4. Students will be required to take a written comprehensive examination covering their coursework. In addition, an oral final examination covering the problem and coursework is required. The oral examination will be held on the Knoxville campus.

THE DOCTORAL PROGRAM

1. Completion of a master’s degree in the field, or a closely related field, or passing a special qualifying examination is required for admission. Scores on the GRE aptitude test are also required.


3. A minimum of 72 hours beyond the Bachelor’s degree, excluding credit for the master’s thesis, is required. Of this, 24 semester hours must be 600 Doctoral Research and Dissertation.

4. At least 24 hours of coursework numbered above 500 are required exclusive of doctoral research and dissertation. At least 6 of the 24 hours must be courses numbered above 600.

5. A minimum of 6 hours of courses for graduate credit must be taken outside the Department of Food Science and Technology.

6. All candidates must complete 601 (2 hrs.) and are expected to attend 601 during their Ph.D. program.

7. Each candidate must pass both written and oral comprehensive examinations prior to admission to candidacy. Major professors will advise candidates on competencies expected. A final oral examination is required that includes a defense of the dissertation and subject matter that the student’s committee considers appropriate.

GRADUATE COURSES

430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods. Prereq: Basic statistics. 2 hrs. and 1 lab. F


460 Meat Science (3) Carcass and processing of meats. Prereq: Food Technology. 2 hrs. and 1 lab. F


470 Food Crop Products (3) Food products from plants, animals, and microorganisms. Prereq: Food Science 201. 2 hrs. and 1 lab. F

480 Cereal Science and Bakery Products (3) Chemistry and technology of processing cereal grains, interactions of components, and products. Prereq: Food Science 201. 2 hrs. and 1 lab. F

485 Food Processing System Analysis and Evaluation (3) Design and evaluation of food processing systems. Prereq: Food Science 201. 2 hrs. and 1 lab. F

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

501 Seminar (1) Current research on topics from current literature. May be repeated. Maximum 3 hrs. 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/NC only. E

503 Problems in Lieu of Thesis (2-3) May be repeated. S/NC only. E

510 Instrumental Analysis of Food (3) Modern instrumental methods for analysis of food. Prereq: Food Chemistry. 2 hrs and 1 lab. F

511 Color of Foods (2) Basic principles of color analysis. Prereq: Food Chemistry. 2 hrs. and 1 lab. FA

512 Flavor of Foods (2) Chemical basis of flavor. Prereq: Food Chemistry. 2 hrs. and 1 lab. FA

515 Food Carbohydrates, Proteins and Lipids (4) Advanced study of chemical and physical properties of carbohydrate, protein, and lipid components of foods; effects of processing on nutrients; quality of food components; and changes during processing and distribution of food products. Prereq: Food Chemistry, 3 hrs. and 1 lab.

520 Food and Industrial Fermentations (3) Microbiology and technology of fermentation processes. Prereq: Food Chemistry, 3 hrs. and 1 lab.

521 Advanced Food Microbiology (3) Microbiology of food microorganisms and their effects on food quality. Prereq: Food Chemistry, 3 hrs. and 1 lab.

540 Food Product Development (3) Principles and methods of food product development. Prereq: Food Chemistry, 3 hrs. and 1 lab.

542 Food and Industrial Fermentations (3) Microbiology and technology of fermentation processes. Prereq: Food Chemistry, 3 hrs. and 1 lab.

543 Food Product Development (3) Principles and methods of food product development. Prereq: Food Chemistry, 3 hrs. and 1 lab.

560 Advanced Meat Science (3) Physical and chemical changes that occur in conversion of muscle to meat; effect of postmortem treatments on meat quality, composition, and acceptability. Prereq: Food Chemistry, 3 hrs. and 1 lab.

580 Food Oils and Fats (2) Chemistry and technology of food fats and oils. Prereq: Food Chemistry, 3 hrs. and 1 lab.

590 Special Topics in Food Technology and Science (1-3) Critical review of current research and development concerning advanced food technology. May be repeated. Maximum 9 hrs.

593 Directed Studies (1-3) Research on non-thesis topics chosen by student and advisor. Prereq: Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 8 hrs.

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

601 Seminar (1) Current research on topics from current literature. May be repeated. Maximum 3 hrs. F,Sp

620 Food Toxicology (2) Basic principles of toxicology and food contaminants. Prereq: Food Chemistry, 2 hrs. and 1 lab.

640 Advanced Food Processing (3) Principles and methods of food processing. Prereq: Food Chemistry, 3 hrs. and 1 lab.
department also has an application that must be submitted at the time of application to the Graduate School.

**Thesis Option**
1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. Registration for 6 hours of Thesis (Forestry 500 or Wildlife and Fisheries Science 500) is required.
2. A graduate committee of no fewer than 3 faculty members will be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the research requirement, a minimum of 24 hours of graduate coursework is required. This work must be approved by the student's committee and no more than 10 hours of the minimum 30 can be below the 500 level. The committee may require additional coursework if the student's progress or background indicates such need.
3. All students are required to include Forestry 512 or Wildlife and Fisheries Science 512, Seminar, in their programs. This is required of each graduate student in residence the first semester in residence.
4. An oral examination covering the thesis and coursework is required.

**Non-Thesis Option** (Forestry only)
1. Thirty-five hours of graduate coursework, of which 23 must be at the 500 level or above, is required.
2. A graduate committee of no fewer than 3 faculty members will be selected. At least one member shall be from outside the department. The committee will meet and schedule the student's program during the first semester in residence.
3. Nine hours of coursework in the department must be at the 500 level or above, exclusive of Forestry 511.
4. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 28 hours of approved study.

**MINOR IN ENVIRONMENTAL POLICY**
The department participates in a program designed to give graduate students an opportunity to develop an interdisciplinary specialization in environmental policy. See Economics for program description.

**ACADEMIC COMMON MARKET**
An agreement among 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 Forestry is available to residents of the state of Maryland. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

**Forestry**

**GRADUATE COURSES**
421 Forest and Wildland Resource Economics (3) Production functions, supply-demand and market analysis; non-market programs and projects; economic analysis and decision models; investment and financial analysis; managerial economics; taxes; forest products marketing. Prereq: Forest Resource Analysis or consent of instructor. F
422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; forest and wildland law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing. F
423 Wildland Recreation Planning and Management (3) Planning processes, visitor and recreation site planning, management strategies, methods of evaluating recreation programs. Prereq: Seminar and Recreation Site Management. Sp
430 Wood Adhesives and Glued Wood Products (2) Theoretical and practical aspects of adhesive bonding of wood; wood substrate-adhesive interface for bonding; principles of adhesion; wood adhesives; gluing of solid wood and composite wood manufacturing practices; laboratory manufacture and quality control over stress and strength and glued wood performance; day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 2 hrs and 1 lab. Sp
434 Wood Processing and Machining (2) Primary log breakdown and secondary processing into major products. Fundamentals of machining technology for major types of cutting operations; sawing, boring, planning, core cutting, and laser machining; day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. Sp
435 Wood Drying and Preserving (2) Discussion of wood moisture relationships. Introduction to commercial wood drying equipment and practices. Proper use, specification, and disposal of preservative treated wood. Day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. F
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facility (3-15) Required for the student not otherwise registered during any regular semester or during any summer session before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identify, analyze and prepare written reports on topics. Topical reports on problems identified by graduate committee. Available only to students in non-thesis option for M.S. in Forestry. E
512 Seminar (1) Current developments in forestry. Required of all graduate students in residence fall. May be repeated. Maximum 2 hrs. S/NC only. F
520 Advanced Forest Tree Biology (3) Growth, reproduction, and physiobiology; tree species; anatomy, morphology, and physiology; distribution, variability and taxonomy of forest trees. Prereq: Graduate standing in forestry or biological science, or consent of instructor. F, A
530 Advanced Forest Resource Management (3) Analysis of forest management problems advanced as exemplified in public agencies and private firms. Forest organization and computerized regulation systems; financial and operational planning tools, as applied to forest management. Prereq: Senior level forest management or consent of instructor. Sp, A
540 Genetics in Forestry (3) Genetic improvement of forest trees; selection of superior phenotypes; field testing for genetic variability; tree breeding; development of seed orchards; hybridization; core cytology and tissue culture; use of biochemical variation; planning and conducting forest genetics research. Prereq: Silvicultural methods and Biology 220 or consent of instructor. Sp
550 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development on forests and associated lands; analysis and critique of specific contemporary recreation development planning. Prereq: Senior level in forest recreation or consent of instructor. F, A
570 Management & Policy of Forest Resource Organization (3) Theory and application of management as service to natural resource organizations; international direction and culture, and strategic management. Development of policy as planning tool and as results from conflict resolution. Linkage between policy development and execution, and structure and management of organizations. Prereq: Forest administration and policy or consent of instructor. F, A
580 Advanced Silviculture (3) Silvicultural characteristics, silvicultural practices and systems applied to commercially important hardwoods and softwoods. In-depth analyses of silvicultural principles involved and tools used, prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, structure, growth and yield. Prereq: Undergraduate silviculture course or consent of instructor. 2 hrs and 1 lab. Sp
585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory; fixed and variable plot sampling; list sampling; Poisson sampling; regression estimation; multistage and multiphase sampling. Growth and yield predictors for even-aged and uneven-aged forests. Prereq: Land Measurement Techniques and Forest Resource Inventory or consent of instructor. F, A
590 Advanced Topics in Forestry (1-3) Recent advances and concepts; research techniques and analysis of current problems. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
593 Independent Study in Forestry (1-4) May be repeated. Maximum 6 hrs. E

**Forestry, Wildlife & Fisheries**

**GRADUATE COURSES**
410 Wildlife Habitat Evaluation and Management (3) Ecological relationships between wildlife and habitat. Evaluation, modeling, and management of wildlife habitat. Effects of land-use practices on wildlife habitat. Weekend field trips. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. Applicable to majors in Forestry and in Wildlife and Fisheries Science. 2 hrs and 1 lab. F
416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildlife resource management through developing land management plans and analyzing case studies including conflict resolution. Applicable to majors in Forestry and in Wildlife and Fisheries Science. Prereq: Senior standing 1 hr and 2 labs. Sp
525 Management of Forestry, Wildlife, and Fisheries Resources (3) Current technologies and management strategies concerning wise use of forestry, wildlife, and fisheries resources necessary for decision making and implementation. Prereq: 6 hours of biological sciences or consent of instructor. Not available to students in forestry or wildlife and fisheries science. 4 hrs and 1 lab for six weeks. Sp
535 Environmental Impacts to Natural Ecosystems (3) Environmental impacts on natural ecosystems: climatic change, acid precipitation, air pollution, species declines, and introduction of exotic species. Management methodologies to mitigate environmental problems. Weekend field trips. Prereq: 416 or equivalent or consent of instructor. Applicable to majors in Forestry and in Wildlife and Fisheries Science. Sp
540 Seminar on Integrated Resources Management in Biosphere Reserves (2) MAB program, UNESCO-sponsored national conservation initiative. Analysis of integrated resources management practices that demonstrate concept of sustainable development. Environmental impacts and application in various management and planning practice. Applicable to majors in Forestry and in Wildlife and Fisheries Science. Sp

**Wildlife and Fisheries Science**

**GRADUATE COURSES**
440 Wildlife Techniques (2) Methods of wildlife damage control, research, and management. Identification of wildlife field sign, wildlife capturing techniques and management plan preparation.
443 Fisheries Science (3) Quantification and management of freshwater fisheries: population estimation, age and growth, biological assessment, and stocking. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 2 hrs and 1 lab. F

444 Ecology and Management of Wild Mammals (3) Biological and ecological characteristics of game animals and endangered mammals. Current principles and practices of wild mammal management. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 2 hrs and 1 lab. Sp

450 Ethics in Wildlife and Fisheries Management (1) Ethical issues for decision-making and application of methodologies in practice of wildlife and fisheries management. Seminars by ethicists, wildlife and fisheries scientists and managers, and foresters to acquaint students with diverse perspectives of ethical behavior in practices of wildlife and fisheries management. Lec-tures, panel discussions, and case teams. Team taught. Prereq: Senior standing. Sp

500 Thesis (1-15) Only. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when the student uses University facilities and/or faculty time before degree is completed. May be repeated. Maximum 6 hrs. E

512 Seminar in Wildlife and Fisheries Science (1) Current developments in wildlife and fisheries science. Required of all graduate students in residence fall semester. May be repeated. Maximum 2 hrs. SNC only. F

520 Planning and Administration of Fisheries and Wildlife Programs (2) Factors influencing policy and program planning of activities of fisheries and wildlife agencies. Decision-making policies, case histories. Sp,A

525 Endangered Species Management and Conservation of Biodiversity (2) Status, ecology and management of endangered wildlife and plant species. Historic aspects, policy implications and philosophical issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor. Sp,A

530 Wildlife Diseases (2) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr biology, 444 or 445 or consent of instructor. F,A

555 Fish Culture (3) Principles, concepts and techniques of culturing economically important fish and shellfish species. Prereq: 443 or consent of instructor. 2 hrs. and 1 lab. Sp,A

560 Advanced Topics in Wildlife and Fisheries Science (1-3) Recent advances and concepts, research techniques and analysis of current problems. Prereq: 443, 444, 445, or consent of instructor. May be repeated. Maximum 6 hrs. E

593 Independent Study in Wildlife and Fisheries Science (1-4) May be repeated. Maximum 6 hrs. E

French

See Romance Languages

Geography

(Major and Minor Field of Study)

DEGREES

MAJOR

Geography ............................................. M.S., Ph.D.

