L.S. degree program. Elective courses may begin in the final semester of core course work with permission of the advisor and the instructor of each elective course selected.

Concentrations

Upon completion of the core curriculum, students may select a concentration from one of the following:

Youth Services in Public and School Libraries: The concentration includes two specializations: public library youth services and school library media services. Within the concentration, 21 hours (485, 571, 572, 573, 555, 599, one elective) are common and 6 hours are taken in the specialization (public library: 554, 592; school library: 475, 551).

Scientific and Technical Information: The concentration includes 18 hours (450, 532, 533, 540, 555, 599) of required courses and 9 hours of elective courses.

Information Systems and Technology: The concentration includes 12 hours (540, 583, 585, 588) of required courses and 15 hours of elective courses.

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 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 as well as a 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, Virginia, or West Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

430 History of the Book (3) History of writing and various methods of bookmarking.

450 Writing About Science, Technology and Medicine (3) (Same as Journalism 450.)

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

485 Electronic Communications and Information Resources on Internet (3) Exploration of worldwide information and communication resources including e-mail, gopher, Archie, Veronica, WAIS, WWW, and newsgroups.

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

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

502 Registration and 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.
504 Electronic Information and Communications Laboratory (3) Methods for creating and managing information in electronic form. Communication of electronic information in networked environment. Location and use of electronic information resources. For GSLIS graduate students only; must be completed satisfactorily in first semester. S/N only.

520 Information Content Representation (3) Principles of distinguishing, describing, and indexing intellectual works, current approaches: citation systems, descriptive cataloging, non-subject indexing, pre- and post-coordinate subject indexing, classification and categorization; authority control of index terms; standards.

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

522 Advanced Cataloging and Classification (3) Cataloging and classification of more difficult materials, use of larger classification systems and subject heading systems. Library of Congress Subject Headings, and introduction to Medical Subject Headings. Prereq: 521.

523 Abstracting and Indexing (3) Philosophies, standards, and procedures for manual and automatic document retrieval involving keyphrase indexing, vocabulary control, thesaurus construction, and abstracting.

530 Information Access and Retrieval (3) Media for information storage, logical and physical information structures, query logic and languages, search strategies and hierarchies, evaluation of retrieval system performance. Search techniques for various types of databases including multi-media, full-text, numeric, bibliographic.

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

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

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

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

535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, etc.; non-bibliographic formulation and database databases, content page/full-text databases, patents, document delivery alternatives, evaluation, and testing. Prereq: 556.

536 Creation and Distribution of Information and Knowledge Resources (3) Historical, political, and societal dimensions of creation, dissemination, growth, and institutionalization of information and knowledge from antiquity to the twenty-first century university and research environments.

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

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

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

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

550 Management of Information Agencies and Services (3) Management and organizational theories, strategies, techniques applicable to libraries, archives, records management programs, and other information agencies. Prereq: 551.

551 School Library Media Centers (3) Planning, implementing, and evaluating school library programs. Curricular involvement, role of technology, relationships with district and state services.

552 Information Centers in Higher Education (3) Development, mission, trends, issues, users, services, and environment of campus information centers including libraries and alternatives: learning resources center and library-computer center models.

553 Specialized Information Agencies (3) Development and present status, scope and objectives of administrative and organizational problems and techniques.

554 Public Library Management and Services (3) Development, roles, political environment, governance, organization, fiscal management, services, marketing, and performance evaluations.

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

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

560 Information Resources Selection, Acquisition, and Evaluation (3) Principles of development and management of collections in information agencies; community analysis; users and use; policies and procedures; evaluation of items and collections; selecting items to meet particular needs.

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

562 Serials (3) Serials collections: selection, acquisition, storage, preservation, use, and public services.

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

564 Corporate Information Systems (3) Objectives and functional elements of records systems, archival programs, management information systems and technologies within organizations.


566 Environmental Scanning for Information Professionals (3) Principles and practice of environmental scanning; information evaluation and synthesis; role of strategic information in modern organization. Prereq: 556.

567 Advanced Production of Audiovisual Software (3) Same as Curriculum and Instruction 569.


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

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

574 Adult Materials and Services (3) Popular informational and recreational materials and services to meet adult interests in variety of formats. Development of specialized collections.

580 Foundations of Information Sciences and Technologies (3) Definitions of information, information sciences, and information technology: theories of information, information representation, retrieval, and transfer standards and techniques; information processing and distribution; research front; bibliometrics and informetrics; relationships with other disciplines.

582 Library Automation (3) Computer-based applications and systems for libraries including MARC, bibliographic utilities, retrospective conversion, circulation systems, online catalogs, computer-based reference services, acquisitions and serials control, systems planning and implementation. Prereq: 585.

583 Information Systems (3) Systems concept, defining system, analysis and design of information systems. Selecting and using information systems to support various activities. User involvement in the development process. Prereq: 585.

584 Database Management Systems (3) Defining data needs, data structures, role of operating systems in data management, file organization, database management systems, logical data models, internal data models, database administration and evaluation. Design and implementation of application using database management system. Prereq: 585.

585 Information Technologies (3) Fundamental concepts and terminology of information technology. Computer communication and network architectures and standards, network hardware and software.

586 Information Retrieval Systems (3) Historical perspective on information retrieval research; statistical and probabilistic retrieval techniques; cognitive user modeling; expert systems; associations, relations and hyper-text. Prereq: 585.

587 Information System Design Project (3) Supervised and structured experience in design and development of computer-based information systems. Prereq: 585, 583, 584 or 586, and 586.

588 Psychology of Human-Computer Interaction (3) Survey of human-computer interaction and introduction to psychological and other behavioral science knowledge and techniques useful in design of computer systems for human use. Basic psychological phenomena of human cognition, memory, problem solving, and language and how these processes relate to and condition interaction between humans and interactive computing systems. Prereq: 585.

590 Problems in Library and Information Science (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

591 Supervised Readings in Library and Information Science (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

592 Seminar in Library and Information Science (3-6) Prereq: Consent of instructor. May be repeated with consent of advisor. Maximum 6 hrs.

593 Independent Study (3-6) Prerequisite: Consent of advisor. Maximum 6 hrs.

594 Graduate Research Practicum (3) Advanced research techniques under supervision of staff research director whose area coincides with interests of student. Prereq: Consent of advisor and research director. S/N only.

599 Practicum (3-6) Opportunity to translate theory into practice under guidance of qualified information professionals. Prereq: Completion of core and pertinent advanced courses relevant to student's practicum design. Minimum 3.0 cumulative GPA. Written consent of advisor and approval of practicum coordinator. May be repeated. Maximum 6 hours.
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 plus an area of specialization will also be an important part of the training experience.

Required courses are Life Sciences 509, 511, 521, 531, 532, Botany 451, Biochemistry 410, 511, Microbiology 410; Botany 451; Chemical Engineering 475; and Zoology 507.

Cellular, Molecular and Developmental Biology

The interdepartmental program in cellular, molecular and developmental biology includes research in structural or functional aspects of cells or subcellular components, or the interfaces between cells.

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 regulations, pest management, pollution control and repair, and testing and residue analysis of toxicants.

Required courses are Biochemistry 561, 562, 604; and Life Sciences 616.

Ethology

Ethology is the naturalist study of normally occurring animal and human behavior. The program provides intensive training in basic ethology with specialization 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, 455; 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 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; and Plant and Soil Science 551; Microbiology 410.
**Management Science**

*(College of Business Administration and Intercollegiate Program)*

**MAJORS**

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<th>Degree</th>
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<td>M.S., Ph.D.</td>
<td>Management Science (12-3)</td>
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<td>MBA</td>
<td>Business Administration</td>
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Charles E. Noon, Chairperson

**Associate Professors:**

Gilbert, Kenneth C., Ph.D. ........................................ Tennessee

Noon, Charles E., Ph.D. ........................................ Michigan

Srinivasan, M. M., Ph.D. ........................................ Northwestern

**Assistant Professors:**

Bowers, Melissa R., Ph.D. ........................................ Clemson

Clelland, Iain J., Ph.D. ........................................ Southern California

Fowler, Oscar S., Management .................................... Georgetown

Greenwood, Thomas G., Ph.D. ..................................... Tennessee

Ladd, Robert T., Ph.D. ........................................... Georgia

Leitnaker, Mary G., Statistics ................................. Georgia

Fryxell, Gerald E., Ph.D. ........................................ Indiana

Bowers, Melissa R., Ph.D. ........................................ Clemson

Gilbert, Kenneth C., Ph.D. ......................................... Tennessee

Edirisinghe, Chanaka F., Ph.D. .................................. British Columbia

Fryxell, Gerald E., Ph.D. ........................................... Indiana

Srinivasan, M. M., Ph.D. ........................................ Northwestern

**Additional Committee Members:**

Fryxell, Gerald E., Ph.D. ........................................... Indiana

Fryxell, Gerald E., Ph.D. ........................................... Indiana

**THE MASTER’S PROGRAM**

The M.S. program in Management Science is an interdisciplinary 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 and development of quantitative techniques and their application to management 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.
Admissions Requirements

The Master's program requires three applicant recommendation 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 Hours
Core Requirements
Management Science 531, 532, 533, 534
Statistics 563
Applied specialization area (approved by advisor) 9
Statistics elective—500 level or above (approved by advisor) or Mathematics—400 level or above (approved by advisor) 6
Electives selected from mathematics, statistics, computer science, and/or management science area 9
TOTAL 38

Hours
Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the minimum 48 hours of coursework, normally is completed in the third year of the program.

ACADEMIC STANDARDS

A graduate student in the College of Business Administration whose grade-point average falls below 3.0 will be placed on probation. A student on probation will be dropped from the program unless his/her cumulative graduate grade-point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next two semester's coursework as established by the degree program for full-time students and the next two semester's coursework as established by the degree program for part-time students.

PREREQUISITES FOR MANAGEMENT SCIENCE COURSES

The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose 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 requirement is 531, 532, and 534.

GRADUATE COURSES

500 Thesis (1-15) P/NP only
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degrees is completed. May not be used toward degree requirements. May be repeated. S/NC only
531 Mathematical Programming (3) Linear programming, duality and sensitivity analysis, network flows, integer, and nonlinear programming, Prerequisite: Fundamentals of matrix algebra and differential calculus, proficiency in computer language
532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory, Prerequisite: Statistics 563 and 564, Probability theory and statistical inference, Mathematics 471, 472, 453, and 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty will consider waiving the mathematics and/or statistics qualifying examinations. These requirements generally are completed by the end of the first year of the program. There is no foreign language requirement.