Carol Harden, Head

Professors:

Aiken, Charles S., Ph.D. .................. Georgia
Bell, Thomas L., Ph.D. .................. Iowa
Forest, Ronald, Ph.D. .................. Rutgers
Hammond, E. H. (Emeritus), Ph.D. ...... California
Jumper, Sidney R., Ph.D. .................. Tennessee
Long, Robert G. (Emeritus), Ph.D. ...... Northern Minkel, C. W., Ph.D. .................. Syracuse
Balant, C. T. (UTSI), Ph.D. .............. Denver
Pulsipher, Lydia, Ph.D. .................. Southern Illinois
Ruston, Bruce, Ph.D. .................. Northwestern
Schmude, Theodore H. (Emeritus), Ph.D. .... Wisconsin

Associate Professors:

Brinkman, Leonard W., Jr., Ph.D. ........ Wisconsin
Harden, Carol P., Ph.D. ........ Colorado
Horn, Sally P., Ph.D. ........ California
Rehder, John B., Ph.D. ........ Louisiana State

Assistant Professor:

Orvis, Kenneth H., Ph.D. ........ California

The department offers the Master of Science and Doctor of Philosophy degrees. The master's degree emphasizes development of professional competence as a geographer and offers opportunities to gain substantial depth in a concentration or a major technique. An emphasis in geographic information systems is available for students who have appropriate background in mathematics and computer science. The doctoral program is for those who have demonstrated proficiency in conducting independent research. The department is particularly well-qualified to direct graduate work in location analysis, transportation geography, urban and rural geography, cultural ecology, and the geography of the natural environment (especially biogeography and geomorphology). The faculty is qualified to direct students from a variety of approaches ranging from historical and humanistic to rigorously analytic and GIS-based.

THE MASTER'S PROGRAM

The department offers the thesis and non-thesis options for the Master of Science. Both options require a minimum of 30 semester hours beyond the completion of an undergraduate 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) 504. A minimum of 9 hours must be earned in related fields outside the department. Competence in cartography 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 an oral 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 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 on an in-state tuition basis. The Ph.D. program in Geography is available to residents of the states of Alabama, Arkansas, Mississippi, Virginia, or West Virginia. The master's program is also available to residents of Texas. 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, cadastral, and cartographic data structures. Prereq: 310 and knowledge of computer language 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 and uses of remote sensing imagery, digital data, and spectral data: geographic interpretation and
GRE scores (general). Students are not normally admitted under 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 admitted, 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 completion of written thesis and a minimum 3.0 GPA in all graduate coursework.
Course requirements are a minimum of 30 semester hours, including:
1. Six hours of Thesis 500.
2. Registration in 595 during the first two years in residence. Two hours may be counted toward the 30-hour total. This requirement may be waived in unusual circumstances.
3. Sixteen hours of geology courses, with at least 14 hours at the 500 to 600 level, including at least one course from any of the following five groups:
   Group 1: 410, 480, 485, 530, 536, 569.
   Group 2: 420, 520, 525, 545, 568.
   Group 3: 470, 570, 571, 575, 576.
   Group 5: Any 400- or 500-level courses with graduate credit from related departments (allied sciences, mathematics, and engineering), selected with concurrence of the advisor.
4. Eight hours of additional graduate coursework.

THE DOCTORAL PROGRAM
The prerequisites 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 nine hours of coursework in the last in #3, above, including one course from each group. These courses may be taken while completing other course requirements.
Graduation requires passing a comprehensive examination, taken no later than the end of the second year, completion of all course requirements, 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 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 study 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 geologic literature, as approved by the student's dissertation committee. The foreign language requirement may be waived for Ph.D. students whose native language is not English and who have demonstrated mastery of the English language, as determined by the student's dissertation committee.

GRADUATE COURSES
401 Quantitative Methods in Geology (3) Applications of calculus and differential equations to problems in historical sciences. Examples of diffusion equation in hydrogeology, wave equation in mechanical models, and boundary conditions in structural geology and tectonics. Prereq: The Dynamic Earth or Earth, Life, and Time, 2 semesters of Calculus.
410 Advanced Mineralogy (3) Crystal chemistry of rock-forming minerals. Interrelation of electromagnetic radiation and crystal structure. Optical properties of minerals, visible and infrared spectroscopy, and x-ray diffraction. Laboratory exercises emphasize thin section and X-ray diffraction methods of mineralogy. Prereq: 310, 2 hrs and 1 lab.
420 Paleocology (4) Principles of ecological analysis as applied to fossil and fossil assemblages: data collection and interpretation. Laboratory designed around preparation of scientific reports based on field and laboratory analysis. Writing emphasis course. 3 hrs and 1 lab.
421 Invertebrate Paleontology (4) Survey of invertebrate animal phylogeny: skeletal structure and preservation, functional morphology, and stratigraphic distribution. Prereq: Paleobiology or consent of instructor. 2 hrs and 2 lab hours.
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 geologic 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 of landscape evolution and mapping techniques. Prereq: 101-02. (Same as Geography 450.) 2 hrs and 1 lab.
455 Basic Environmental Geology (3) Applications of geological sciences toward comprehension of environmental processes on earth's environments. 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 geologic problems. Prereq: Completion of major core courses and consent of instructor.
460 Principles of Geochemistry (3) Application of chemical principles to geochemical problems. Crystal chemistry and relation between basic atomic structure and distribution of elements in various types of mineral. Prereq: Chemistry 120-30. Recommended prereq: 330, 2 hrs and 1 lab.
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. Formative processes of evolution of atmosphere, crust, mantle, and core. Interdependence of quakes, volcanism, plate tectonics, geomagnetism, chemical and isothermal processes of interior, and earth's temperature. Historical perspective on major controversies of past, and problems unresolved today. Prereq: 16 hrs of geology courses numbered 300 and above. 2 hrs and 1 discussion.
480 Principles of Economic Geology (4) Ore-forming processes, classification of mineral deposits, survey of different types of mineral deposits with examples, and mobilization processes. Prereq: 310 and 330 or consent of instructor. Recommended prereq: 460. 1 hr and 2 lab.
485 Principles of Hydrogeology (3) Physical principles of flow, flow equations, geologic controls, aquifer analysis, water well designing, introduction to transport processes. Prereq: The Dynamic Earth; Calculus. Fundamentals of Physics or equivalent, or consent of instructor. (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
505 Structure of the Southern and Central Appalachians (3) Structural geology of Southern and Central Appalachians from extensional Late Proterozoic-early Paleozoic rift-drift-platform margin through processes relating to compressional events producing accretionary complexes that transgressed Appalachian through the Paleozoic. Comparisons to similar orogenies. Prereq: Structural Geology.
510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques in clay mineral studies. Prereq: 310 and 568 or equivalent. 2 hrs and 1 lab.
521 Data Analysis in Geology and Environmental Science (3) Application of statistical and other quantitative methods using computers to analyze geological data: environmental problems.
525 Biostratigraphy (3) Examination of principles of stratigraphy and biostratigraphy through selected case histories. 1 hr and 2-1/2 hr seminar.
530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metamorphic rocks, magmatic and metamorphic processes and physical conditions. Labo-
535 Ground Water Hydrology (3) (Same as Environmental Engineering 553.)
540 Seminar in Local Geology (1) Introduction of geology of Southern Appalachians. 1 hr plus field trips.
545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of terrigenous clastic rock types; physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. 3 or 4 hrs.
546 Carbonate Sedimentology (3) Environments of deposition of modern and ancient carbonate sediments and diagnosis of resultant rocks; field and laboratory analysis of sample material and preparation of scientific reports. 3 hrs.
550 Regional Geomorphology (3) Integrative approach to study of natural 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 550.)
556 Quaternary Geology of North America (3) Interpretation of geomorphologic, stratigraphic, and sedimentologic evidence in order to reconstruct Quaternary landform history; glaciated, periglacial, and nonglacial regions of North America; correlation of major episodes of North American ice cap and paleo-oceanographic changes in Atlantic and Pacific Oceans. Prereq: 101 or consent of instructor.
557 Quaternary Paleoecology (3) Perturbation, process, and pattern within Quaternary ecosystems; climate change and vegetational responses during last 2.5 million years. Prereq: Consent of instructor.
563 Stable Isotopes in Geochemistry (3) Theoretical aspects of isotopes, fractionation processes, stable isotope geologic systems, isotope exchange, variations in natural waters, diagenetic, 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 spectrophotometric techniques. Prereq: 310 or consent of instructor. 2 hrs and 1 lab.
570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; re-
Germanic and Slavic Languages

(Majors in Arts and Sciences)

MAJORS

German ................................................. M.A.
Modern Foreign Languages .................. Ph.D.

David E. Lee, Head

Professors:
Falen, James E. (Emeritus), Ph.D. Pennsylvania
Fiere, Donald M. (Emeritus), Ph.D. Indiana
Hodges, Carolyn R., Ph.D. .................... Chicago
Kratz, Henry (Emeritus), Ph.D. ................ Ohio State
Osborne, J. C. (Emeritus), Ph.D. ............... Northwestern
Ritenhous, Ursula C. (Emeritus), Ph.D. ........ Connecticut

Associate Professors:
Laukon, Nancy A. (Liaison), Ph.D. Wisconsin
Lee, David E., Ph.D. .............................. Stanford
Mellor, C. J., Ph.D. ............................... Chicago
Pervukhin, Natalia K., Ph.D. ...................... Bryn Mawr

Assistant Professors:
Blackwell, Stephen H., Ph.D. ................. Indiana
Hoeyng, Peter, Ph.D. .............................. Michigan
Livers, Keith A., Ph.D. ......................... Georgetown
Ohsensp, Stafanie, Ph.D. ........................ McColl

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 and Asian Languages and requires advanced training in a major language and either a second language or applied linguistics. Students whose language of first concentration is French or Spanish should consult the section on Romance and Asian 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 with German as a first concentration 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.

The coursework must be distributed as follows:

1. First Concentration: German. A minimum of 39 hours of German courses beyond the bachelor’s degree, distributed as follows:
   - 400 level: A maximum of 6 hours of 400-level classes taken for the M.A. may be applied.
   - 500 level: A minimum of 21 hours must be taken. These must include German 512, 519, 520, and 560. Thesis hours are excluded. If 512 is used as part of a second concentration in applied linguistics, another course must be substituted in the first concentration.
   - 600 level: A minimum of 12 hours must be taken, exclusive of dissertation hours.

2. Second Concentration. A minimum of 18 hours beyond the bachelor’s degree, taken in the field of applied linguistics or in a second language, either French, Italian, Russian or Spanish. Twelve of these hours must be at the 500 level or above.

Students choosing applied linguistics as a second concentration are strongly urged to take their cognate work in a second language.

4. Additional requirements: For any languages taken as a first or second concentration, a student must demonstrate competence by taking a test. 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 Teachers Examination, the MLA Examination for Teachers and Advanced Students, or the proficiency standards of the United States Foreign Service Institute (FSI).

If a 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.

For students choosing applied linguistics as an area of second concentration, reading competence in a second language is required. Competence will be determined by translation of a text from the foreign language into English, the test to be administered by the department offering the language.

A comprehensive examination on 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 with a second concentration in another language should have the opportunity and will be strongly encouraged to instruct in the languages of both their first and second concentration, 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 and Asian Languages.

**ACADEMIC COMMON MARKET**

An agreement among southern states for sharing graduate students 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. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

### German

**GRADUATE COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite(s)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>331-32</td>
<td>Elements of German for Upper-Division and Graduate Students (3,3)</td>
<td>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 101-02 or 107. 332 may be repeated. Maximum 6 hrs. Undergraduate credit only.</td>
<td></td>
</tr>
<tr>
<td>411-12</td>
<td>Advanced Conversation and Composition (3,3)</td>
<td>Prereq: 311-12 or equivalent or consent of department.</td>
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</tr>
<tr>
<td>415</td>
<td>Special Topics (3)</td>
<td>Topics vary. May be repeated.</td>
<td></td>
</tr>
<tr>
<td>420-30</td>
<td>Selected Topics in German Literature from 1750 to the Present (3)</td>
<td>Prereq: 6 hrs of 300-level courses (excluding 301-32 and courses in English translation) or equivalent.</td>
<td></td>
</tr>
<tr>
<td>421</td>
<td>German Lyric Poetry (3)</td>
<td>Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.</td>
<td></td>
</tr>
<tr>
<td>422</td>
<td>German Drama (3)</td>
<td>Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.</td>
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</tr>
<tr>
<td>423-42</td>
<td>German Narrative Prose (3)</td>
<td>Prereq: 6 hrs of 300-level courses (excluding 331-32 and courses in English translation) or equivalent.</td>
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</tr>
<tr>
<td>424</td>
<td>German Literary Movements (3)</td>
<td>Survey of major periods in development of German literature since 1750: problems and pitfalls of periodization.</td>
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</tr>
<tr>
<td>425-52</td>
<td>Introduction to Descriptive Linguistics (3)</td>
<td>(Same as French 425, Spanish 425, Linguistics 426, and Russian 425.)</td>
<td></td>
</tr>
<tr>
<td>426</td>
<td>Methods of Historical Linguistics (3)</td>
<td>Phonetics, distinctive feature analysis, sound change types, nature of sound change, principles of reconstruction, and fundamental assumptions about language change through time. Survey of non-phonological linguistic change, language families, Proto-Indo-European, and other proto languages. Prereq: 6 hrs of upper division foreign language courses (excluding courses in translation and graduate reading courses). (Same as Russian 426, French 426, Spanish 426, and Linguistics 426.)</td>
<td></td>
</tr>
<tr>
<td>435</td>
<td>Structure of the German Language (3)</td>
<td>Contrastive English-German segmental and suprasegmental phonemes, contrastive German-Linguistic structures, selected topics in advanced German grammar and syntactic analysis. Prereq: 6 hrs of upper division German language courses (excluding courses in translation and graduate reading courses). (Same as Linguistics 435.)</td>
<td></td>
</tr>
</tbody>
</table>

### Russian

**GRADUATE COURSES**

<table>
<thead>
<tr>
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<th>Prerequisite(s)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>401-02</td>
<td>Advanced Grammar, Conversation, and Composition (3,3)</td>
<td>Prereq: Russian Composition and Conversation</td>
<td></td>
</tr>
</tbody>
</table>

**Health, Leisure, and Safety Sciences**

**DEGREES**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Program</th>
<th>MAJORS</th>
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</thead>
<tbody>
<tr>
<td>Health, Leisure, and Safety Sciences</td>
<td>College of Human Ecology</td>
<td>MAJORS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professors:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gorski, June, Dr.P.H. ....................................................................</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hamilton, Charles B. (Liaison), Dr.P.H. .....................................</td>
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<tr>
<td></td>
<td></td>
<td>Hayes, Gene A. (Liaison), Ph.D. ...............................................</td>
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<tr>
<td></td>
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<td>Kirk, Robert H., H.S.D. ................................................................</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wallace, Bill C. (Liaison), Ed.D. ...........................................</td>
</tr>
</tbody>
</table>

**Associate Professors:**

<table>
<thead>
<tr>
<th>Professor</th>
<th>Institution</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanton</td>
<td>University of Tennessee</td>
<td>Tennessee</td>
</tr>
<tr>
<td>Crick</td>
<td>University of Illinois</td>
<td>Illinois</td>
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<tr>
<td>Pursley</td>
<td>University of Iowa</td>
<td>Iowa</td>
</tr>
<tr>
<td>Zemel</td>
<td>University of Oregon</td>
<td>Oregon</td>
</tr>
<tr>
<td>Smith</td>
<td>University of Tennessee</td>
<td>Tennessee</td>
</tr>
</tbody>
</table>

**Assistant Professors:**

<table>
<thead>
<tr>
<th>Professor</th>
<th>Institution</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goffin</td>
<td>University of Tennessee</td>
<td>Tennessee</td>
</tr>
<tr>
<td>Fitzhugh</td>
<td>University of Pennsylvania</td>
<td>Pennsylvania</td>
</tr>
<tr>
<td>Hendrick</td>
<td>University of Alabama</td>
<td>Alabama</td>
</tr>
<tr>
<td>Smith</td>
<td>University of Tennessee</td>
<td>Tennessee</td>
</tr>
</tbody>
</table>

The Health, Leisure, and Safety Sciences Department offers graduate programs leading to the Master of Science with majors in Health Promotion and Health Education, Recreation,
Tourism and Hospitality Management; and Safety Education and Service; and to the Master of Public Health degree in Public Health. The department provides doctoral preparation through a concentration in Human Ecology. Inquiries should be directed to the department head. Application packets are available by request to department.

The department fosters a natural uniting of disciplines that contribute to a holistic approach to healthy living and the enjoyment of life for all citizens. The academic disciplines focus on assisting students, clients, and faculty to (1) develop a healthful and safe lifestyle that considers the dimensions of disease and injury prevention, and the role of leisure as it contributes to mental, social, and physical health; and (2) prepare persons for competent practice of their respective disciplines, including scholarly, creative scholars with an intent of research. The department is committed to the educational value of community-based experiential learning.

**Health**

A graduate program is available leading to the Master of Science with a major in Health Promotion and Health Education (thesis and non-thesis options), requiring completion of 30 semester hours.

The Doctor of Philosophy with a major in Human Ecology offers a concentration in community health.

**THE PH.D. CONCENTRATION**

The community health concentration integrates the behavioral and natural sciences with public health, community health education, health promotion and the safety sciences to prepare educators with an interest in improving the health of the nation.

Requirements include:
1. Minimum 21 hours of foundation courses: 610, 620, 6 hours of statistics, 3 hours of specialized research methods, and 6 hours of natural or behavioral sciences.
3. Minimum 12 hours in supporting specialization in a focused area: public health, safety, gerontology or a program approved by doctoral committee.
4. Minimum 6 hours in a cognate area.

**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. Factors which make alcoholism serious and the impact of alcoholism on society. Various types of institutional educational and intervention programs. F

406 Death, Dying and Bereavement (3) Aspects of dying, death and handling of trauma of loss. Medical, financial, physical, legal and social implications of death. F, Sp

420 Sex Education As It Relates to Human Sexuality (3) Exploration of social, cultural, medical and psychological aspects of human sexuality. F

425 Women's Health (3) Factors influencing women's health and women consumers in nation's health service delivery systems. Health problems/concerns of women and techniques for prevention, maintenance and/or correction. (Same as Women's Studies 425) E

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

435 Substance Use and Abuse (3) Drug and alcohol abuse problems and causes; pharmacology of drugs and effects on society; strategies for intervention and education. Sp

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

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

520 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

590 Research MethodsinHealth (3) Basic research techniques in study of health settings. Development of research skills and problem identification for research topic. (Same as Public Health 590) F

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

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

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

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

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

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


**Public Health**

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

**ADMISSION REQUIREMENTS**

A statement of the applicant's educational and career goals and three rating forms are requested. Request application packet from the department. Preferential consideration for admission to degree status shall be given to those with a minimum undergraduate grade-point average of 2.8 and with at least one year of professional experience in a health-related occupation. As a restricted program, non-degree admission requires department recommendation. Deadlines for completed applications are 1 February for Summer term and 1 April for Fall semester.

**THE MASTER'S PROGRAM**

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

As an alternative to field practice, preparation of a master's essay may be used to fulfill the professional skills development component of the curriculum. Approval must be received from the Public Health Academic 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.

**DUAL MS-MPH PROGRAM**

The College of Human Ecology offers a coordinated dual program leading to the conferral of both the Master of Science with a major in Nutrition (public health nutrition concentration) and the Master of Public Health. The dual program allows students to complete both degrees in less time than would be required to earn both degrees independently.

The program is designed to meet the needs of students who are interested in the benefits of majors in both nutrition and public health. Therefore, it accommodates the interests of students who: 1) plan a career in Public Health Nutrition and want to acquire the knowledge and skills of the nutritionist and public health professional; 2) plan a career in nutrition and want to acquire the knowledge and skills and the perspective of the public health professional; or 3) plan a career in public health and want to acquire the knowledge, skills and perspective of the nutritionist.

**Admission Requirements**

Applicants for the M.S.-M.P.H. program must make separate application to, and be competitively and independently accepted by, the Department of Nutrition for the M.S. Department of Health, Leisure and Safety Sciences for the
COURSE REGISTRATION

Non-degree students must obtain permission from the department 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 (Same as Health 400.)
410 Health in the Work Environment (Same as Health 410.)
509 and Social Work 509.) S/NC only. F,Sp
510 Environmental and Occupational Health (2) Concepts and theoretical foundations essential to occupational health theory, practice and regulations: recognition, evaluation and control of workplace health hazards. Prerequisite: 509. F,Sp
511 Fundamentals of Industrial Hygiene (3) Occupational health, practice and regulations; recognition, evaluation and control of workplace health hazards. Prerequisite: 509. F,Sp
512 Industrial Hygiene Controls (4) Activities in comprehensive practice of industrial hygiene controls: purposing for industrial processes. Application of industrial hygiene techniques and instrumentation in solution of workplace hazards. Prerequisite: 511. F,Sp
513 Industrial Hygiene Instrumentation and Sampling (3) Methods and instruments for evaluating industrial environment for exposure to chemical and physical stresses affecting worker's health. Lecture, demonstration, and lab. Prerequisites: 511, MPH (OBH) 520, Biostatistics (PH 530), and Epidemiology (PH 540). F,Sp
514 Industrial Toxicology and Occupational Exposure (3) Principles of industrial toxicology, basic mechanisms, portals of entry, physiologic and biochemical responses. Occupational exposure assessment, protective factors and environmental considerations. Influence exposure characterization, statistical aspects of sampling, and transport of contaminants into general environment. Prerequisite: 511, and 1 semester of general chemistry. F,Sp
520 Public Health Policy and Administration (3) Administrative considerations of community-based health care programs and public health practice. Health policy formulation, political environment and governmental involvement in health, legal responsibilities, and management concepts/techniques/process. F,Sp
521 Organization Theory and Health Care Delivery (3) Administrative and Organization theory related to health facilities; organization and management of community hospital. Case discussions and problem-solving exercises; managerial functions and skills. F
523 Management in Extended Care Settings (3) Managerial concepts and 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. Prerequisites: 521 or consent of instructor. So
525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities in management research. Prerequisites: 520 or consent of instructor. Sp
530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of data, and computerized research methodology preparatory for first course in epidemiology. Prerequisite: Introductory statistics or consent of instructor. F,Sp
540 Principles of Epidemiology (3) Distribution and determinates of health-related outcomes in specified populations, with application to control of health problems. Historical origin of discipline, hypothesis formulation, research design, data and error sources, measures of frequency and association, etiologic reasoning, disease screening, and injury control. Prerequisite or consent: 530. F,Sp
542 Advanced Epidemiological Methods (3) Nature, content, analysis and interpretation of data pertaining to cohort and case-control studies. Surveillance and analytic methods: multiple logistic regression and some multivariate analysis techniques. Prerequisite: 540 or consent of instructor. Sp
550 Principles and Practices of Community Health Education (3) Theoretical foundations for community health education: opportunities for skill development in various 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 planning and evaluation techniques. Opportunities to practice skills in realistic settings. Prerequisite: 550 or consent of instructor. Sp
560 Theories and Techniques in Health Planning (4) Overview of health planning concepts and methodologies; systematic planning process. Major elements of planning: formulation and conceptualization of problem, plan design and evaluation and implementation. Health problems and institutions, community and selected population groups, appropriate diagnoses, and programs for addressing needs. Sp
568 Physical Activity and Positive Health (3) Same as Exercise Science 568.
569 Fitness Testing, Programming, and Leadership for Diverse Populations (3) Same as Exercise Science 568.
580 Special Topics (3) Prerequisite: Consent of instructor. May be repeated under different topics. Maximum 6 hrs.
587-88-89 Internship (3,3,3) Internship (community health education or health planning/administration) in an approved organization or research setting under supervision of designated preceptor. Prerequisites: MPH major, one semester advance notice and consent of major advisor: 587: available only for approved extended placements. S/NC only. E.
590 Research Methods in Health (3) Same as Health 590.
593 Directed Independent Study (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