Comprehensive Examination

Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written comprehensive examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis. Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.

Research and Dissertation

The student must complete 24 semester hours of Management Science 600: Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the minimum 48 hours of coursework, normally is completed in the third year of the program.

PREREQUISITES FOR MANAGEMENT SCIENCE COURSES

The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose 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 requirement is 531, 532, and 534.

GRADUATE COURSES

500 Thesis (1-15) P/NP only
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degrees is completed. May not be used toward degree requirements. May be repeated. S/NC only
531 Mathematical Programming (3) Linear programming procedures, duality and sensitivity analysis, network flows, integer, and nonlinear programming, Prerequisite: Fundamentals of matrix algebra and differential calculus, proficiency in computer language
532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory, Prerequisite: Statistics 563 and 564, Probability theory and statistical inference, Mathematics 471, 472, 453, and 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty will consider waiving the mathematics and/or statistics qualifying examinations. These requirements generally are completed by the end of the first year of the program. There is no foreign language requirement.

Comprehensive Examination

Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written comprehensive examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis. Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.

Research and Dissertation

The student must complete 24 semester hours of Management Science 600: Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the minimum 48 hours of coursework, normally is completed in the third year of the program.

ACADEMIC STANDARDS

A graduate student in the College of Business Administration whose grade-point average falls below 3.0 will be placed on probation. A student on probation will be dropped from the program unless his/her cumulative graduate grade-point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next two semester's coursework as established by the degree program for full-time students and the next two semester's coursework as established by the degree program for part-time students.

PREREQUISITES FOR MANAGEMENT SCIENCE COURSES

The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose 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 requirement is 531, 532, and 534.

GRADUATE COURSES

500 Thesis (1-15) P/NP only
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degrees is completed. May not be used toward degree requirements. May be repeated. S/NC only
531 Mathematical Programming (3) Linear programming, duality and sensitivity analysis, network flows, integer, and nonlinear programming, Prerequisite: Fundamentals of matrix algebra and differential calculus, proficiency in computer language
532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory, Prerequisite: Statistics 563 and 564, Probability theory and statistical inference, Mathematics 471, 472, 453, and 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty will consider waiving the mathematics and/or statistics qualifying examinations. These requirements generally are completed by the end of the first year of the program. There is no foreign language requirement.

Comprehensive Examination

Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written comprehensive examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis. Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.

Research and Dissertation

The student must complete 24 semester hours of Management Science 600: Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the minimum 48 hours of coursework, normally is completed in the third year of the program.
BUSINESS ADMINISTRATION CONCENTRATIONS

For complete listing of MBA and Ph.D. program requirements, see Business Administration.

MBA Concentration: Marketing
Minimum course requirements are 511 and 512.

Ph.D. Concentration: Marketing
Minimum course requirements are 12 hours from among the following courses: 601, 602, 603, 604, 605, 606.

GRADUATE COURSES

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 be repeated. S/NC only. E

503 Buyer Behavior—Analysis for Marketing (3) Consumer behavior concepts and processes developed and applied to market analysis and design, and control of marketing programs. Social psychology and demographic factors that affect consumer product, brand and patronage decisions. Prereq: Business Administration 504 and 505 or consent of instructor.

504 Analyzing Market Opportunity for Marketing Decisions (3) Major determinants of opportunity in markets, framework for finding markets and analyzing them for opportunity, application of market opportunity related issues to marketing strategy decisions. Prereq: Business Administration 504 and 505 or consent of instructor.

505 Marketing Research and Information Planning (3) Design of a rigorous marketing study from inception to implementation of results by recognizing key decision points and critically evaluating merit of research project. Prereq: Business Administration 504 and 505 or consent of instructor.

506 Marketing Strategy (3) Integration of concepts and analytical skills from each component area of marketing to formulate cohesive, well-organized marketing program. Prereq: Business Administration 504 and 505 or consent of instructor.

510 Principles of Marketing Management for Non-MBA Students (3) For students from other disciplines interested in obtaining knowledge of marketing discipline at graduate level.

511 MBA Marketing Concentration I (6) Determination of customer value. Principles of consumer behavior, marketing research, and building customer value. Prereq: Business Administration 504 and 505 or consent of instructor.

512 MBA Marketing Concentration II (6) Delivery of customer value. Communication of customer value, marketing strategy, and providing customer responsive organizations. Prereq: Business Administration 504 and 505 or consent of instructor.

550 Market Opportunity Analysis for New Ventures (3) Concepts for understanding coverage of new venture MOA and various information sources and procedures; identify and analyze sales opportunities in markets for new product or service. Prereq: Consent of instructor.

593 Independent Study (1-6) Directed research and study. Prereq: MSA Core and consent of instructor. May be repeated. Maximum 6 hrs.

599 Special Topics Seminar (1-6) Topics vary: nonbusiness marketing applications, macroenvironmental issues, market segmentation, international marketing, services marketing, marketing channels and related issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

601 Marketing Theory (3) Nature and scope of marketing role of theory development and theory testing important to marketing research.

602 Research Methods I (3) Research process: problem formulation, research and experimental design, measurement and implementation of results. Design: experimental design, survey research, and measurement.

603 Marketing Thought (3) Marketing literature across number of research areas. Evaluate individual works, determine state of research in each area, and identify areas that merit further study.

604 Seminar in Buyer Behavior Research (3) Behavioral study of people in their roles as buyers and users of goods and services both individual and group processes.

605 Research Methods II (3) Analytical approach to marketing decisions and role of quantitative methods. Models and modal building in marketing; consideration of decision theory, linear programming, simulation and other mathematical representations of marketing phenomena.

606 Special Topics (3) Topics vary: marketing strategy, advanced consumer behavior, influence and persuasion theory and strategy, pricing issues, international marketing issues, and nonprofit organization marketing issues.

Logistics and Transportation

Professors: Davis, F. W., Jr. (Liaison), Ph.D., Michigan State, Dier, G. N., DBA, Indiana, Frye, L. J. (Emeritus), Ph.D., Florida, Hendrix, F. L. (Emeritus), Ph.D., North Carolina, Langley, C. J., Jr., Ph.D., Penn State, Mundy, R. A., Ph.D., Penn State, Patton, E. P., Ph.D., North Carolina

Associate Professor: Foggins, J. H., DBA, Indiana

Assistant Professor: Holcomb, M. C., Ph.D., Tennessee

BUSINESS ADMINISTRATION CONCENTRATIONS

For complete listing of MBA and Ph.D. program requirements, see Business Administration.

MBA Concentration: Logistics and Transportation
Minimum course requirements are 501, 508, and one course from the following: 504, 506, 507, 509, and 559.

Ph.D. Concentration: Logistics and Transportation
Minimum course requirements are 12 hours to include 601, 602, 603.

GRADUATE COURSES

501 Survey of Logistics and Transportation (3) U.S. logistics and transportation: physical, economic, social, and political environment; financing, maintaining, and enhancing U.S. transportation infrastructure.

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

504 Freight Carrier Systems and Management (3) Analysis of freight carrier management's efforts to provide services demanded by consumers in logistics and transportation marketplace.

506 Logistics Systems Management (3) Development of strategy for management of logistics systems. Executive level integration of logistics operations with market-
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 from 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; chemical, mechanical, and physical 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 area courses, such as 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 publication that 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 600 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 Admissions Specialist 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 Chemical Process Metallurgy (3) Application of chemical thermodynamics to metallurgical processing of ferrous and nonferrous pyrometallurgical refining; slag and metal equilibrium; solidification, gas-metal processing. Prerequisite: 503.

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

443 Polymer Processing (3) Rheological measurements; flow through tubes and dies, end effects and extrudate swell; selected applications, 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. 50


472 Fundamental Principles of Composite Materials (3) Establishment of physical principles basic to design, manufacture and application of fiber reinforced polymers, metals and ceramics. Prereq: 302 or equivalent.

474 Biomaterials (3) Metals, polymers and ceramics used in orthopedic, cardiovascular, and dental surgical implant devices; corrosion and degradation problems; material properties of primary importance; tissue response to synthetic materials. Prereq: 301. Recommended for engineering science and mechanical majors.

475 Fracture-Safe Design (3) (Same as Engineering Science and Mechanics 423.)

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

502 Registration for Use of Facilities (3-15) Required.

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 defect interactions 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, loading rate effects, effect of ordering and solid solution on work hardening; plastic stability 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.

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

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

530 Phase Transformations in Metallic Materials (3) Thermodynamics of phase equilibrium, theory of nucleation in solids; kinetics and morphology of diffusion controlled growth; kinetics of interface controlled phase transformations; martensite and bainite; and relation to metastable transformations.

531 Advanced Corrosion (3) Analyses of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors on corrosion processes leading 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 and thermodynamics or equivalent.

541 Fluid Mechanics and Polymer Processing (3) Nature of 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. Prereq: 541.


544 Polymer Solution Thermodynamics and Characterization (3) Theories of solutions, 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 mechanical behavior: Hookean and rubber elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss tangent; experimental methods. Introduction to mechanical properties of polymers; polymer processing; raw materials preparation and formulation. Prereq: 543.

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 solid polymer processing operations. Coreq: 540 or consent of instructor.

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

550 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 solid polymer processing operations. Coreq: 540 or consent of instructor.

556 Mechanical Properties of Solid Polymers (3) Types of mechanical behavior: Hookean and rubber elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss tangent; experimental methods. Introduction to mechanical properties of polymers; polymer processing; raw materials preparation and formulation. Prereq: 543.

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; kinematical and dynamical diffraction theories; structure determination; analysis of lattice defects. Prereq: 301 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: amorphous, ceramic, inorganic, metallic and polymer structures.

573 Biomaterials Analysis and Development (3) Physico-chemical limitations of current surgical implant materials; biological 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 Formability of Materials (3) Modeling and analysis of finite plastic strain with application to primary and secondary forming operations; crystalline and noncrystalline materials; flow localization, instability, predictive testing. Prereq: Consent of instructor.

576 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) P/NP only. E

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

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

641 Advanced Rheology and Viscoelasticity (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: 541.

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

643 Phase Transformations in Polymers (3) Glass transition and glassy states; theories of polymer glasses; crystallization of polymers; nucleation, growth and morphology; secondary nucleation theory; solidification of copolymers; crystallization under stress. Prereq: 543.

671 Quantitative Microscopy (3) Principal optical, x-ray, electron and field-ion techniques for examination of microstructures of materials. Prereq: 425.

672 Advanced High Performance Fiber Composite Materials (3) Continuation of 422. Design, manufacture and testing of high performance fiber reinforced composites for aerospace and prosthetic applications. Laminate theory, composite project and failure analysis exercises. Prereq: 422.

676-77 Advanced Topics in Materials Science and Engineering (3,3) Latest developments in 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 DEGREES

Mathematics (College of Liberal Arts)

John B. Conway, Head

Professors:
Albert, G. E. (Emeritus), Ph.D. Wisconsin
Alexiades, V., Ph.D. (Emeritus) Delaware
Alikakos, N., Ph.D. Brown
Anderson, D. F., Ph.D. (Emeritus) Cornell
Baker, G. A., Ph.D. (Emeritus) Cornell
Bradley, John S. (Emeritus), Ph.D. Iowa
Carruth, J. H., Ph.D. Louisana State
Clark, C. E., Ph.D. Wisconsin
Conway, J. B., Ph.D. Louisana State
Daverman, Robert J., Ph.D. Wisconsin
Dessart, Donald J., Ph.D. Maryland
Dobbs, E. Ph.D. Cornell
Dyjak, J. Ph.D. Warsaw

Mathematics
The following requirements must be met:

1. Complete 30 hours of coursework of the following:
   - 6 hours must be in courses numbered above 400.
   - Of these, 21 hours (at least 15 of which must be in mathematics) must be in courses in mathematics numbered above 500.
   - After one semester of graduate study, a student whose advisory committee gives its approval may choose the non-thesis option, for which 30 hours in courses numbered above 400 are required. Of these, 21 hours (at least 15 of which must be in mathematics) must be in courses numbered above 500. Of the 30 hours, 9 in courses approved by the advisory committee may be chosen from areas other than mathematics. For this option it is also required that a written final examination be passed and that credit be received for a reading course (598) in which a term paper or project is required.

2. Take a one-year, 600-level sequence in a through e.
   - a. Modern Algebra 531-532
   - b. Complex Analysis 541-542
   - c. Topology 561-562
   - d. Real Analysis 541-542
   - e. Applied Linear Algebra 547-548
   - f. Partial Differential Equations 536-537
   - g. Ordinary Differential Equations 531-532
   - h. Numerical Mathematics 571-572
   - i. Statistics 525-526
   - j. Probability 523-526

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 four 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.

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 approval 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

HISTORY OF MATHEMATICS (3) Development of major ideas in mathematics from prehistoric times 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.

MATHEMATICS AND MICROCOMPUTERS (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts of algebra and trigonometry. Does not satisfy the major requirements for a B.S. or M.S. in mathematics. Prereq: Calculus I.

APPLIED VECTORS (3) Topics from multivariate and vector calculus, line and surface integrals, divergence and gradient theorems and theorems of Gauss and Stokes. Prereq: Calculus III.

MODELS IN BIOLOGY (3) Difference and differential equation models of biological systems. May not be counted toward graduate degree. Prereq: Calculus II or equivalent.

MATHEMATICAL MODELING (3) Construction and analysis of mathematical models in business and industry. Prereq: Differential Equations, Calculus III, and Matrix Algebra I.

COMBINATORICS (3) Introduction to problems of enumeration and the study of discrete structures: sequences, partitions, graphs, finite fields and geometries, or experimental designs. Prereq: 323 or consent of instructor.


PROBABILITY II (3) Random processes. Markov chains and Poisson processes. Other topics as selected by instructor. Prereq: Probability I or consent of instructor.

STATISTICS (3) Theory of functions of real variable: derivative and contour integrals. Prereq: Calculus I.

DERIVATION OF STANDARD STATISTICAL DISTRIBUTIONS, CONDITIONAL PROBABILITY AND EXPECTATIONS, AND continuous distributions. Prereq: Probability I or consent of instructor.

PROBABILITY I (3) Axiomatic probability, multivariate distributions, conditional probability and expectations, random vectors. Prereq: 351 or consent of instructor.

DERIVATION OF STANDARD STATISTICAL DISTRIBUTIONS, CONDITIONAL PROBABILITY AND EXPECTATIONS, AND continuous distributions. Prereq: Probability I or consent of instructor.

TOPOLOGY (3) Topology of finite and infinite-dimensional spaces. Prereq: Calculus II, and Discrete Mathematics I; or consent of instructor.

NUMERICAL ANALYSIS (3) Computation, instabilities, and rounding. Interpolation and approximation by polynomials and splines. Prereq: Calculus III. 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.)

ALGORITHMS (3) Direct and iterative methods for systems of linear equations. Solution of single nonlinear equation and nonlinear systems. Orthogonal decomposition, least squares and algebraic eigenvalue problems. Prereq: Calculus III. Numerical Algorithms I or consent of instructor. Recommended prereq: 453. (Same as Computer Science 472.)

READINGS IN MATHEMATICS (1-3) Topics selected by instructor. May be repeated. Maximum 9 hrs.

SEMINAR IN MATHEMATICS (1-3) Topics selected by instructor. May be repeated. Maximum 9 hrs.

THESIS (1-15) P/NP only. E

REGISTRATION FOR USE OF FACILITIES (3-15) Required of students in Master of Mathematics program and for students in graduate programs in College of Education. May not be applied toward M.S. degree in mathematics. Prereq: Consent of faculty mentor to supervise independent work. May be repeated. Maximum 15 hrs.

MASTER OF ARTS DEGREE IN MATHEMATICS (1-15) May be repeated. Maximum 12 hrs.

MASTER OF SCIENCE DEGREE IN MATHEMATICS (1-15) May be repeated. Maximum 12 hrs.

521-22 ENUMERATIVE COMBINATORICS (3,3) sieve methods, recursion, generating functions, and permutation groups applied to enumeration of discrete structures. incidence algebras and combinatorics of partially ordered sets.


525-26 STATISTICS (3,3) Pertinent facts from probability theory; formulation of statistical models; sufficiency, Fisher's information function and sufficient statistics; Neyman-Pearson formulation of hypothesis testing; hypothesis testing; confidence procedures and hypothesis testing; optimal tests and confidence intervals; the Neyman-Pearson lemma, uniformly most powerful tests; general linear model estimation and tests in linear models; rank methods for comparison; linear regression and independence, robust tests; topics from decision theory. Prereq: 445-46. Recommended prereq: 426.

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


535-36 PARTIAL DIFFERENTIAL EQUATIONS (3,3) First order equations, classification of equations and properties of elliptic, hyperbolic, and parabolic equations in several variables. Prereq: 445-46 and 231 or consent of instructor.

537-38 MATHEMATICAL PRINCIPLES OF CONTINUUM MECHANICS (3,3) Conservation principles, equations of equi-
repeated. Maximum 12 hrs.


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

550 Matrix Algebra (3) Advanced topics in linear algebra: matrices, determinants, systems of linear equations, eigenvalues, and eigenvectors. Prereq: 450 or consent of instructor.

551-52 Modern Algebra (3,3) Groups, rings, modules, and fields. 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 (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; metrization; homeomorphic invariants of point sets. Mappings and homeomorphisms; covering spaces and fundamental group. Prereq: 456-56 or consent of instructor.

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 iterative and direct methods for large systems of linear equations; sparse matrix analysis, relationship to modern computer architecture, ill-conditioning, and round-off errors. 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 ecology. Prereq: 431, 453 or consent of instructor.

584 Mathematical Systems Theory (3) Analytic approach to discrete and continuous dynamical systems; optimal control. Applications to ecology. Prereq: 431, 453, 445-46 or consent of instructor.


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

593 Independent Study (1-15) May be repeated. Maximum 6 hrs.

600 Doctoral Research and Dissertation (3,3) Thesis research. May be repeated. Prereq: 581-82 or 531, 667, or consent of instructor.

569 Seminar in Topology (3) May be repeated with consent of department. Maximum 12 hrs.


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

581-82 Advanced Mathematical Ecology (3,3) Selected topics in theoretical and applied mathematical ecology; population community, ecosystem ecology and applied topics such as dendrochronology, geodetic applications, epidemiology, environmental change, and resource management. Prereq: 581-82. May be repeated. 

Mechanical and Aerospace Engineering

(College of Engineering)

MAJORS

Aerospace Engineering .................................. M.S., Ph.D.
Mechanical Engineering ............................... M.S., Ph.D.

DEGREES

A. J. Edmondson, Acting Head

Professors:
Armilli, R. V., Ph.D. .................................. VPI
Bailey, Joel F. (Emeritus), PE, Ph.D. ................. Lehigh
Braun, G. W. (Emeritus) (UTSI), PE, Ph.D. ....... California
Braun, R. W. (Emeritus) (UTSI), PE, Ph.D. ..... Pennsylvania
Collins, Frank G. (UTSI), PE, Ph.D. ............... California
Crawford, Frank G. (UTSI), PE, Ph.D. ............... Pennsylvania
Edmondson, A. J., PE, Ph.D. ......................... Texas A&M
Flandro, Gary A. (Boling Chair in Aerospace Engineering) (UTSI), Ph.D. ....................... Georgia Tech
Holland, R. W. (Emeritus), PE, M.S. ................. Tennessee
Johnson, W. S., PE, Ph.D. ......................... Clemson
Krane, R. J., Ph.D. .................................. Oklahoma
Liston, Hardy, Jr. (Emeritus), M.E.A. ................. George Washington
Lo, C. F. (UTSI), Ph.D. ............................... Cornell
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 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 590 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 courses numbered 500 and above, with at least 12 of these semester hours courses in the major. A minimum of 9 semester hours 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 (or two 500-level courses) 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 on 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 Admissions Specialist 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: measurements and control of noise in industrial and community environments. Prereq: Senior standing in engineering or consent of instructor.


451 Systems and Controls (3) Analytical models of physical systems comprised of combinations of mechanical, electrical, and fluid systems; 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 Electronic Components. F, Sp
post dry-out; heat transfer; condensation processes; analysis of laminar and turbulent convection heat transfer; time-dependent heat conduction by numerical methods.

512 Computational Fluid-Thermal Analysis (3) (Same as Engineering Science and Mechanics 552.)

521-22 Thermodynamics I and II (3,3) Macroscopic thermodynamics, including First and Second Law analysis; energy balances for chemical and physical systems; combustion; gas mixtures, and property relations; determination of thermodynamic properties from molecular structure, spectroscopic data, kinetic theory, statistical mechanics, quantum physics, Schroedinger equation.

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

526 Combustion and Chemically Reacting Flows I (3) Fundamentals: thermodynamics, chemical kinetics and conservation equations; phenomenological approach to laminar flames; diffusion and premixed flame theory; single droplet combustion; deflagration and detonation theory; stabilization of combustion waves in laminar streams; flammability limits of premixed laminar flames; introduction to turbulent flames. Prereq: 522, 551, or consent of instructor.