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

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

Recreation and Tourism Management

Graduate study leads to a Master of Science degree with a major in Recreation, Tourism and Hospitality Management. Four concentrations are available: therapeutic recreation, recreation administration, tourism, and hospitality management. The thesis option requires 33-36 hours and non-thesis option requires 36-39 hours depending upon the specific concentration. For all thesis concentrations, individuals not possessing an undergraduate degree in the discipline or having appropriate full-time work experience will be required to take 590 (graduate internship).

Requirements for each concentration are:

**Hospitality Management**
- All students (28 hours): Hotel and Restaurant Administration 532, 537, 542; Nutrition 541; Hotel and Restaurant Administration/Nutrition electives (12 hours); related area (6 hours); statistics (3 hours);
- Thesis Option (6 hours): 500;
- Non-Thesis Option (6 hours): 535; Hotel and Restaurant Administration/Nutrition elective (3 hours); elective (3 hours).

For a description of courses in the hospitality management concentration, see Nutrition.

**Recreation Administration**
- All students (24 hours): 415 or 440, 510, 515, 540, 541; Safety Education 443; Sport Management 512; statistics (3 hours); research methods (3 hours);
- Thesis Option (6 hours): 500;
- Non-Thesis Option (6 hours): 535; Hotel and Restaurant Administration/Nutrition elective (3 hours); elective (3 hours).

**Therapeutic Recreation**
- All students (24 hours): 420 or 425, 510, 515, 520, 521, 522; statistics (3 hours); research methods (3 hours);
- Thesis Option (9 hours): 500; elective (3 hours);
- Non-Thesis Option (12 hours): electives (6 hours); 590 (3-6 hours);
- Thesis Option (9 hours): 500; elective (3 hours);
- Non-Thesis Option (12 hours): electives (6 hours); 590 (3-6 hours).

**Tourism**
- All students (30 hours): 470, 510, 515; Hotel and Restaurant Administration 532, 542;
- Marketing 510; Hotel and Restaurant Administration 550; Planning 540; Planning 548 or 550; statistics (3 hours); research methods (3 hours);
- Thesis Option (6 hours): RTM or HRA 500;
- Non-Thesis Option (9 hours): 590 (3-6 hours); elective (3-6 hours).

**GRADUATE COURSES**

**415 Development and Maintenance of Leisure, Sport, Tourism Services (3) Principles of planning, designing, outfitting and operating leisure/sport related facilities such as aquatic centers, tennis complexes, activity centers. Prereq: Leisure Program Development and Evaluation, or consent of instructor. (Same as Sport Management 415). F**

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


**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**

**470 Tourism and Leisure Industries (3) Symbolic relationship between tourism and various sectors of leisure industry. Use of resources, both natural and developed, and economic impacts of ventures. Sociocultural impacts on venue as well as venues impact on local population. Sp**

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

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

**510 Perspectives and Trends in Leisure 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. Sp**

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

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

**521 Facilitation Techniques in Therapeutic Recreation (3) Role of therapeutic recreation in clinical and non-clinical settings: application of life-style planning, safety awareness, problem solving, and leisure interventions in training in therapeutic recreation, relationship of leisure education to therapeutic recreation. Prereq: 520 or consent of instructor. Su**

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

**540 Fiscal Policies for Recreation and Sports Related Organizations and Facilities (3) Application of fiscal policies and procedures to operation of recreation and sports related organizations and facilities. Finance, revenue generating strategies, cash and inventory control, commercial/public cooperative ventures and microcomputer applications. Prereq: 450 or consent of instructor. Sp**

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

**590 Graduate Internship (3-4) Required of all graduate students. Minimum 50 clock hours for each hour credit. Work experience, evaluation by agency and university and written paper required. 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 study with a major in Safety Education and Service (thesis and non-thesis options) leads to the Master of Science degree. The M.S. requires completion of 36 semester hours. Students may elect an internship experience with private industry or nonprofit organizations. Curricular experiences will assist graduate in preparation for certified safety professional examination.

**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 Safety Education and Service is available to residents of the states of Alabama, Arkansas, or Florida. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

**GRADUATE COURSES**

**443 Sports & Recreational Safety (3) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and interrelationship in sports injury and control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs and 2 labs.**

**452 General Safety (3) Principles, practices, and procedures in general safety. Safety problems in school, traffic, recreation, industry, home and other public areas. F, Su**

**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 before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E**

**532 Behavioral Problems in Safety Education & Accident Prevention (3) Problems of behavior, causes of accidents, and application of principles of psychology in development of safe behavior in all segments of environment. F**

**533 Problems and Research in Accident Prevention (3) Safety problems found in wide variety of accidents that occur in community; findings of current research in behavioral sciences as related to variation incidence of accidents. F**

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

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

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

**590 Special Topics (1-3) Advanced study in selected disciplinary or professional area of safety education management. May be repeated. Maximum 12 hrs.**

**593 Directed Independent Study (1-3) Individual identification and study of problem/issue in safety. Extensive reading and critical analysis of safety literature. Specified proposal to instructor before registration. May be repeated. Maximum 12 hrs. E**

**601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, re-
History
(College of Arts and Sciences)

Russel Buhite, Head

Professors:
Bergeron, Paul H., Ph.D. Vanderbilt
Buhite, Russell D., Ph.D. Michigan State
Chmielewski, Edward V., Ph.D. Harvard
Culler, Everett W., Ph.D. Texas
Farris, W. Wayne, Ph.D. Harvard
Finger, John R., Ph.D. Washington
Haas, Arthur G., Ph.D. Chicago
Hao, Yen-Ping (Lindsay Young Prof.), Ph.D. Harvard
Haikins, Ralph W. (Emeritus), Ph.D. California
Klein, Milton M. (Emeritus) (Distinguished Prof.), Ph.D. Columbia
Moser, Harold F., Ph.D. Wisconsin
Ratner, Lorman A., Ph.D. Cornell
Utley, Jonathan G. (Emeritus), Ph.D. Illinois
Wheeler, W. Bruce, Ph.D. Virginia

Associate Professors:
Becker, Susan, Ph.D. Case Western
Bing, J. Daniel, Ph.D. Indiana
Boehstedt, John, Ph.D. Harvard
Brummell, Palmira R. (Liason), Ph.D. Chicago
Dacon, Todd A., Ph.D. Wisconsin
Johnson, Charles W., Ph.D. Michigan
Muldowly, John, Ph.D. Yale
Pinone, Paul J., Ph.D. Vanderbilt

Assistant Professors:
Ash, Stephen V., Ph.D. Tennessee
Bast, Robert J., Ph.D. Arizona
Bradley, Owen P., Ph.D. Cornell
Burman, Thomas E., Ph.D. Toronto
Glover, Lorri, Ph.D. Kentucky
Haiken, Elizabeth, Ph.D. California (Berkeley)
Higgs, Catherine A., Ph.D. Yale
Lulevich, Jesia G., Ph.D. Pennsylvania

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

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).

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

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

The comprehensive examination is to be taken no later than the semester following the term in which the student has completed the residence, coursework, and language requirements. A student stands examination in one field selected from Group I and one field selected from Group II below. Both parts are 4-hours, written, and taken during the same semester. A general oral exam will be taken following the successful completion of the two parts. 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 one of the three parts (Group I or Group II or the Oral) which constitute the Comprehensive Exam must repeat the failed exam within two semesters, excluding summer. A second failure on any one of the three parts (regardless of which one) will cause the student to be dropped from the History graduate program. Likewise, a student who does not repeat a failed exam within the allotted time (two semesters) will be dropped 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)
- Asian
- World History

Group II:
- To be defined by the student's doctoral committee from within the following fields:
  - United States
  - Colonial and Early Republic
  - 19th century
  - 20th century
  - Regional
  - Military and Foreign Relations
  - Social and Cultural
  - American Political
  - European
  - Medieval
  - Early Modern
  - Modern
  - Political and Diplomatic
  - Intellectual and Cultural
  - Social and Economic
  - National Fields
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

415 Western Economic Thought Since the 18th Century (3) Methods of study of doctrinal history. Origins and evolution of major doctrines: classical and neoclassical economics, economics of Keynes and his followers, principal developments of second half of 20th century. Major writing requirement. May not be used toward degree requirements. May be repeated. Max. 15 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 the student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.

510 Foundations of 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-Century United States (3) Reading seminar: secondary sources on 19th-century United States. Focus varies. May be repeated. Maximum 15 hrs.

543 Topics in 20th-Century United States (3) Reading seminar: secondary sources on 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 nuclear 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.

585 Topics in World History (3) Reading seminar in transnational themes involving analyses of two or more world cultures. Focus varies. May be repeated. Maximum 9 hrs.

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

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

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

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

621 Directed Readings (3) Directed readings to prepare candidate for doctoral comprehensive examination. May be repeated. Maximum 1 per doctoral field. S/NC only.

632 Seminar in Modern European History (3) Research seminar in primary sources culminating in scholarly paper in modern European history. Focus varies. May be repeated. Maximum 15 hrs.

641 Seminar in Early American History (3) Research seminar in primary sources culminating in scholarly paper in American history. Focus varies. May be repeated. Maximum 15 hrs.


651 Seminar in Military and Foreign Relations History (3) Research seminar in primary sources culminating in scholarly paper in military or foreign relations history. Focus varies. Not restricted by national groupings. 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.

Holistic Teaching/Learning

(College of Education)

MAJORS

DEGREES

Education .................. M.S., Ed.S., Ed.D., Ph.D.

L. Knight, Leader

Professors:


Associate Professors:

Chace, Charles A., Ph.D. .................. Ohio State Hannum, Michael C., Ed.D. .................. Northern Colorado

Assistant Professors:

Gilrene, Colleen P., Ph.D. .................. Illinois Hendricks, D. A., Ph.D. .................. Alabama

Instructor:

Butterworth, Jennifer R., Ph.D. .................. Vanderbilt

The Holistic Teaching/Learning unit participates in graduate programs leading to degrees, majors, and concentrations in:

Master of Science

Education

Track 1-elementary education
Track 1-modified and comprehensive special education
Track 1-reading education
Track 1-social science education
Track 2-elementary teaching
Track 2-modified and comprehensive special education
Track 2-secondary teaching

Education Specialist

Education

Elementary education
Reading education
Social science education

Doctor of Education

Education

Elementary education
Reading education
Social science education

Doctor of Philosophy

Education

Elementary education
Literacy studies: reading and language arts

The unit also houses programs for students seeking licensure in early childhood, primary, and middle school education (grades K-8 and 1-8), reading endorsement, special education licensure, and secondary social studies. See Education under Fields of Instruction for full description of all degree requirements. The unit's central emphasis is on holistic, integrative, and interdisciplinary teaching/learning as opposed to teaching disciplinary subject content (e.g., science, mathematics, language arts) as separate entities. The focus on integration is similar to how children learn and how language is central to the teaching/learning process. The faculty believe that students should be prepared as teachers who can facilitate learning rather than merely dispense content. Central to the philosophy of holistic teaching and learning is knowing each individual child's learning style, abilities, and interests.