528 Combustion and Chemically Reacting Flows II (3) Advanced topics: phenomenological approaches to turbulent flames; fundamentals of turbulent flow; application to combustion. Prereq: 526.


551-52 Mechanical Engineering Design (3,3) Design of mechanical systems and devices. Prereq: Consent of instructor.

553 Development of Superior Products and Processes (3) Case studies of latest techniques of superior product and process development. May be repeated. Limited to students in problems program. Prereq: Consent of instructor. May be repeated. S/NC only.

554-55 Selected Topics in Mechanical Engineering (1-1,4) Problems and topics related to developments and practice in mechanical engineering. Prereq: Consent of instructor. E

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

566 Measurement Science I (3) (Same as Nuclear Engineering 588, Aviation Systems 588, Chemical Engineering 588, Engineering Science and Mechanics 588, and Aerospace Engineering 588.)

575 Expert Systems in Engineering (3) (Same as Nuclear Engineering 576 and Engineering Science and Mechanics 576.)

576 Mechanical and Aerospace Engineering

577 Neural Networks in Engineering (3) (Same as Nuclear Engineering 577 and Engineering Science and Mechanics 577.)

580 Rocket Propulsion I (3) Rocket propellant fundamentals; fundamentals of rocket engines; non-Thermal Decomposition and gas phase reaction models; effect of chamber pressure and additives on solid propellant burn rates, erosion burning; analysis of two-phase rocket exhaust flows; electric and rocket engine; electric resistance and electric field (e.g. engine performance, magnetohydrodynamic thrusters, traveling wave thrusters; exotic propellants systems. Prereq: Consent of instructor.

582 Rocket Propulsion II (3) Solid propellant rocket propulsion, homogeneous and heterogeneous propellants, and combustion engines; thermal decomposition and gas phase reaction models; effect of chamber pressure and additives on solid propellant burn rates, erosion burning; analysis of two-phase rocket exhaust flows; electric and rocket engine; electric resistance and electric field (e.g. engine performance, magnetohydrodynamic thrusters, traveling wave thrusters; exotic propellants systems. Prereq: Consent of instructor.

584-85 Turbomachinery Systems I, II (3,3) Ideal cycle analysis of turbine engines. Cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flow through theory, engine component matching, transient operation, and rotating stall, engine control system design. Prereq: First year graduate standing and consent of instructor.


587 Dynamic Modeling and Simulation (3) Modeling and simulation of dynamic and control systems. Prereq: Consent of instructor.

588 Measurement Science II (3) (Same as Nuclear Engineering 588, Aviation Systems 588, Chemical Engineering 588, Engineering Science and Mechanics 588, and Aerospace Engineering 588.)

594-95 Selected Topics in Mechanical Engineering (4) Advanced topics: phenomenological approaches to combustion, turbulence, and combustion processes. Prereq: 456, 466.

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

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

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, turbulence and variational methods of analysis, heat exchanger theory and design. May be repeated. Maximum 6 hrs. Prereq: Consent of instructor.

611 Advanced Convection Heat Transfer, Fluid Mechanics and Passage Transfers (3) Stagnation point and high speed viscous boundary layer flows; problems in heat transfer at high supersonic and hypersonic speeds; laminar and turbulent boundary layer heat transfer with surface melting, ablation, sublimation; effects of gas species recombination; stagnation point heat transfer; Lee and Yang solution for hot solid surfaces; heat flux scaling rules; mass transfer and radiation cooling techniques. Prereq: 512 and consent of instructor.

612 Numerical Modeling in Heat Transfer, Fluid Mechanics and Heat Mass Transfer (3) Implicit finite-difference numerical schemes for solution of Navier-Stokes equations in two and three dimensions. Numerical mapping techniques for solution of flow fields over complex geometries. Numerical algorithms for solving internal viscous laminar and turbulent flows with heat and mass transfer; trans...
port models for internal flows; treatment of heat and mass transfer boundary conditions. Prereq: 512 and consent of instructor.

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


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

651-52 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science and Mechanics 651-52.)


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

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 bodies for desired characteristics. Potential flow theory, viscous effects, compressibility effects. Subsonic, supersonic, and supersonic airfoils. Prereq: 370. F.

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.


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

426 Introduction to Aerospace Design (2) Design process, synthesis, selection, analysis, synthesis of space systems. Prereq: 362, Mechanical Engineering 332. 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) PrN only. E.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester in which the 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.

511 Inviscid Flow (3) Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping. Prereq: 422 or Mechanical Engineering 531, Mathematics 425 or equivalent.

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

513 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments; representative experiments; hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, water table experiments, super sonic flow experiments, boundary layers, laser Doppler measurements. Prereq: 423 or Mechanical Engineering 531.

515-16 Air Vehicle Aerodynamics and Performance (3,3) Application of aerodynamics principles to air vehicles; provide estimates of performance, stability, and control characteristics for subsonic to supersonic speeds. Relations among thrust, drag, lift, and attitude, propulsion systems, vehicle aerodynamics and trajectory optimization. Prereq: 422; 515 for 516.

521-22 Aerodynamics of Compressible Fluids (3,3) One-dimensional internal and external flow; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics. Prereq: 422; 521 for 522.

525 Hypersonic Flow (3) Boundary layer; similar flows; Newtow-Newtonian theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow. Prereq: 512.

527-28 Aerospace Ground Test Facilities (3,3) Atmospheric models and similarity considerations; aerodynamic test facilities; tunnel and instrument panelaffle systems; aeroacoustic and mechanical tests; space environment and space vehicle test facilities. Prereq: 512 and 521, Mechanical Engineering 513 and 522.

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

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

532 Introduction to Turbulence (3) Kinematic effects; analyses, statistical treatment; correlation functions, energy spectra, diffusion; application of turbulent jets and pipe flow. Prereq: 511-12.

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

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

551 Aerospace Mechanics (3) Principles of mechanics applicable to aerospace vehicles; equations of motion, multibody problems and trajectory analysis. Prereq: Mathematics 471.

554-55 Aerospace Vehicle Stability and Control (3,3) Static and dynamic longitudinal and lateral stability and control of coupled modes. Motion with free and fixed flight control surfaces. Automatic control systems. Prereq: 423, 551.

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


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

543 Metabolism of Drugs (1) Drug mechanisms of action: membrane transport, enzyme reactions, ionization, stereochemistry and metabolic pathways. For students interested in biochemical pharmacology. Prereq: Biochemistry 310. Sp

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

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

610 Medical Biology Seminar (1) Invited speakers. Topics posted in advance. May be repeated. S/N only. F,Sp

611 Advanced Topics in Medical Biology (1-3) New developments in biological research applicable to clinical medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp

652 Special Topics in Pathology (1-3) Pathologic anatomy, biochemical pathology, and related areas. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp

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 biological science, (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 one 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 familiarize himself or herself with the activities of a research professor. Usually the student selects a research advisor 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 biochemistry or molecular biology; (5) 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 related 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 receive 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) two semesters of biochemistry or molecular biology; (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. Sp

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

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

430 Immunology (3) Principles of immunology and immunopathology: formation and defense of the immune system, 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 439) F


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

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

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 Microbial Physiology (3) Topics in microbiological 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 Immunopathology (3) Topics in molecular and cellular aspects of immune response, immunology, and immunopathology. Prereq. 420, 410, 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.)

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

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

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

594 Selected Topics in Microbiological Research (2-4) Literature surveys and discussions of selected topics. Prereq. Graduate standing. May be repeated. Maximum 8 hrs. S/NC only.

595 General Seminar (1) Lectures and seminars by invited speakers, graduate students. May be repeated. Maximum 18 hrs. S/NC only.

596 Laboratory Rotation (1) Familiarization with research areas in department through series of rotations in laboratories of individual faculty members. May be repeated. Maximum 3 hrs. S/NC only.

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

601 Journal Club in Microbial Physiology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

602 Journal Club in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only.

603 Journal Club in Immunology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

604 Journal Club in Virology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only.

605 Current Topics in Biological Membrane Research (1) (Same as Biochemistry 605) E

610 Advanced Topics in Microbial Physiology (3) Prereq. 510 or consent of instructor. May be repeated. Maximum 12 hrs.

620 Advanced Topics in Microbial Pathogenesis (3) Prereq. 520, 530 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Advanced Topics in Immunology (3) Prereq. 530 or consent of instructor. May be repeated. Maximum 12 hrs.

640 Advanced Topics in Virology (3) Prereq. 440, 540, or consent of instructor. Maximum 12 hrs.

650 Advanced Topics in Microbial and Molecular Genetics (3) Prereq. 550 or consent of instructor. May be repeated. Maximum 12 hrs.

670 Advanced Topics in Environmental Microbiology (3) Prereq. 570 or consent of instructor. May be repeated. Maximum 12 hrs.

Microbiology-Veterinary Medicine

See Veterinary Medicine for program description.

Music

Musical degrees offered:

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), ....... Schurz
Dorn, W. (Emeritus), M.A. .......... Columbia
Fried, Herbert W. (Emeritus), ......... Northwestern

Ph.D. ........................................ North Carolina
Holford, A. G. (Emeritus), M.M. .... Northwestern
Huber, Calvin, Ph.D. .................. North Carolina
Julian, W. J (Emeritus), Ph.D. ........... Northwestern
Keeling, Kenneth A., Sr., D.M.A. ....... Catholic
McCullough, D. K., M.A. ............. Columbia
Meacham, John J., M.M. ........... Northwestern
Moore, M. C., Ph.D. .................... Michigan
Northrup, D. B., D.M.A. ............... Yale
Pederson, D. M., Ph.D. .............. Iowa
Starr, W. J. (Emeritus), M.M. ....... Eastman
Stutzenberger, D. R., D.M.A. ......... Maryland
Tipps, A. W., Ph.D. ................... Michigan
VanVactor, D. (Emeritus), M.M. ...... Northwestern

Associate Professors:

Adams, Fay, M.M. ....................... Tennessee
Boling, M. E., M.M. ............... Tennessee
Bonniewicz, W. (Emeritus), M.M. ....... Tulsa
Carter, P. S., M.M. .............. Colorado
Horodyski, P. M., M.M. .............. Manhattan
Hough, Don, M.M. ..................... Tennessee
Hough, Dolly C., M.M. .............. Tennessee
Jacobs, K. A., D.M.A. .......... Texas
Johnson, A. E., D.M.A. .......... Stanford
Leach, C. M., F.M. ................... New Mexico
MacMorran, W. S., M.M. .......... Wisconsin
McDaniel, Walter H. (Emeritus), ....... M.S.
Michaels, L. W., M.A. .............. Columbia
Mintz, J. O., Ed.D. .................. Columbia
Root, Patricia, M.A. .......... Washington State
Scarlett, William P., M.M. .......... Louisiana State
Searle, S. M., M.M. ............. Tennessee
Sparks, J. R., M.S. .............. Tennessee
Sper, G. R., M.M. ............... Indiana
Young, S. E., Ph.D. .............. North Carolina

Assistant Professors:

Brown, Donald R. ..................... Yale
Duberry, T., S., D.M.A. ............... Peabody
Hawthorne, W., Ph.D. .......... Cincinnati

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 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, ear-training, and 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/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 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 suitable for school, college, and community bands; contemporary and standard band literature. Prereq: Consent of instructor.