GRADUATE COURSES

419 Psychology and Education of Students with Mild Disabilities (3) Nature and characteristics of persons with mild handicaps and educational strategies
appropriate for these persons. Prereq: Special Education Principles and Special Education Strategies, Admission to Teacher Education Program. Coreq: 420, F.

420 Field Experience in Modified Programs (3) Practicum in teaching in modified programs: planning, development, implementation, and evaluating instruction. Prereq: Special Education Principles and Special Education Strategies, Admission to Teacher Education and Curriculum and Instruction 422. Coreq: 420. S/NC only. F.

421 Elementary and Middle School Science and Social Studies Instruction (3) Methods and materials for teaching science and social studies. Development of functional relationships and entities of two fields. Not open to students with fewer than 6 credits in these courses. Prereq: Admission to teacher education. F, Sp.

422 Elementary and Middle School Teaching Methods I (6) Methods and materials (knowledge base) for teaching reading, writing, social studies, science and social studies, content and curriculum, evaluation. Unit planning, daily planning, evaluation, etc., and language and concept development.

423 Language Arts/Reading Instruction in Elementary and Middle School (3) Language and language development as applied to teaching of oracy (listening, speaking) and aspects of literacy (reading, writing, and note-taking). Not open to students with fewer than 6 credits in these courses. Prereq: Admission to teacher education. F, Sp.

430 Elementary and Middle School Developmental Reading Instruction (3) Word recognition, identification, comprehension, evaluation, and materials. Not open to students with fewer than 6 credits in these courses. Prereq: Admission to teacher education. F, Sp.

431 Field Experience in Comprehensive Programs (3) Prereq: Special Education Principles and Special Education Strategies, Admission to Teacher Education and Curriculum and Instruction 422. Coreq: 420. S/NC only.

432 Psychology and Education of Students with Moderate/Severe Disabilities (6) Nature and characteristics of persons with moderate/severe disabilities and educational strategies appropriate for those persons. Prereq: Special Education Principles and Special Education Strategies, Admission to Teacher Education and Curriculum and Instruction 422.

434 Topics in Reading Education (1-5) Prereq: Admission to teacher education or reading education. May be repeated. Maximum 6 hrs. E.

454 Teaching Strategies and Issues in Social Studies Education (3) Goals, objectives, techniques, materials, and evaluation; directed observation in public schools, preparation of teaching plans, and materials; simulated teaching experiences. Prereq: Admission to Teacher Education Program.

456 Speech and Language Basis of Learning Disabilities in the Classroom (3) Normal communication development, understanding of speech and language impairments in school-age students; integration of oral/written communication skills into existing curriculum, especially for high incidence special education students.

470 Psychology of the Exceptional Child (3) Variables of exceptional children; general characteristics and educational needs. Implications of developmental variations for functioning as adults. Opportunity to expand study upon particular exceptionality. Enrollment limited to non-special education majors.

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 his degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hrs. S/NC only. E.

504 Studies and Theory in Language Development (3) Studies and theory of language development in children. Prereq: 1 elementary school language arts course or consent of instructor. F.

505 Elementary and Middle School Teaching Methods II (6) Content area teaching and development of students to apply modified instructional materials and to develop innovative teaching strategies. Not open to students with fewer than 6 credits in these courses. Prereq: Admission to teacher education. Coreq: 575. S/NC only. E.

506 Internships in Teaching in Special Education and Rehabilitation (3-15) Placement in professional settings in public schools or agencies under supervision of qualified practitioners. Enrollment limited to those in five-year program. S, Sp.

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only. E.

521 Teaching Social Studies in Elementary and Middle Schools (3) Planning and techniques. Trends in curricular development of concepts and generalizations, integration of social studies and special education, development of specific content area instruction students or consent of instructor. Sp.

523 Diagnosis and Correction of Children's Difficulties in Learning Mathematics (3) Children's difficulties in learning mathematics and procedures for helping classroom teacher correct difficulties. Prereq: 522 or equivalent or consent of instructor. Sp.


525 Strategies, Programs, and Materials for Teaching Language Arts (3) Analysis of new and innovative learning programs, program materials and techniques for improving reading in social studies education. Prereq: Previous course in teaching of social studies or consent of instructor. Sp.


528 Teaching Language Arts Elementary and Middle School (3) Recent trends and current materials and methods in teaching foreign language and language arts, except reading. Prereq: Consent of instructor. F, Su.

529 Practicum in Diagnosis and Remediation of Difficulties in Learning Mathematics (3) Assessment and practicum experience with children having difficulties in learning elementary school mathematics. Prereq: 523 or consent of instructor. Su.

530 Teaching Reading in Elementary and Middle Schools (3) Trends in methods, materials, basic approaches, skill development and assessment procedures for teaching reading at elementary school level. Prereq: Course in teaching of reading or consent of instructor. F, Su.

534 Seminar in Reading Education (1-6) May be repeated. Maximum 6 hrs. E.

536 Psychology of Reading (3) Reading act, relationship between learning, reading, role of reading in child's overall intellectual development, affective and cultural factors. Prereq: 500-level course in reading education or consent of instructor. F.

537 Diagnosis and Correction of Classroom Reading Problems (3) Procedures, methodological and materials for diagnosing and correcting classroom reading problems. Prereq: Course in reading education, or equivalent teaching experience, or consent of instructor. Sp.

539 Practicum in Diagnosis and Remediation of Reading Problems (3) Application of learning and teaching methodology in working with elementary and/or secondary school students on one-to-one or small group basis. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor. Sp.

553 Assessment of Exceptional Students (3) Issues related to assessment; advanced study of evaluation models for special education, and new innovative assessment approaches. Advanced study of application to educational programming; basic statistics and application in assessment.

554 Developmental Reading Practicum (2) Diagnosing and teaching remediation of reading and compensatory reading needs. Prereq: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Su.

555 Characteristics of Affective/Motivational Functioning in Children with Disabilities (3) Definition, methods, identification and symptoms of children with affective/motivational development in disabled youngst. Comparison to normal development and that of children labeled disturbed or behavior disordered.

556 Instructional Systems for Affective/Motivational Education for Children with Disabilities (3) Educational strategies and models of instruction; simulation, demonstration, and media. Teaching techniques, materials, and teacher/pupil family interactions. Therapeutic forms of education through art, music, role play, puppetry, bibliotherapy, and group interactions. Prereq or coreq: 555 or consent of instructor.

557 Positive Preventive Discipline (3) Instructional, classroom and preventive/proactive strategies for use in classroom which positively effect efficiency of classroom. Research on how curriculum can encourage appropriate interactions of children and youth. Prereq: Admission to graduate program.

579 Special Topics (1-3) Prereq: Admission to graduate program. May be repeated. Maximum 9 hrs. S/NC or letter grade.


587 Seminar in Research Techniques in Special Education (3) Evaluation of appropriate research methodologies and presentation of current research. Prereq: Admission to graduate program.

589 Seminar in Research Techniques in Social Science (3) Evaluation of appropriate research methodologies and presentation of current research. Prereq: Admission to graduate program.

591 Clinical Studies (4) Relationship between educational theory and application; internship; research project, development of portfolio, and capstone experience.

593 Independent Study (1-3) May be repeated. S/NC or letter grade.

594 Supervised Readings (1-3) May be repeated. S/NC or letter grade.

599 Special Topics (1-3) May be repeated. S/NC or letter grade.

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

602 Seminar in Reading Education (1-6) May be repeated. Maximum 6 hrs. E.

603 Advanced Studies and Theoretical Models of Reading (3) Research on reading processes. Current theoretical models related to how language is processed. Prereq: 500-level course in reading education or consent of instructor. Sp.
Human Ecology

(College of Human Ecology)

MAJOR DEGREE

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

The College of Human Ecology offers the Doctor of Philosophy degrees with a major in Human Ecology.

ADMISSION REQUIREMENTS

A completed file for review includes the Graduate School application file, departmental 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

Graduate study leading to the Doctor of Philosophy degree with a major in Human Ecology is available in the Departments of Child and Family Studies; Health, Leisure, and Safety Sciences; Human Resource Development; Nutrition; and Textile, Retail, and Consumer Sciences. Concentration areas are child development, family studies, community health, human resource development, nutrition science, textile science, and retail and consumer sciences.

A major challenge of the doctoral program in Human Ecology is to draw upon basic research generated from the natural sciences, social sciences, humanities, and the arts, and to provide a holistic perspective that contributes to the improvement of individual and family well being. Within the College of Human Ecology, research from one discipline is enhanced by encompassing and utilizing the findings of research from other disciplines.

The Ph.D. 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.

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

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 Arts and Sciences. A cross-listed seminar between contributing programs is designed to integrate experiences from different sources and to demonstrate the multi-faceted nature of working within an aging society.

Declaration of a Minor

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

Core Experience

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

1. coursework 9 hours required. A variety of coursework may be taken toward satisfaction of this requirement. Courses which are offered on a regular basis include: Health 406, 465, Health/ Public Health 560, Nutrition 518, Public Health 523, Social Work 566, Sociology 415, Psychosocial Studies 504, 522, 525.

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


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

Graduate Committee

At least one faculty member from the Gerontology Policy Committee who is qualified to work with graduate students, must serve on the graduate committee of each student who declares a gerontology minor.

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, Kentucky, Mississippi, Virginia (concentration in health education only), 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) P/NP only, E

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/NC only. E

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

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

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

545 Evaluation in Home Economics Education (3) Assessment of programs and pupil progress; techniques, methods and purposes. Prereq: 540. Cor: 575. F, S, A

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

574 Analysis of Teaching for Professional Development (2) Strategies to document and analyze effectiveness of teaching and of professional development. Study and application of various approaches. Cor: 575. F

575 Professional Internship in Teaching (1-8) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to postbaccalaureate students in professional year program. Prereq: Admission to Teacher Education Program. May be repeated. Maximum 12 hrs. S/NC only. S

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

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

585 Seminar in Gerontology (1) Scope of gerontology as discipline and as related to academic and professional disciplines. Speaker's board internal and external to UTK. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. (Same as Counselor Education and Counseling Psychology 585, Exercise Science 585, Nursing 585, Public Health 585, Psychology 585, Social Work 585, and Sociology 585.) S/NC only.

591 Clinical Studies (1-4) Group and individual seminar activities during full-time internship. Application and evalu-
Human Resource Development

(College of Human Ecology)

**Majors**

Human Ecology .................................... Ph.D.
Human Resource Development ................. M.S.

**Professors:**

Campbell, C. P., Ed.D. ....................... Maryland
Cheek, Gerald D. (Emeritus), Ph.D. ........... Kansas State
Coakley, Carroll B. (Emeritus), Ph.D. ........... Wisconsin
Craig, D. G. (Emeritus), Ed.D. ............... Cornell
DeJonge, Jacqueline O., Ph.D. ............... Iowa State
Haskell, R. W., Ph.D. ......................... Purdue
Petty, G. C. (Liaison), Ph.D. ................. Missouri
Wagoner, G. A. (Emeritus), M.S. ............ Indiana

**Associate Professors:**

Brewer, Ernest, Ph.D. ....................... Tennessee
Dean, Peter J., II, Ph.D. ..................... Iowa
Hanson, R., Ph.D. ............................... Purdue
McInnis, Jackie H., Ph.D. .................... Florida State
Stout, Vickie J., Ed.D. ........................... Tennessee

**Assistant Professors:**

Mimbs, Cheryl, Ph.D. ....................... Virginia Tech
Pierce, R., Ph.D. ................................. Ohio State

**THE MASTER'S PROGRAM**

The Department of Human Resource Development offers a graduate program leading to the Master of Science with a major in Human Resource Development. The program is designed to provide opportunities for graduate students to achieve professional objectives, develop needed competencies, and gain desirable experiences and understandings of human resource development. In addition, a teacher licensure concentration is available. Both the thesis and non-thesis options are offered.

**Concentration:** Students must complete 12 hours (9 hours for thesis option) from one of the following concentration areas: education (business and marketing education, family and consumer sciences education, industrial education, vocational-technical education), organizational learning systems, workforce training.

Teacher licensure concentration students must complete 12 hours (9 hours for thesis option) from one of the following concentration areas: business education, family and consumer sciences education, marketing education, technology education.

**Statistics** (3 hours): May be waived upon committee approval.

**Cognate or Related Studies** (6 hours): Must support specialization or can consist of additional specialization courses. Not required for teacher licensure concentration.

**Culminating Experiences**:

- Thesis Option (6 hours): Problems in lieu of thesis (6 hours): Internship 551 (6 hours) for students changing career path; internship 575 (12 hours) required for non-thesis option teacher licensure concentration.

Note: For students in the Nashville area, only the Workforce Training (formerly Industrial Training) is available.

**THE PH.D. CONCENTRATION**

The Doctor of Philosophy degree with a major in Human Resource Development is designed to provide opportunities for graduate students to achieve professional objectives, develop needed competencies, and gain desirable experiences and understandings of human resource development. Students must possess a Master's degree before acceptance to the program. A minimum of 24 credits above the baccalaureate is required.

**Concentration** (21 hours): Must include courses to support Human Resource Development and may be taken from the Master's degree.

**Departmental Core** (11 hours): Must include 510, 511, 512 or equivalents and 504.

**Specialization** (12 hours): Must support career path of either university faculty member or manager of education/training.

**Cognate** (6 hours): Must be obtained from an academic unit outside the department, support specialization, and be represented by a committee member.

**Related Studies** (6 hours): Research and theory in support of theoretical framework.

**Research and Statistics** (15 hours):

- Statistics must include advanced statistics such as multivariate analysis and computer applications, 9 hours minimum; research methodology must include 504 and 610 or equivalents, 8 hours minimum.
- Internship (0-6 hours): Required for those changing career path.
- Dissertation (24 hours): Must be original research project.
- Detailed information regarding the Ph.D. concentration program of study may be obtained from the departmental liaison for graduate studies.

**GRADUATE COURSES**

- 401 Utilization of Community Resources (3) Special topics in developing liaison between vocational education and private sector through advisory committees, councils, and working partnerships. Development and management of public relations programs. Prereq: 3 yrs teaching experience. Sp.
- 415 Coordination Techniques (3) Necessary procedures, duties and responsibilities to implement, maintain, and evaluate successful cooperative education program. Prereq: Senior standing and consent of instructor. Sp.
- 430 Principles and Organization of Business and Marketing Education (3) Historical background and current issues. Principles of business and marketing education in business and marketing, curriculum implications, establishing, evaluating, and improving programs.
- 432 Methods and Materials in Business and Marketing Education (3) Teaching techniques, aids and evaluation in subject matter fields. Prereq: Consent of instructor. F, S.
- 436 Supervised Occupational Experience (3-9) Practicum in business and marketing settings under supervision of practitioner and departmental representative. May be repeated. Maximum 6 hrs.
- 438 Areas of Marketing (3) Marketing, personal development, operations, and management, as affects instructional programs in business education. Prereq: Consent of instructor. F, S.
- 439 Adapting Vocational Instruction for Special Needs Learners (3) Specialized techniques and methods for special needs learners. Educational, social, psychological, and legal considerations for nontraditional student populations. Prereq: Consent of instructor. F, S.
- 451 Training Aids Development (3) Study and preparation of instructional aids and print media commonly used by technical instructors and trainers. Prereq: Consent of instructor. F, S.
- 455 Performance-Based Evaluation (3) Assessing effectiveness of training through development of performance-based measures. Prereq: Consent of instructor. F, S.
- 456 Organization and Operation of VICA/HOSA (3) Planning, organizing and implementing youth-club activities in vocational-technical programs. Prereq: Consent of instructor. F, S.
- 500 Thesis (1-15) P/NP only. E
- 502 Registration for Use of Facilities (3-15) Required for 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 requirement. May be repeated. S/NC only. E
- 503 Problems in Lieu of Thesis (3) May be repeated. Maximum 6 hrs. S/NC only. E
- 505 Selection, Placement, and Follow-up Procedures in Human Resource Development (3) Methods and procedures utilized in establishing criteria for trainee selection and placement in instructional programs. Prereq: Consent of instructor. F, S.
- 506 Developing Organizational Resources (3) Strategies for developing human and organizational resources through community partnerships and learning. Effective utilization of human resources through active learning programs. Sp.
- 509 Internship in Human Resource Development (3) Practical field experiences in selected settings under supervision of a practicing professional as representative. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
- 510 Foundations of Human Resource Development (3) Historical, philosophical, economical, social, and psychological foundations of vocational, technical and adult education and human resource development; fundamental principles and contemporary objectives. Prereq: Consent of instructor. F.
- 512 Human Resource Management (3) Process-systems approach to human resource management: interdependent human resource activities (planning, work design, staff development, training and development, compensation, etc.) and organizational goals.
513 Special Topics in Human Resource Development (1-3) Specified objectives, activities, and evaluation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

514 Individual Study in Human Resource Development (4) Prereq: Consent of supervising instructor. Approval form must be filed in office of department head. May be repeated. Maximum 6 hrs. E

515 Microcomputer Operations and Programming in Education (3) Operating procedures and BASIC programming for education and training applications. Hands-on experience in operating and programming microcomputers, writing, debugging, and running educational programs using sequential data files. Prereq: Teaching, administrative, or related work experience in education or training, or consent of instructor. E

516 Microcomputer Software Development (3) Advanced software design in BASIC: random access and binary files, search and sort algorithms, and bitmapped graphics for educational environment. Hands-on learning and program development. Prereq: 515 or consent of instructor. E

518 Education Specialist Research and Thesis (3) May be repeated. Maximum 9 hrs. P/NP only. E

521 Design and Development of Instruction (3) Curriculum development and program planning; design of instruction; development of teaching materials for classroom and educational purposes. Prereq: Consent of instructor. E


530 Methods and Materials for VOE Programs (3) Development of instructional aids, recent developments and research, individualized instructional, and occupational clusters. Prereq: 510 or equivalent. Sp, Su

531 Organization and Supervision of VOE and Marketing Programs (3) Development of office and marketing occupations, guidelines in cooperative laboratory, and model office programs. Trends in office and marketing education, physical facilities, state plans, instructor qualifications and advisory committees. Prereq: Consent of instructor. F, Su

534 Special Topics in Business and Marketing Education (1-3) Specific objectives, activities, and evaluations vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

542 Problems in Business and Marketing Education (3) Selective research problems in teaching of business and marketing education and related areas. Prereq: Consent of instructor. E

550 Administration of Industrial Education Programs (3) Developing, staffing, administering and evaluating trade, industrial and technical education programs in secondary and post-secondary school. Prereq: Consent of instructor. Sp, Su

551 Supervision of Industrial Education Programs (3) Techniques used to improve industrial education programs. Staff development, curriculum improvement, and program updating techniques. Prereq: 455 or equivalent. F, Su

552 History and Philosophy of Industrial Education (3) Social, political, and economic events that impact development of industrial education. Philosophical problems: justification, values, principles and concepts of industrial education. Prereq: Consent of instructor. F, Su

553 Planning Technical Education Facilities (3) Preparation of educational facilities, site selection, and working relationships with other professionals involved in process of planning technical facilities. Prereq: Consent of instructor. Sp

554 Technical Program Planning (3) Instructional systems attending to analysis, design, development, implementation, and evaluation of trade, technical supervisors, and related training. Prereq: Curriculum development course and consent of instructor. F, Su

555 Curriculum Planning for Industrial Education Programs (3) Developing performance-based, criterion-related instructional programs. Prereq: 374 or 554 or consent of instructor. Sp, Su

556 Organizational Development (3) Strategies and interventions for organizational development: training and development of staff, models, assessment, organizational change and consultant's role. Prereq: 512 or consent of instructor. F

557 Advanced Methods of Teaching Technical Subjects (3) Proper selection and effective application of innovative methods and teaching specialized skills and technical information. Diversifying and individualizing teaching of technical subjects. Prereq: 373. Sp, Su

558 Seminar in Industrial Education (1-3) Current issues, innovations, problems associated with technical programs. Prereq: 12 hrs of graduate courses. May be repeated. Maximum 6 hrs. F, Su

559 Evaluation of Technical Training Programs (3) Internal and external evaluation of technical programs to maintain quality control and to justify revisions. Prereq: 455 and consent of instructor. Sp, Su

560 International Perspective of Workforce Training (3) Examination and comparison of workforce systems in highly industrialized countries. In-school training programs, out-of-school training systems, upgrading skills of incumbent workers, retraining displaced workers, transfer of new technologies, and role and responsibilities of businesses, private sector organizations, agencies, and state and federal government agencies. F

562 Grant Writing and Project Implementation (3) Writing grant proposals, negotiating with funding sources, implementing and maintaining funded programs, and closing projects at end of funding support. F

564 Self-Directed Work Teams (3) Theory and practice of implementing self-directed work teams, motivating employees, increasing employee productivity via teams and related issues.

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

601 Curriculum Planning in Human Resource Development (3) Curricular theory, models, content, planning evaluation and implementation of specialized program areas. Prereq: 555 or equivalent. Sp, Su


610 Research Development in Human Resource Development (3) Proposal development, theoretical base, research design, sampling, application of statistics, and evaluation of research in human resource development. Prereq: 601 or 604. F, Su

611 Internship in Human Resource Development (3) Field experience in relevant organizations. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs. E

613 Special Topics in Human Resource Development (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

Inclusive Early Childhood Education

(College of Education)

MAJORS

EDGREES

Education M.S., Ph.D.

Susan Benner, Leader

Professors:

Benner, Susan M., Ed.D. Columbus Blank, Kermit J., Ph.D. Ohio State Colemen, Laurence J., Ph.D. Kent State Hatch, J. Amos, Ph.D. Florida

Associate Professor:

Cagle, Lynn C., Ed.D. Georgia

Assistant Professor:

Judge, Sharon L., Ph.D. California (Santa Barbara)

The Inclusive Early Childhood Education unit participates in graduate programs leading to degrees, major and concentrations in:

Master of Science

Education

Track 1-early childhood special education
Track 1-elementary education
Track 2-early childhood special education

Track 2-elementary teaching

Doctor of Philosophy

Education

Early childhood education

See Education under FieldsofInstruction for full description of all requirements. Early childhood licensure and degree programs are also available through the College of Human Ecology.

The unit is focused on the preparation of teachers for the education of all young children with and without disabilities in inclusive settings. All young children are defined as children from birth to age eight, including children of poverty, those of color, of disabilities, with advanced development and "mainstreamed" children.

GRADUATE COURSES


454 Education of the Gifted and Talented Children (3) Orientation to psychometric and behavioral studies of giftedness. Analysis of past and present school practices in reference to curriculum and program implementation.

471 Early Childhood Special Education (6) Assessment, curriculum planning and development and teaching approaches used in early childhood special education. Prereq: Admission to teacher education. F

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

502 Registration for Use of Facilities (1-3) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 8 hrs. S/NC only. E

504 Clinical Experience in Teaching and Supervision of Exceptional Children (3-9) Placement in educational settings. May be repeated. Maximum 9 hrs. S/NC or letter grade. (Same as Rehabilitation and Deafness 504.)