550 Curriculum Development and Evaluation in Music Education (3) Principles of curriculum development applied to music education programs. Formulating objectives; construction of evaluation instruments; survey of appropriate literature. 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 music 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.

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

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

593 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 Tubachoir (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.

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 Chorus (1) May be repeated.

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

599 Accompanying (1) May be repeated.

Music General

GRADUATE COURSES

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

501 Graduate Recital (2)

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 Lecture Recital (2)

521 Special Topics in Performance (1-3) Prereq: Consent of department head.

540 Secondary Applied Music (1) May be taken by music majors desiring applied study on a 2nd or 3rd instrument. May be repeated for a maximum of 4 hours credit on each instrument. Admission by audition. Requires payment of Applied Music fee.

561 Church Music Performance Project (1-2) May be repeated. Maximum 3 hrs.

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, 1600-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 era 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, canons, 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-romanticists.

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 project.

593 Independent Study (1-15) See College of Liberal Arts. 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 psychology, procedures and literature utilized by Shinkichi Suzuki in Japan. Prereq: 495 or consent of instructor. May be repeated. Maximum 6 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 bands including bands at all levels. Supervised laboratory teaching.

**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)** Topic varies.

## Music Keyboard

### GRADUATE COURSES

**420-30 Piano Literature I-II (3,3)** From 1750 to mid-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 accompaniment of full recital for accompanying concentrators only. 531--Vocal recital, 541--Instrumental recital. Prereq: Consent of instructor.

**540-50 Advanced Piano Pedagogy I-II (2,2)** 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, Daehne, Eurhythmics, 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)**

**479 Guitar (1-4)**

**480 Piano (1-4)**

**485 Harpsichord (1-4)**

**490 Organ (1-4)**

**495 Composition (1-3)**

**496 Composition for Media (1-2)**

**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 Piano (1-4)**

**545 Tuba (1-4)**

**550 Percussion (1-4)**

**555 Voice (1-4)**

**560 Violin (1-4)**

**565 Viola (1-4)**

**570 Cello (1-4)**

**575 String Bass (1-4)**

**580 Electric Bass (1-4)**

**585 Guitar (1-4)**

**590 Organ (1-4)**

**594 Composition (1-3)**

**595 Composition with Electronic Media (1-3)**

**596 Improvisation (1-4)**

## Music Theory

### GRADUATE COURSES

**410 Ear Training Review (1)** Review and application of harmonic and melodic dictation skills for graduate and advanced undergraduate students. Prereq: Advanced Ear Training. Required of entering graduate students with deficiency in ear training.

**430-40 Countercounterpoint I-II (3,3)** Study of species counterpoint in modal and tonal styles, works of Palestrina and J.S. Bach. Prereq: 220, 440--Writing of contrapuntal forms of 16th century and fugal; 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.

**510 Musical Styles (3)** Elements of design and their role in definition of musical styles. Prereq: Consent of instructor.

**520 Analytical Techniques (3)** Analytical techniques, contemporary approaches, tonal and neotonal music. Prereq: Consent of instructor.

**530 Music Theory Pedagogy (3)** Techniques, methods, and materials involved in college-level theory programs. Prereq: Consent of instructor.

**540 Computer Projects (1-3)** Programming languages, design and implementation of projects in computer-managed instruction. Prereq: Consent of instructor.

**593 Independent Study (1-15)** See College of Liberal Arts. Prereq: Consent of department head.

## Music Voice

### GRADUATE COURSES

**425 Functional Diction for Singers (3)** Comprehensive survey of singing diction in six languages: English, French, German, Italian, Latin, and Spanish. Basic instruction in International Phonetic Alphabet; development of basic diction skills; overview of diction styles and traditions in each language; survey of diction resources and reference materials. Does not fulfill deficiency requirements for graduate students in voice or accompanying.

**510 Vocal Literature Seminar (3)** Topics vary. May be repeated. Maximum 6 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 6 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)** Study of vocal production, examination of different methods. 550--Study of teaching materials, observation of studio teaching, analysis of vocal problems in selected students, and supervised teaching.

**570 Vocal Chamber Music Performance (2)** Prereq: Consent of instructor.

**580-85 Choral Literature I-II (2,2)** Choral music from medieval ages to present with consideration of historical development of major choral genres.

**590 Advanced Choral Conducting (3)** An expansion and continued refinement of conducting techniques; 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

(College of Engineering)

MAJOR DEGREES

Nuclear Engineering ........................................ M.S., Ph.D.

Thomas W. Kerlin, Head

Professors:

Dodd, H. L., PE, Ph.D. .................................... Tennessee
Kerlin, T. W. (Liaison), Ph.D. ......................... Tennessee
Mihalcz, 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:

Groth, 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.

All entering students must have, as a minimum, competency in mathematics through ordinary differential equations, competency in atomic and nuclear physics, and competency consistent with a course in introductory nuclear engineering. If these competencies do not exist, the student must take appropriate courses not for graduate credit.

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 sequences: 511, 512; 551, 552; 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 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 then 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. He/She submits a report, in thesis format, on each project. The student must then pass an oral examination on his/her engineering practice projects and all graduate coursework. The student must enroll for six semester hours of NE 508 (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.S. thesis or Nuclear Engineering Practice. A candidate must successfully defend, in an oral examination, all work presented for the degree--all coursework and the dissertation.

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 CREDIT FOR UNDERGRADUATE COURSES

403 Nuclear Engineering Laboratory (3) Cross-sectional measurement, diffusion properties of neutrons, criticality loading experiment, control rod calibration, statistical weight, shielding, xenon poisoning, dynamics and controls experiments. Prereq: Nuclear Engineering Laboratory or equivalent. Coreq: 471, 445.

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 accidents, safety standards, overview of experiments, computational methods, and applications. Prereq: Introduction to Nuclear Engineering.

463 Introduction to Fusion Energy (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 cross sections, kinematics of elastic scattering, reactor kinetics, reactor systems and nuclear data. Analytical and numerical methods applicable to general criticality problems, eigenvalue searches, perturbation theory, and multigroup diffusion equations. Prereq: 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.
4. Each student must present evidence of current 2-person CPR certification.
5. Non-registered nurse students must have completed courses in chemistry, nutrition, microbiology, anatomy, and physiology plus 12 hours of behavioral science courses.

Thesis and Non-Thesis Options
The thesis option is available for interested students and is especially encouraged for those who are considering pursuit of doctoral degrees sometime in the future. Students who choose the non-thesis option must register for 580 Nursing Research 3 or 582 Supervised Research.

Program Requirements
All students must complete a minimum of 36 semester hours distributed as follows:

**Core (12 credits)**
- 503-04 Holistic Nursing 6
- 510 Theoretical Foundations of Nursing 3
- 520 Nursing Research Management 3

**Research (9-12 credits)**
- Graduate level statistics course 3
- 501 Nursing Research: Methods, Design & Analysis 3
- 500 Thesis 6
- OR 580 Nursing Project 3
- OR 582 Supervised Research 3

**Concentration (12 credits)—choose one**
- 630-31 Adult Health Nursing I, II 12
- 540-41 Family Nurse Practitioner I, II 12
- 550-51 Parent-Child Nursing I, II 12
- 560-61 Mental Health Nursing I, II 12
- 590-91 Nursing Administration I, II 12

**Elective (3 credits)—waived for those who choose thesis option**

Students who enter the program as non-RNs must complete the following undergraduate nursing courses in addition to meeting the requirements listed above:

- 301 Pharmacology 3
- 302 Introduction to Professional Nursing 3
- 304 Nursing Assessment and Health Promotion 4
- 311 Acute Care Nursing 3
- 313 Nursing Research 3
- 414 Community Mental Health Nursing 6
- 415 Family/Community Health Nursing 6

Registered nurses whose bachelor’s degrees are not in nursing must have complete courses in chemistry, nutrition, microbiology, anatomy, and physiology plus 12 hours of behavioral science courses. They must also complete 304, 305, 313, 315, and 403 and complete or successfully challenge the following:

- 301 Pharmacology 3
- 306 Health Deviation Concepts I 4
- 316 Health Deviation Concepts II 4
- 325 Nursing of Children and Adults 6
- 402 Family Health Nursing Theory 3
- 412 Psychosocial Long Term Nursing Theory 3

**Final Examination Requirements**
All students must successfully complete a final examination as required by the Graduate School. For thesis students, the examination will consist of an oral defense of the thesis as well as an essay or oral questions designed to measure student mastery of the entire program of study. For non-thesis students, the written examination will cover the entire program of study and may, at the discretion of the student’s committee, be followed by an oral examination.

**Special Policies**
1. If the clinical performance of any student for any course is found to be unsatisfactory, the student will receive a grade of “F” for the course.
2. If a student achieves a final grade of “D” or “F” for any required undergraduate or graduate nursing course, his or her graduation will 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.

**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 unified 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 integrating 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 knowledge 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. Some outstanding applicants who are prepared at the bachelor's level in nursing may be considered. In such cases, graduate level courses in nursing theory, concentration, and research will be integrated into the formal program of doctoral degree requirements.
3. Have a minimum cumulative grade point average of 3.0 on a 4.0 scale for previous college work.
4. Have a cumulative score of at least 1000 on the verbal and quantitative sections of the Graduate Record Examination.
5. Have successfully completed a basic statistics course and graduate nursing theory and research courses prior to enrollment in nursing doctoral level courses.

6. Have TOEFL scores of at least 550 if native language is not English.
7. Complete Graduate Program Data Form, College of Nursing.
8. Submit Graduate School Rating Forms from three college level instructors and/or nurses and administrators who have supervised applicant's professional work.
9. Submit a sample of scholarly writing (e.g., thesis, published paper).
10. Submit an essay describing personal and professional aspects of the applicant.
11. Submit Graduate Application for Admission, academic transcript(s), Graduate Record Examination scores, and, if required, TOEFL scores to the Graduate School. Submit three Graduate School Rating Forms, sample of scholarly writing, and Graduate Program Data Form with essay to the Director of the PhD program prior to March 15.
12. Schedule a personal interview with the College of Nursing PhD Student Admissions Committee prior to March 15 of the year preceding Fall admission.

Program Requirements
The following courses are required for all students:
- 620 Directed Research 3
- 601-2 Theory Analysis & Construction I, II 6
- 605-6 Nursing Research Seminar 4
- 607 Qualitative Nursing Research 3
- 608 Quantitative Nursing Research 3
- 610 Nursing Science Seminar 2
- 611 Advanced Nursing Seminar 2
- 614 Nursing Preceptorship 3

- Statistics 3
- Electives 12
- Electives 24

TOTAL 68

Possible cognate areas include, but are not limited to, anthropology, child and family studies, psychology, education, management, medical ethics, public health, social work, philosophy, and statistics.

Doctoral Committee
Early in the student's program, a nursing faculty advisor will be selected by the student in consultation with the program director. The advisor will chair the student's comprehensive examination committee which consists of the faculty teaching core courses and one representative from the cognate area. The student then selects the dissertation committee. Five faculty holding the rank of assistant professor or above comprise the committee, three of whom (including the chair) must be approved by the Graduate Council to direct doctoral dissertations. At least two members of the committee must be from an academic unit other than nursing.

MINOR IN GERONTOLOGY
Graduate students in the College of Nursing may pursue a specialized minor in gerontology. This interdepartmental/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 Ph.D. program in Nursing is available to residents of the states of Alabama and Arkansas. Additional information may be obtained from the Admissions Specialist 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 relationship to nursing implementation, evaluation, and evaluation of nursing and health-related research. Investigation of computer applications to data analysis. Prereq or coreq: Graduate level statistics course. 510. 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时间的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 new paradigms for nursing assessment, diagnosis, and intervention. Exploration and application of principles of holistic health, education, and innovative strategies for achievement of wellness. Roles of health habits, genetics, psychological factors, and mental stress in the maintenance of health. 501, 510. F.

504 Holistic Nursing: Illness (3) Exploration, analysis, and application of principles of holism to nursing of clients with acute and chronic pathophysiological 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; reactions, contraindications, side and interactive effects, and methods of administration of prescribed drugs. Prereq: 301 or equivalent or consent of instructor. F.

506 Advanced Holistic Nursing (3) Seminar and clinical practicum designed to facilitate further development of specialized knowledge and skills used for advanced practice. Role of clinical specialist or nurse practitioner in nursing management of women and/or child-bearing or child-rearing families in community, hospital, or other health care settings. Prereq: 500. 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 of clinical specialist or nurse practitioner in nursing management of women and/or child-bearing or child-rearing families in community, hospital, or other health care settings. Prereq: 500. Prereq or coreq: 501, 520. 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 parent-child nursing practice. Prereq: 500, 2 hrs and 4 labs. 550.

560 Mental Health Nursing I (6) Exploration and application of advanced theories of therapeutic nursing intervention to clients experiencing mental health problems. Options for clinical practice with clients of various age groups in community or institutional settings. Prereq: 504 or consent of instructor. 501, 520, 2 hrs and 4 labs. F.

565 Teaching Practicum (1-6) Individually designed teaching experience in collegiate nursing program or service practice setting. Objectives to be developed collaboratively by student and faculty. Prereq or coreq: 564 and consent of instructor. S/NC or letter grade. Sp.

566 Educational Principles and Strategies (3) Exploration and analyses of selected educational, curriculum, teaching-learning, measurement, and evaluation principles and theories as applied to instruction of undergraduate nursing students, staff development, and patient education. Prereq: Consent of instructor. Su.

577 Special Topics (1-3) Topic determined by faculty and student interest. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp.

580 Nursing Project (3) Research culminating in scholarly paper. Student initiated project with faculty permission, small research utilization project, pilot study, or "state of the science" paper in clinical area. Original research projects may require human subject approval in prior semester or extension to two semesters. Prereq: Consent of instructor. 501, 510. May be repeated. Maximum 6 hrs. F,Sp.


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

601-02 Theory Analysis and Construction I, II (3,3) Theory development; analysis of existing health and nursing theories; theory building from existing knowledge. Prereq: 504 or equivalent or consent of instructor. F,Sp.

605-06 Nursing Research Seminar (1,2) 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, methods, 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 nursing research. F.

609 Research Practicum (1-3) Supervised individual or group research experience under guidance of faculty. 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. Sp.

611 Advanced Nursing Seminar (2) Exploration of historical and current issues of interest to doctorally prepared nurses. F.

612 Health and Nursing Policy/Planning (3) Policies affecting nursing education and practice; health policies and political processes; interactions between health professionals, consumer groups, and government in health policy development and health planning activities. Sp.

613 Nursing Management of Complex Systems (3) Comparative organizational structures, functions, and strategies and techniques needed for effective administrative leadership in nursing education, practice, research, and entrepreneurial settings. F.

614 Nursing Preceptorship (3) Individually designed practicum, field, or internship experiences in a variety of administrative, educational, research, or clinical practice settings. Prereq: 620, 601, 602, 607, 608, 611. F.

620 Directed Research (3) Exploration of theoretical considerations and research methodologies in nursing research with completion of study under faculty guidance. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. Sp.

NUTRITION

(Course 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
Nutrition

GRADUATE COURSES

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 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 606, 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 analysis of state or regional community nutrition program. Location of in-depth study 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 foodservice 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, see 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 Admissions Specialist in the Office of Graduate Admissions and Records. For the Ph.D., see Human Ecology.
to be selected in consultation with instructor. Prereq: 513, 514 and consent of instructor. S/NC only. E

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; effects 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 processes. Prereq: Nutrition in Disease or consent of instructor. F

524 Nutrition Education: Principles, Implementation, and Evaluation (3) Conceptual models, principles, application, and evaluation models in nutrition education research. Prereq: 508 or consent of instructor. Su, A

527 Nutrition in Mental Retardation and Developmental Disabilities (1-3) Interdisciplinary diagnosis and treatment of developmentally-handicapped child; role of nutritionist; clinical experiences and lectures at 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. 541 or coreq. Sp

543 Human Metabolic Research Methods (2) Application of research principles in conducting and interpreting metabolic study. Prereq. 541 or coreq. 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. 541 or coreq. 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 (3-15) 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 Socio-cultural Change (2) Critical evaluation of research. Prereq: 508 or consent of instructor. F

Hotel and Restaurant Administration

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 in which 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 Computer-Assisted Foodservice and Lodging Management (3) Application of computer technology to foodservice and lodging industry. Inventory, cost accounting, production, customer analysis, rooms management, and sales planning and analyses. Prereq: Quantity Food Procurement, Production and Service, Microcomputer Applications or consent of instructor. F

517 Advanced Financial Management (3) Financial planning, operations, and evaluation techniques used in foodservice and lodging management; developing budgets, accounting systems and financial reports. Prereq: Food and Lodging Cost Control 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 evaluate service delivery decisions. Prereq: Quality 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: 531, 532.

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.

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- and lodging-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. S/NC 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 when applicable. Prereq: Hospitality Law or equivalent, or consent of instructor. F

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

610 Advanced Topics in Lodging Management (1-3) Individual study and group discussion of topics related to current problems. Prereq: 542 or consent of instructor. F

620 Advanced Topics in Foodservice Administration (1-3) Individual study and group discussion of topics related to current problems. Prereq: 533 or consent of instructor.
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 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, 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.

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 diseases. Prereq: 5 hrs. of biology, 8 hrs. of 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 juvenile phase change, flowering, photoperiodism, thermoperiodism, vernalization, cold acclimation, dormancy, growth regulators, environmental stress, and post-harvest consideration. Prereq: Botany 321 and consent of instructor. Sp, 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

510 Research Methods in Ornamental Horticulture and Landscape Design (2) Literature retrieval; research proposal writing; use of computers for word processing, data entry, statistical analysis, and graphics production. Required of all students in thesis option. Prereq: Plant and Soil Science 471. F

511 Plant Disease Fungi (4) Same as Entomology and Plant Pathology 510.

550 Microtechnique (3) Methods of investigating histology, histochimistry, biochemistry, and physiological structures in ornamental and crop plants, light microscopy. Prereq: 5 hrs. biology, 8 hrs. chemistry, and consent of instructor. 1 hr. and 2 labs. Su

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

501 Special Topics in Pathobiology (1-5) May be repeated. Maximum 6 hrs. 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

505 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar per term enrolled. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E

506 Veterinary Pathology Seminar (1) Microscopic slides and transparencies of lesions from cases examined by pathologists, residents, and graduate students. Interpretation of observations. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

507 Correlative Post-Mortem Pathology (1-3) Gross and microscopic post-mortem examination of animals. Correlative interpretation of clinical and lesions. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E

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

509 Mechanisms of Disease (4) Advanced topics in pathobiology and mechanisms of disease: pathophysiology, cellular degeneration, immunological, and clinical virology. May be repeated. Maximum 6 hrs. E

DEGREE

MAJOR

Veterinary Medicine.................. D.V.M.

David O. Stauson, Head


Michel, R. L. (Emeritus), V. M. D. .... Ph.D. .............. Michigan State

Patton, S., D.V.M. ......................... Ohio State


Shull, R. M., D.V.M. ....................... Cornell

Slauson, D. O., D.V.M. .................... California (Davis)

Woychik, R. (Adjunct), Ph.D. .......... Case Western Reserve University

Associate Professors: McCracken, M. D., D.V.M., Ph.D. ........ Purdue

Wilkinson, J. E., D.V.M., Ph.D. ......... Cornell

Assistant Professors: Bochsler, P. N., D.V.M., Ph.D. ............ Cornell

Godfrey, V. (Adjunct), D.V.M., Ph.D. ...... Tennessee

Kernegy, W., D.V.M., Ph.D. .......... Louisiana State

McEntee, M. F., D.V.M. ................ Cornell

Merryman, J. I., D.V.M., Ph.D. .......... Ohio State

Miller, M. S., Ph.D. ...................... Columbia

Munson, L., D.V.M., Ph.D. .......... Cornell

Schulz, A. E., D.V.M., Ph.D. .......... Michigan State

506 Post-Doctoral Research Associates: 

Jian, X., D.V.M. .................... China

Richards, W., Ph.D. ............... SUNY (Stony Brook)

Yang, Z., M.D........................ China

Residents: 

Brenneman, K., D.V.M. .............. Virginia

Dean, D. F., D.V.M. .............. Tennessee

Donnell, R., D.V.M. ............... Tennessee

Mason, G. L., D.V.M. .............. Texas A&M

Richtman, L., D.V.M. .............. Wisconsin

See Veterinary Medicine for program description.