515 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC only. E

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only. E

550 Action Research and Practical Inquiry in Education (3) Principles of action research and practical inquiry for practitioners in early childhood and school settings and methods for conducting such inquiries in professional role. Prereq: Admission to graduate program.
Industrial and Organizational Psychology

(College of Business Administration)

MAJOR DEGREES

Industrial and Organizational Psychology

Robert T. Ladd (Liaison), Director

Committee:

Fowler, Oscar S., Management
James, Lawrence R., Management
Larsen, John M., Jr. (Emeritus), Management
Russell, Michael C., Management
Russell, Joyce E. A., Management
Schumann, David W., Marketing, Logistics & Transportation

The master's and doctoral programs are designed to prepare students for personnel, managerial, and organizational research; for university teaching; and for consulting relationships with industry. The program emphasizes a scientific/practitioner model in applying and conducting research based on accepted theory, organizational behavior, psychology, management, and statistics. The degree programs are administered by a committee appointed by the Associate Vice Chancellor of Dean of the Graduate School on recommendations from the department head and the program director.

It is intended that students entering the I/O program will represent widely different undergraduate backgrounds including psychology, business administration, engineering, sciences, 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 Office of Graduate Admissions and Records. All applicants should meet the general requirements set forth in the Graduate Admissions and Records bulletin and the School of Business Administration bulletin. Students who wish to pursue special research interests, or who are planning to complete a comprehensive examination in general psychology, are encouraged to contact the department head and the program director.

The University of Tennessee, Knoxville, TN 37996.

Two separate applications are required: 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. A student must demonstrate evidence of special weakness in mathematics and physics sciences.

Test scores on each section of the general portion (verbal and quantitative) of the Graduate Record Examination (GRE) are required. Customarily, students admitted to the program have performed at or above the 60-70th 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; Statistics 537, 538.

Twelve hours of additional coursework to be selected primarily from the following with the approval of the student's advisor: Management 611, 622, 610; Management/Psychology 625, 626, 627, 638; Psychology 505, 550, 610, 620, 624.

Electives, as approved for an individual's plan of study, may be selected from graduate courses in psychology, social work, sociology, management, education, planning, etc. Students who wish to pursue special research interests are recommended (or letter grade..)

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, and an overall score of 630 (or 65th 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 537-38.

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 aside from their dissertation may register for Management 525, 526 (Maximum 6 hrs per term; courses may be repeated) or Management/Psychology 690.

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

Doctoral candidates must pass a final oral examination on their dissertation research.

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

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

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 Industrial and Organizational Psychology is available to residents of the states of Alabama or West Virginia. The Ph.D. program is available to residents of Alabama, Arkansas, Kentucky, Virginia, or West Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions at UT Knoxville.

Industrial Engineering

(College of Engineering)

MAJOR

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

C. H. Aikens, Head

Professors:

Bontadelli, J. A., P.E., Ph.D. .................. Ohio State

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

Devine, Michael D., Ph.D. .................... Texas

Garrison, G. W. (UTSI), Ph.D. ......... NC State

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

Schmitt, H. W., Ph.D. ............................ Texas

Associate Professors:

Aikens, C. H. (Liaison), PE, Ph.D. .......... Tennessee

Hailey, M. L. (UTSI), PE, Ph.D. ........ Texas Tech

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

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

Kirby, K. E., Ph.D. .............................. Kentucky

Assistant Professors:

Ford, R. E., Ph.D. .............................. Tennessee

Kress, T. A., Ph.D. .............................. Tennessee

Sawhney, Ruoy, Ph.D. ................. Tennessee

THE DEPARTMENT OF INDUSTRIAL ENGINEERING offers a graduate program leading to the Master of Science degree with a 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 Mechanical and Aerospace Engineering and Engineering Science with a concentration in industrial engineering.

THE MASTER'S PROGRAM

Students who enroll in the Master of Science degree may select a concentration in either industrial engineering or engineering management. Admission is open to graduates of ABET-accredited undergraduate programs in engineering, or to graduates of other technical curricula who satisfy prerequisites depending on their academic backgrounds. 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 27 hours of coursework and 6 hours of thesis. The non-thesis option requires 30 hours of coursework plus a 3-hour 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 and production systems, human factors engineering, information systems engineering, maintenance and reliability engineering, or general industrial engineering.

Engineering Management

The engineering management concentration has an additional admission requirement of two years of U.S. 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 3 hours of capstone project. This concentration is fully supported for 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

400 Manufacturing Materials/Processes (3) Characteristics of materials and manufacturing, Prereq: Chemistry 130, Engineering Science and Mechanics 211.


402 Production System Planning and Control (3) Theory and application of forecasting systems, regression analysis and planning for overall systems, independent systems data 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 systems, independent systems data, 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, replacement, and replacement of equipment. Decisions among engineering alternatives involving capital recovery, economic life of equipment, and rate of return on investment.


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


421 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: Senior standing.

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

423 Industrial Safety (3) Accident causation, losses, and investigative techniques. Role of human, task, machine, and environment in accident prevention. Safety standards and codes, and how to conduct liability, design, evaluation, and management of safety organizations and programs. Hazard recognition, analysis, control and risk assessment, systems safety and related techniques. Prereq: Senior standing.

440 Total Quality Management (3) Philosophy of continuous improvement in organizations: management and implementation issues; definition, identification and analysis of problems, design, problem definitions, implementation and assessment. Prereq: Senior standing.
correlation and experimental design to improve system validity. Lab. Prereq: Quality Control or consent of instructor.

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

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

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

513 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, applications of research models, and use of these to design manufacturing facility. Prereq: Production Facilities Design and Material Handling or consent of instructor.

514 Information Systems II (3) Systems analysis and systems concepts applied to service and manufacturing organizations. Role of IE in office and future of management. Management support systems, decision support systems, and integrated support systems.

515 Advanced Production and Inventory Systems (3) Advanced logistics concepts in production and inventory systems. Material requirements planning; production planning and master scheduling; just-in-time concepts; distribution planning and other selected topics. Prereq: 402 or consent of instructor.

516 Statistical Methods in Industrial Engineering (3) Application of classical statistical techniques to industrial engineering problems. Statistics and statistical thinking in managerial context of organizational improvement; descriptive statistics and distribution theory; relationship between statistical process control techniques and classical statistical tools; parameter estimation and hypothesis testing; goodness-of-fit testing; linear regression and correlation; analysis of variance; single and multiple factor experimental design. Prereq: Probability and Statistics for Scientists and Engineers I or consent of instructor. (Same as Engineering Management 516.)


518 Advanced Engineering Economy (3) Application of engineering economic analysis in complex decision situations. Inflation and price changes; uncertainty evaluation using new methodologies; capital recovery factors; project allocation; evaluations involving equipment replacement, investor-owned utilities, and public works projects; production and inventory planning; computer simulation and decision trees; multi-attribute decision analysis; and other advanced topics. Prereq: Probability and Statistics for Scientists and Engineers I and 405, or equivalent. (Same as Engineering Management 518.)

519 Human Factors Engineering and Ergonomics (3) Application of human factor and ergonomic concepts and principles to design and analysis of man-machine systems and products. Human as biotechnological system; human information processing: minimizing of human error; anthropometry; anatomy and physiology; physical and mental workload; effects of environmental factors: thermal environment; noise, light, and vibration; human information; manual materials handling and back injuries; design of workstations and office ergonomics; design of displays and controls; hand tool design; and cumulative trauma injuries. Prereq: Probability and Statistics for Scientists and Engineers I or consent of instructor.

520 Human Factors and Product Safety Engineering (3) Role of human factors and safety engineering, legal considerations in product design, product liability, industrial safety, and system failure analysis. Product testing, reliability, and system safety analysis techniques. Case histories of accidents and/ or product liability litigation. Prereq: 519 or consent of instructor.

521 Advanced Human Factors Engineering Methodology (3) Advanced methodologies used in human factors engineering, observational methods, human work environment analysis; human reliability and error prediction; evaluation of human-machine interface; modeling techniques; questionnaire and survey design; experimental design, and other selected topics. Prereq: 519 or consent of instructor.

522 Optimization Methods in Industrial Engineering (3) Classical optimization applied to constrained and unconstrained, non-linear, multiobjective, variable functions; search techniques; decision making under uncertainty; game theory; and dynamic programming. Prereq: Operations Research or Engineering Management 537.

523 Linear Programming and Extensions (3) Simplex and revised simplex methods; duality; parametric and post-optimal analysis; and quadratic, separable, integer, goal, and fuzzy linear programming. Prereq: Operations Research or Engineering Management 537.


526 Dynamic System Simulation (3) Discrete, continuous, and combined systems simulation using current simulation software. Systems modeling, design of simulation experiments, and analysis of output. Prereq: Probability and Statistics for Scientists and Engineers I.

527 Lean Production Systems (3) Characteristics and performance of mass and lean production systems. Learning curve concepts and principles. Planning, designing and implementing lean production systems: line balancing, set-up time reduction, cost management, maintenance support and other selected topics. Application at enterprise level to achieve strategic competitive goals. Prereq: 515 or consent of instructor.

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

601 Operations Research Models in Engineering Economic (3) Mathematical programming techniques applied to capital budgeting; advanced topics in multiple attribute decision analysis; Bayesian analysis of sequential decision making; and other selected topics. Prereq: 516, 523.


604 Advanced Topics in Optimization (3) Multi-stage optimization techniques. State incumbent dynamic programming, adaptive optimization theory. Prereq: 603.


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

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 for degree completion. May not be used toward degree requirements. May be repeated. S/NC 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 practices to improve individual and organizational capabilities. Success in meeting goals, improving creativity/innovation, and developing personal interpersonal skills. Improvements through organizational structure, policies, 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 processes. Cost of quality. Overview 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 competitive strategy; role of engineering in improving profitability; team building; corporate culture and leadership in new organization; and quality, empowerment, and team management. Prerequisite application to work settings and case studies.


535 Management of Technology (3) Creativity and innovation; incorporation of advanced technology equipment; implementation of new methods in business and manufacturing organizations; justifying technology; assimilating and managing change; changing management roles; and impacts of new technologies. Prereq: 536 and Industrial Engineering 519.

536 Project Management (3) Development and management of engineering and technology projects. Project proposal preparation; resource and cost estimating; project planning and control; marketing and controlling; network diagramming and other technical aspects. Role of project manager: team building, conflict resolution, and contract negotiations. Discussion of typical problems and alternative solutions. Case studies and student projects. Prereq: 537 or consent of instructor.

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

538 New Venture Formation (3) Factors other than mechanical or chemical which enter into successful new venture formation. Role of entrepreneurship. Organizational and financial planning and evaluation. Cost and location studies and market analysis to determine commercial feasibility of new ventures. Prereq: 539.

539 Strategic Management in Technical Organizations (3) Strategic planning process and strategic management in practice; corporate vision and mission; product, market, organizational, and financial strategies; external factors; commercialization of new technologies; and competition and beyond. Prereq: 533 and Industrial Engineering 518 or consent of instructor.


541 Total Quality Management and Beyond (3) Continuous improvement in capabilities, competitiveness, and productivity of organizations. Principles of total quality management; systems theory and analysis; perfor-
Information Sciences

MAJOR DEGREE

Information Sciences ................................ M.S.

W. David Penniman, Interim Director
Kristin Atwood, Assistant Director
Shawn Collins, Budget Officer and Computing Services Coordinator
George Hoemann, Distance Education Coordinator

Professors:
Penniman, W. David, Ph.D. ............... Ohio State
Purseal, Gary R. (Emeritus), Ph.D. ........ Case Western Reserve
Tenopir, Caroline, Ph.D. .................... Illinois
Wilson, P. (Emeritus), Ph.D. ............. Michigan

Associate Professors:
Fisher, Patricia L., Ph.D. ................... Florida State
Pemberton, J. Michael, Ph.D. ............. Tennessee
Pollard, Richard, Ph.D. .................... Brunel (UK)
Robinson, William C., Ph.D. ............... Illinois
Sinkankas, George M., Ph.D. .......... Pittsburgh

The School of Information Sciences 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 degree. The program is accredited by the American Library Association. A Ph.D. degree program may also be pursued with a major in Communications, concentration in information sciences.