GRADUATE COURSES

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

501 Special Topics in Pathobiology (1-5) May be repeated. Maximum 6 hrs. 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

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

601 Advanced Topics in Pathobiology (1-3) Necropsy, histopathology, clinical pathology, clinical parasitology, clinical immunology, clinical bacteriology and mycology, and clinical virology. May be repeated. Maximum 12 hrs. E

602 Veterinary Biopsy (1-2) Examination of biopsy specimens and interpretation of results. Preparation of specimens for sectioning. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

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

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

606 Mechanisms of Disease (4) Advanced topics in pathobiology and mechanisms of disease: pathophysiology, cellular degeneration, immunological, and clinical virology. May be repeated. Maximum 6 hrs. E

Philosophy

(College of Liberal Arts)

MAJOR

DEGREES

Philosophy.......................... M.A., Ph.D.

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 D., Ph.D. ............ Tulane

Bohstedt, Kathleen Emmett (Liaison), Ph.D. ............ Ohio State
Cohen, Sheldon M., Ph.D. .............. Northwestern University
Lavin, Michael, Ph.D. ................... Stanford University
Nott, John E., Ph.D. ...................... Ohio State University
Osborne, Martha Lee, Ph.D. .......... Tennessee State University

Assistant Professors:
Baylis, Francoise, Ph.D. ............... Western Ontario University
Hamlin, H. Phillips, Ph.D. ............. Georgia Institute of Technology

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. No philosophy course numbered under 400 may be taken for graduate credit.

There are no particular courses that M.A. students are required to take. The nature of the student’s coursework should be determined in consultation with the student’s faculty committee. The non-thesis M.A. requires 30 hours of coursework of which at least two-thirds must be in courses at or above the 500 level. Students seeking the non-thesis option must also pass a final written examination on all work offered for the degree. An additional oral examination may be required.

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 courses or their 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 302 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), Texas (concentration in medical ethics only), Virginia (concentration in medical ethics only), 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 ay be obtained from the Admissions Specialist 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.)
412 Classical Indian Systems of Philosophy: The Moksha Tradition (3) (Same as Religious Studies 412.)
420 Topics in History of Philosophy (3) Figures or movements from antiquity through mid-twentieth century. Prerequisite: 6 hrs of philosophy or consent of instructor. May be repeated when topic varies. Maximum 9 hrs.
425 American Philosophy (3) Colonial to early 20th Century. Prerequisite: 6 hrs of philosophy or consent of instructor.
430 Topics in Logic (3) Prerequisite: 6 hrs of logic or consent of instructor. May be repeated when topic varies. Maximum 6 hrs.
440 Contemporary Ethical Theory (3) Topics in meta-ethics or ethics. Prerequisite: 6 hrs of philosophy or consent of instructor.
446 Theoretical Issues in Medical Ethics (3) Prerequisite: 240 or 345 or consent of instructor. (Same as Religious Studies 446.)
460 Philosophy of Science (3) Methodological and conceptual issues in natural and social sciences: patterns of theory modification and replacement; nature, explanation and causation, status of theoretical entities. Prerequisite: 360 and 1 yr of natural or social science, or consent of instructor.
465 Philosophy of History (3) Speculative and critical aspects of philosophy of history. Prerequisite: 6 hrs of philosophy or consent of instructor.
473 Philosophy of Mind (3) Problems of mind and body in relation to consciousness and personal identity. Prerequisite: 6 hrs of philosophy or consent of instructor.
475 Analytic Metaphysics and Epistemology (3) Topics in metaphysics and epistemology in recent Anglo-American tradition. Prerequisite: 6 hrs of philosophy or consent of instructor.
476 Philosophy of Language (3) Survey of issues such as meaning, reference, and truth. Prerequisite: 6 hrs of philosophy or consent of instructor.
479 Studies in Recent Continental Philosophy (3) Selected thinkers or topics: existentialism, phenomenology, hermeneutics, structuralism, post-structuralism. Prerequisite: 6 hrs of philosophy or consent of instructor. May be repeated when topic varies. Maximum 6 hrs.
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 Topics in the History of Ancient and Medieval Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.
522 Topics in the History of Modern Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.
524 Topics in the History of Twentieth-Century European Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.
530 Topics in Logic and Philosophy of Mathematics (3) May be repeated. Maximum 9 hrs.
540 Topics in Value Theory (3) May be repeated. Maximum 9 hrs.
542 Ethics (3) Dominant movements in history of ethics. May be repeated. Maximum 9 hrs.
544 Applied Ethical Theory (3) Single author, tradition, or topic in ethical theory, application to issues in health, business, technology, ecology, and other practical fields. May be repeated. Maximum 9 hrs.
548 Orientation to Medical Ethics (3) Survey of ethical theories in application to issues in medical ethics. Prerequisite: Consent of Medical Ethics Committee.
547 Clinical Medical Ethics (3) Medical terminology, history of medical ethics, case study discussion, clinical observation. Open only to students concentrating in medical ethics. May be repeated. Maximum 4 hrs. S/NC or letter grade.
548 Clinical Residency in Medical Ethics (3-12) Only to students concentrating in medical ethics. Prerequisite: Consent of Medical Ethics Committee. May be repeated. Maximum 20 hrs. S/NC only.
563 Philosophical Topics in Literature and the Arts (3) Aesthetics, criticism, art and society. May be repeated. Maximum 9 hrs.
565 Philosophy of Natural Sciences (3) Nature of subject matter and method of science. 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 College of Liberal Arts.
592 Off-Campus Study (1-15) See College of Liberal Arts.
593 Independent Study (1-15) See College of Liberal Arts.
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 Twentieth-Century Philosophy (3) May be repeated. Maximum 9 hrs.
Physicists

(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.)

A student who intends to present Physics as a graduate minor will have completed an undergraduate minor in Physics or its equivalent. Physics 311-12, 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 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 621-22 of students in nuclear physics; Physics 626-27 of students in solid state physics; and Physics 633-44 of students in plasma physics; Physics 661-62 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 580, 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. German 332 or French 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; or the Oak...
Physics and Astronomy

Physics

GRADUATE COURSES


421 Modern Optics (4) Transmission of light in uniform, isotropic media; reflection and transmission at interfaces; mechanics 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.


461-62 Modern Physics Laboratory (3,3) Introductory 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 other Fundamentals of Physics. Modern Physics or 411, 482. Advanced experiments and experimental techniques in modern physics; experimental teamwork. 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, health physics, nuclear 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 he/she resides in a University facility time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

506 Experimental Methods (3) Principles, real operational behavior of detectors of particle types, interaction detectors, photomultiplier tubes, image intensifiers, ion converters, image dissectors, streak cameras, and fast-frame cameras. High-vacuum systems including cryogenically-based detection or operation of photon detectors including synchronous detection, digital electronics methods and micro-computer data acquisition and registration methods.

507 Contemporary Optics (3) Topics in geometrical, physical, Fourier, and nonlinear optics and introduction to laser physics. Extensive use of computer calculations and design of practical and sophisticated optical systems.

508 Laser Physics (3) Mode analysis, stable and unstable resonators; rate equations and population inversion, saturation, relaxation oscillations, fluctuations and noise, laser stability; quantum theory of laser, photon coherence, models of gain and intensity 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.


532 Advanced Classical Mechanics (3) Variational principles, canonical transformations, Hamilton-Jacobi theory, non-linear mechanics, elasticity, fluid mechanics. Prereq: 531.


561 The Theory of Relativity (3) Geometry of space-time, relativistic electrodynamics, particle mechanics and continuum mechanics, Einstein's field equations, Schwarzschild solutions, the classical test of general relativity. Prereq: or coreq: 531, 511, 542.


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

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

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

594 Special Problems (3) Especially assigned theoretical or experimental work on problems not covered in other courses. May be repeated. Maximum 9 hrs. E


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


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, passive mixing and phase conjugation, transient coherent optical effects and free induction decay, optical breakdown and nonlinear effects in plasmas. Prereq: 572.

610 Quantum Optics (3) Quantum theory of emission and absorption of radiation; frequency-dependent susceptibility; coherence theory; field quantization and coherent photon states; interaction of radiation with atoms; photon optics, counting and higher-order coherence; atomic scattering phenomena. Prereq: 521.

611 Advanced Quantum Mechanics & 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: 561 or consent of instructor.

612 Advanced Topics in Quantum Field Theory (3) Renormalization, Lautz shift, anomalous magnetic moments, gauge theories, electroweak theory, quantum chromodynamics, grand unified theories, and advanced topics in laser physics and quantum optics. Topics vary according to interests of students, instructor and present state of physics. Prereq: 561 or 611 or consent of instructor.

621-22 Nuclear Structure (3,3) General properties of nucleus; two-body scattering problems; saturation and symmetry properties of nuclear forces; properties of light and heavy 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, interplay between 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 Theoretical Physics (3) To meet special needs of students. Advanced dynamics and hydrodynamics, electromagnetic theory, statistical mechanics, and field theory of equilibrium processes. Prereq: 532, 542, 551. May be repeated. Maximum 15 hrs. E

642 Advanced Topics in Quantum Theoretical Physics (3) To meet special needs of students. Angular-momentum theory,
Planning

(MAJOR of Architecture and Planning)

MAJOR DEGREE

Planning........................................ M.S.P.

David A. Patterson, Acting 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

Assistant Professor:

Andersen, 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 entrance 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 letter should also be provided by the work supervisor. Graduate Record Examination scores are requested of all applicants whose undergraduate GPA is below 3.0. Other applicants are encouraged to submit them.

Degree Requirements

The M.S.P. requires completion of at least 40 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, 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 faculty committees.

Each student is required to demonstrate competence in individual research. This may be done in one of two ways:

1. Thesis Option—Complete a thesis for 6 hours credit
2. 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 with a 3.5 cumulative grade-point average. The student meeting these criteria may present a proposal to the faculty 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, and Virginia. Additional information may be obtained from the Admissions Specialist 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 planning; U.S. experience; urban and other levels of planning. State of the art, process, comprehensive plan, implementation plans. Issues in society. Not for credit for M.S.P. degree.


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

501 Thesis and Major Paper Proposal Writing (1) Preparation

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. SNC only. E

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 concepts of computer hardware and software, use of mainframe and microcomputers in planning and government.

523 Statistics for Planners (3) Applications of 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
Plant and Soil Science

(College of Agricultural Sciences and Natural Resources)

MAJOR DEGREES

Plant and Soil Science ...................... M.S., Ph.D.

John E. Foss, Head

Professors:

Allen, Fred L., Ph.D. ....................... Minnesota
Bell, Frank F. (Emeritus), Ph.D. ....... Iowa State
Boswell, F. C. (Adjunct), Ph.D. ........ Penn State
Coffey, D. L., Ph.D. ....................... Purdue
Conger, B. V. (Distinguished Prof.), Ph.D. Washington State
Duck, B. N., Ph.D. ....................... Auburn
Foss, John E., Ph.D. ...................... Minnesota
Fribourg, Henry A., Ph.D. ............... Iowa State
Hayes, R. M., Ph.D. ....................... Illinois
Howard, D. D., Ph.D. ..................... Auburn
Josephson, L. M. (Emeritus), Ph.D. .... Wisconsin
Luxmore, R. J. (Adjunct) (California) (Riverside)
Mullins, C. A., Ph.D. ..................... Tennessee
Parks, William L. (Emeritus), Ph.D. ..... Purdue
Reynolds, John H., Ph.D. ................. Wisconsin
Seatz, Lloyd F. (Emeritus), Ph.D. ....... Kansas State
Springer, M. E. (Emeritus), Ph.D. ....... California
Swingle, H. D. (Emeritus), Ph.D. ....... Louisiana State
Tyler, D. D., Ph.D. ......................... Kentucky

Associate Professors:

Ammons, J. T., Ph.D. ...................... West Virginia
Dayton, D. E. (Liaison), 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., Ph.D. ......................... Nebraska
Wyatt, J. E., Ph.D. ....................... Florida

Assistant Professors:

Eisington, 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 student and the major professor identify a doctoral committee consisting of the major professor, who acts as chairperson of the committee, and a minimum of two faculty members. The advisory committee approves the doctoral program and coursework for the student's coursework and the report on participation in a research program for 593. Students are required to take a 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 6 must be in courses numbered above 600. 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 MASTER'S PROGRAM

Thesis Option

This option requires writing a thesis based on original research. Six hours of 500 Thesis are required. Prior to conducting research, the student must develop a detailed written research plan. In addition to the thesis hours, a minimum of 24 hours of graduate coursework is required, of which at least 14 must be taken in courses numbered 501 and 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 1 hour of 503, and to present an exit seminar on the thesis research.

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 research problem and coursework for the final oral examination integrating the thesis and coursework.

A student having satisfied the thesis option is not eligible to transfer to the non-thesis option after the end of the first semester of graduate study or after having received a Graduate Research Assistantship stipend for more than one semester. A student having started on the non-thesis option may transfer to the thesis option upon approval by a potential major professor and the Department Head.

Non-Thesis Option

A student desiring the non-thesis option should declare this intention at the beginning of the first semester of graduate study, and must declare it before the beginning of the second semester. In lieu of the thesis, students are required to complete 3 hours of 593 for satisfactory participation in a single research program for a period of 12 weeks and the writing of an original, creative, and well-written report, both to be conducted by the major professor and approved by the advisory committee. In addition to 3 hours of 593, a minimum of 30 hours of graduate coursework is required, of which at least 20 must be taken in courses numbered 501 or above, for a total of 33 hours.

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 faculty members. The faculty advisory committee approves the student's coursework and the report on participation in a research program for 593. Students are required to take a comprehensive examination integrating the coursework.
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 their role in soil ecosystem, microbial transformation of organic and inorganic compounds, decomposition of residues, dynamics of soil organic matter. Prereq: Introduction to Soil Science and Introduction to Organic and Biochemistry of Organic Matter or consent of instructor. 2 hrs and 1 lab. F A

412 Soil Genesis, Classification, and Mapping (3) Soil genesis and formation; observing and describing morphology of agricultural and forest soils; chemical and physical properties, classification, mapping. Two Saturday field 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; colloidal fraction as related to chemical change, chemical equilibria, soil acidity, oxidation-reduction, weathering, nutrient availability and waste disposal. Prereq: 311 or consent of instructor. F

414 Soil, Land Use, and the Environment (3) Soil as environmental component and soil-plant-organism-land-use relationship. Soil as resource in development planning: consideration of non-engineering aspects of site selection for land use, soil survey and resource data in land use, recognition and prevention of soil pollution. Prereq: 210 or consent of instructor. Sp, A

415 Soil Hydrology (3) Physical relationships among solid, liquid, and gaseous phases of soil system. Relationships of soil properties to processes governing transport of water, air, and heat 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: 512, Botany 521. 2 hrs and 1 lab. F A

432 Bioclimatology (3) Solar energy budget; interactions between global, regional and local climates and biological systems; quantification of macro- and microclimates; micrometeorological and their modification; automated weather station data collection and analyses; biological responses to climatic stresses; climate variability and change and their effects on biological systems. Prereq: 1 yr physical or biological sciences, junior standing. 2 hrs and 1 lab. F A

433 Agricultural Pesticides (3) Regulation of pesticide development, manufacture, transportation, marketing and use. Structure, use, mode of action, degradation and environmental impact of pesticides 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. Preharvest handling, harvesting, storage facilities and techniques, quality evaluation and biological and physiological mechanisms related to postharvest senescence. Graduate credit requires a short lab 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 related to maintenance of quality of horticultural crops. Prereq: Biology 220 or equivalent. 2 hrs and 1 lab. Sp

471 Statistics for Biological Research (3) Application of statistics to interpretation of biological research. Notation, descriptive statistics, probability, distributions, confidence intervals, hypothesis 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 Preparation (1) Application of speaking, writing, and organizational skills in preparation and presentation of scientific material to both scientific and general audiences. Preparation of abstracts for scientific presentations. Required of all entering graduate students during their first year of graduate study. F, Sp

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 Seminar (1) Presentations and discussion of current scientific material. May be repeated. Maximum 3 hrs. F, Sp

511 Advanced Soils Fertility (3) Concepts of soil chemistry as related to nutrient movement and adsorption by plant roots. Fertilizer use efficiency as measured by plant response factors. Prereq: 413, Sp, A

512 Pedology (3) Physical and chemical weathering processes, factors of soil formation, soil forming processes. Prereq: 412 or consent of instructor. 2 hrs and 1 lab. F A

514 Advanced Soil Physics (3) Theory and mathematical modeling of flow and solute transport in unsaturated soils; geostatistical analysis of soil heterogeneity, stochastic processes for multi-scale pore processes, anisotropy, hysteresis, analytical, and numerical solution of flow and transport equations for unsaturated zone. Prereq: Calculus III, 415, or consent of instructor. F A

530 Integrated Pest Management (3) (Same as Entomology 530.)

532 Advanced Crop Ecology (3) General and specific relationships among environmental factors, crop organisms, and agricultural systems; quantification of macro- and microclimatic influences on crop growth; world climates, crop distribution and productivity, human cultures, and their interaction. Prereq: 471 or equivalent, 451 or equivalent, or Agricultural Climatology or equivalent. 2 hrs and 1 lab. F A

551 Advanced Plant Genetics (3) Discovery of genetics: controlling elements, induced mutations, genome organization, polyploidy, tetrasomic inheritance, extra-chromosomal inheritance, apomixis, incompatibility systems, and genetic engineering of higher plants. Prereq: Biology 520. F A


571 Design and Analysis of Biological Research (3) (Same as Animal Science 571.)

593 Special Problems in Plant and Soil Science (1-3) May be repeated. Maximum 6 hrs. E

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

601 Special Topics in Soil Science (1-3) Thermodynamics of soil solids, clay structure and surface chemistry, soil mineralogy, plant mineral nutrition, soil microbiology, water movement and use by plants, soil structure, soil thermal properties, interaction in the soil-plant environment. May be repeated. Maximum 6 hrs. E

603 Special Topics in Crop Physiology and Ecology (1-3) Microclimatology of agroecosystems, crop dormancy and response to stress, physiology of crop growth and reproduction. Interactions of physiology and genotypic in crop production, theory and application of quantitative methods in crop physiology and ecology research. May be repeated. Maximum 6 hrs. E

605 Special Topics in Plant Breeding and Genetics (1-3) Genotype by environment interactions, estimation of quantitative parameters, mutants, chromosome dynamics, polyploidy, genetic engineering, interspecific hybridization, linkage, selection, genome organization. May be repeated. Maximum 6 hrs. E

613 Advanced Soil Chemistry (3) Surface and colloidal chemistry of soil minerals; recent developments in ion speciation, ion movement, surface charge, surface complexation, and contaminant stability. Prereq: 413 or consent of instructor. Sp, A


633 Plant Growth Control and Herbicide Action (3) Principles of uptake, translocation, mode of action and uses of herbicides and plant growth regulators and their effects on plant morphology, metabolic systems and enzymatic activities. Practical aspects and current commercial uses of plant growth regulators. Prereq: Botany 521 and 522 or equivalent. F A

653 Advanced Plant Breeding (4) Development and utilization of concepts of plant improvement, breeding techniques and selection, introgression, interspecific hybridization, stability parameters, genetic resistance and vulnerability to pests and environmental stresses. Prereq: 453 and 571 or equivalent or consent of instructor. 3 hrs and 1 lab. Sp, A

671 Advanced Research Planning (3) Development of research proposals utilizing prescribed resources and emphasizing experimental design and statistical techniques. Prereq: 571, Animal Science 572, Statistics 461, or equivalent. F A

Political Science

(Majors of Liberal Arts)

MAJORS

DEGREES

Political Science M.A., Ph.D.

Public Administration M.P.A., J.D., M.P.A.

Michael Gant, Head

Professors:

Carlisle, D. H. (Emeritus), Ph.D. North Carolina

Fitzgerald, Michael R., Ph.D. Oklahoma

Gant, Michael M., Ph.D. Michigan State

Gorman, Robert A., Ph.D. New York

Iredell, Vernon R., Ph.D. Chicago

Lyons, William, Ph.D. Oklahoma

Plaas, Hyram, Ph.D. Utah

Robinson, Nelson M. (Emeritus), Ph.D. Syracuse

Smith, T. Alexander, Ph.D. New York

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, Gill C., Ph.D. Columbia

Folz, David H. (Liaison), Ph.D. Tennessee

Freeland, Patricia K., Ph.D. Wisconsin (Milwaukee)

Peterson, Robert L., Ph.D. Yale

Scheib, John M., II (Liaison), Ph.D. Florida

Assistant Professors:

Houston, David J., Ph.D. SUNY (Binghamton)

Nowakens, 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