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 Information Sciences. The goals and objectives of the school are:

A. 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:

1. Knowledge of the generation, production, management, dissemination and uses of information.

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

3. An understanding of the role of the information professional as mediator between information resources and their users.

4. An understanding of the roles of various tools and technologies in facilitating access to information.

5. An understanding of the structure and content of information resources in various formats and subjects.

6. Knowledge of theoretical and practical evolution of information sciences and technologies and their relationship with other disciplines.

7. Competence in creating, managing and accessing information in a variety of formats.

B. 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:

1. Continuing education for information professionals and, on a selective basis, to persons outside the information field.

2. Advisory services to information organizations.

3. Leadership for professional associations.

C. To conduct basic and applied research which promotes the generation of new knowledge, services and technology. The school will encourage:

1. Research which strengthens its instructional and public service programs.

2. The use of a variety of research methods.

3. Sharing the results of its research.

4. Increased research quality and productivity.

ADMISSION REQUIREMENTS

Applicants to the Information Sciences program must have 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 MS degree.

The verbal, quantitative and analytical aptitude portions of the Graduate Record Examination (GRE) are required for 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 1500 points or better.

A personal data sheet and three recommendations (obtained from the School of Information Sciences) should be returned to the admissions office of the school. Foreign applicants are required to take the Test of English as a Foreign Language.

THE MASTER'S DEGREE

The program leading to the Master of Science involves a total of 43 semester hours of graduate courses, 16 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 37 hours must be taken in the School of Information Sciences, allowing up to 6 hours outside the school with a maximum of 6 from outside the University.

Core Curriculum

The core curriculum is a 16 semester hour sequence of six courses required of all students: 450, 520, 530, 540, 550, 560. 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 one-hour electronic information and communications laboratory experience required of students during the first semester: 504.

The 16 hour core is prerequisite to all elective courses for students enrolled in the MS 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:

Corporate Information Systems and Services: The concentration includes 15 hours (535, 550, 553, 564, 567) of required courses and 9 hours of elective courses, one selected from each of these groups: information environment (537, 538, 555, 556); information sources (531, 532, 533, 534); information technologies (521, 523, 565, 566, 592, 583, 594, 585); culminating experience (either 6 hours of Thesis 500 and successful defense or 3 hours of alternatives—590, 591, 592, 593, 599—with grade of B or better plus passage of the comprehensive examination).

Electronic Publishing: The concentration includes 15 hours (537, 561, 563, 565, 585) of required courses plus 3 hours of 587 for non-thesis option students and six required hours of 500 for thesis option students, as well as 9 hours of elective courses, one selected from each of these groups or all electives selected from one group: development and design aspects (430, 523, 555, 566, 588, Journalism 460 or 535 or 580); standards and technical aspects (567, 583, 584, 589, 599); policy and market aspects (539, 539, Communications 550 or 560). Note: thesis option students may substitute 3 hours of 500 for an elective.

Information Systems and Technology: The concentration includes 18 hours (540, 583, 584 or 586, 587, 588, 598) of required courses and add 9 hours of elective courses.

Scientific and Technical Information: The concentration includes 18 hours (450, 532, 535, 540, 555, 559) of required courses and 9 hours of elective courses.

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 (567, 571, 572, 573, 585, 599, one elective) are common and 6 hours are taken in the specialization (public library: 554, 592, school library: 475, 551).

Additional Program Requirements

Thesis Option: Students electing the thesis option will write a master's thesis under close supervision of a thesis committee. Six hours of Thesis (IS 500) must be taken within the 43 hours required for graduation. (Students may register for more than 6 hours of 500, but only 6 hours will count toward graduation.) Students must be registered for IS 500 in the semester they complete and defend their thesis. The oral
defense of the thesis (final comprehensive examination) substitutes for the written examination that is taken by non-thesis students. The writing of the master’s thesis serves as the culminating experience.

Non-Thesis Option: Upon completion of the program, all students who elect the non-thesis option must take and pass a written comprehensive examination. A culminating experience (5 hours maximum) is also required which must be completed in one of the student’s last two terms with a grade of B or better (except as noted) selected from the following and approved by the student’s advisor: 587 Information System Design Project, 590 Problems in Information Sciences, 591 Supervised Readings in Information Sciences, 592 Seminar in Information Sciences, 593 Independent Study, 594 Graduate Research Participation (S/NC only), 599 Practicum.

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 contracts with Oak Ridge National Laboratory and the Department of Energy.

A limited number of graduate teaching assistantships are available through the school.

Assistantships may be awarded to students in the School of Information Sciences, 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. in Information Sciences, write to Admissions, School of Information Sciences, University of Tennessee, 804 Volunteer Blvd., Knoxville, TN 37996-4330.

GRADUATE COURSES

430 History of the Book (3) History of writing and various methods of bookmaking.
450 Writing About Science, Technology and Medicine (3) (Same as Journalism 450).
475 Utilization of Instructional Media (3) (Same as Education in the Sciences, Mathematics, Research and Technology 475). E
485 Electronic Communications and Information Resources on Internet (3) Exploration of worldwide information 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 behavior, information industry, economics of information products and services, technological and organizational change, information professions, and issues. F,Sp,Su,A
500 Thesis (1-15) P/NP only. E
502 Registration and Use of Faculties (3-15) Required for the student not otherwise registered during the 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 Electronic Information and Communications Laboratory (1) Methods for creating and managing information in electronic form. Communication of electronic information in networked environment. Location and use of information resources. For GSLIS graduate students only; must be completed satisfactorily in first semester. S/NC only. F,Sp
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. F,Sp,Su,A
521 Cataloging and Classification (3) Basic library-oriented cataloging and classification techniques, tools, and supporting operations. Descriptive cataloging; choice and form of non-subject indexing, general classification, authority control, bibliographic utilities, online library catalog.
523 Abstracting and Indexing (3) Philosophies, standards, and procedures for manual and automatic document indexing, back-of-the-book indexing, vocabulary control, thesaurus construction, and abstracting.
530 Information Access and Retrieval (3) Media for information storage, logical and physical information structures, query logic and languages, search strategies and heuristics, user interfaces, evaluation of retrieval system performance. Search techniques for various types of databases including multi-media, full-text, numeric, bibliographic, F,Sp,Su,A
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. F
534 Government Information Sources (3) Selection, acquisition, organization, and utilization of government information in a variety of formats from legislative, judicial, and executive branches of federal, state, local, and international government agencies.
535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, e.g., non-bibliographic data and catalog databases, text and page databases, full-text databases, patents, document delivery. Sp
536 Creation and Distribution of Information and Knowledge Resources (3) Historical, political, and social dimensions of creation, storage, distribution, and institutionalization of information and knowledge from Aristotle’s Lyceum to twentieth-century university and research environments.
537 Information Industry (3) Issues and trends concerning information and technology products and services. Standards, enabling technologies, choices of distribution media, entrepreneurial opportunities. Legal, ethical, and quality concerns. F
538 Economics of Information (3) Costing and pricing of information resources; value of information and various added services; cost-benefit analysis and tradeoffs; policy issues related to economic aspects of information exchange and transfer.
539 Information Policy (3) Role of government in creation and management of information. National and international policy areas related to information creation, production, and distribution; development of information policy for organizations. Sp
540 Research Methods (3) Research methods in various of information environments; primary and secondary research; policy research; results interpretation; analysis of published research; techniques supporting research process. F
550 Management of Information Organizations (3) Supervision and management concepts, strategies, and techniques applicable to information professional working in libraries, archives, records management, and other information organizations.
551 Library Management Centers (3) Planning, implementing, and evaluating school library programs. Curricular involvement, role of technology, site-based management, relationships with district and state services. F
552 Information Centers in Higher Education (3) Development, mission, trends, issues, users, services, and environment of campus information centers including library and alternatives; learning resources center and library-computer center models. F
553 Corporate Information Services (3) Development and present status, scope and objectives. Information resources external to organizations.
554 Public Library Management and Services (3) Development, roles, policy environment, governance, organization, fiscal management, services, marketing, and performance evaluations. Sp
555 Scientific and Technical Communications (3) Evolution of scientific and technical communications; current trends, roles 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 end users of information 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, user and uses, policies and procedures; evaluation of items and collections; selecting items to meet particular needs. F,Sp,Su,A
561 Contemporary Book Publishing (3) Creation, design, production, marketing, and distribution, various types of publishers. Sp
563 Graphic Design and Media (3) Principles and practice in visual aspects of communications. Graphic design, typography, production techniques and publication design, as these apply to electronic information delivery systems. F
564 Corporate Information Systems (3) Objectives and function elements of records systems, archival programs, management information systems and techniques within various types of organizations. Management of information internal to organizations. Sp
566 Environmental Scanning for Information Professionals (3) Principles and practice of environmental scanning; information evaluation and synthesis; role of strategic information in modern organization.
567 Information Network Applications (3) Scholarly and policy-based electronic communications. National and international standards, tools, resources, identification, analysis, evaluation, and management of tools and sources, construction and transfer of local technologies as developed and applicable. F,Sp
569 Advanced Production of Audiovisual Software (3) (Same as Education in the Sciences, Mathematics, Research and Technology 569.) F,Sp
Interdisciplinary Programs

The College of Arts and Sciences 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, 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.

Ancient Mediterranean Civilizations

GRADUATE COURSES

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Asian Studies

GRADUATE COURSES

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Cinema Studies

GRADUATE COURSES

400 Special Topics (3) May be repeated. Maximum 6 hrs.

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

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

433 Modern Art and Film (3) (Same as Art Media/Photography 433.)

489 Special Topics in Film (3) (Same as English 489.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Comparative Literature

GRADUATE COURSES

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

402 Latin American Studies Seminar (3) Selected topics. May be repeated. Maximum 6 hrs.

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Latin American Studies

GRADUATE COURSES

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Linguistics

GRADUATE COURSES

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

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

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

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


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

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


433 Special Topics (3) May be repeated. Maximum 6 hrs.

Language and Law (3) (Same as English 422.)

Women's Studies

Graduate Courses

400 Topics in Women's Studies (3) Content varies. May be repeated.

Women Writers in Britain (3) (Same as English 422.)

Women's Health (3) (Same as Health 425.)

Psychology of Gender (3) (Same as Psychology 434.)

Rhetoric of the Woman's Rights Movement to 1930 (3) (Same as Speech Communication 466.)

Rhetoric of the Contemporary Feminist Movement (3) (Same as Speech Communication 476.)

African-American Women in American Society (3) (Same as African and African-American Studies 483.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

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 476.)

462 Language and Law (3) (Same as English 476.)

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

476 Rhetoric of the Contemporary Feminist Movement (3) (Same as Speech Communication 476.)

486 African-American Women in American Society (3) (Same as African and African-American Studies 483.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Russian and East European Studies

Graduate Courses

401-02 Advanced Grammar, Conversation, and Composition (3,3) Prereq: Russian Composition and conversation or equivalent. (Same as Russian 401-02.)

451 Senior Seminar (3) For majors in Russian; minors admitted at discretion of instructor. Intensive study of language, literary style, and literary criticism based on selected major novels. (Same as Russian 451-52.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Medieval Studies

Graduate Courses

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Journalism

(College of Communications)

Major

Communications

M.S., Ph.D.

James A. Crook, Director

Professors:

Adanson, June N. (Emeritus), M.S., Tennessee

Caudill, C. Edward, Ph.D., North Carolina

Crook, James A., Ph.D., Tennessee

Everett, George A. (Emeritus), Ph.D., Iowa

Kasik, Jack B. (Emeritus), Ph.D., Minnesota

Lair, John L. (Emeritus), M.A., Iowa

Lee, B. Kelly (Emeritus), Ph.D., Southern Illinois

Littmann, Mark (Chair of Excellence), Ph.D., Northwestern

Miller, M. Mark, Ph.D., Michigan State

Singletary, Michael A., Ph.D., Southern Illinois

Teebler, Dwight L., Jr., Ph.D., Wisconsin

Teposy, Carol (Adjunct), Ph.D., Illinois

Tucker, Willis C. (Emeritus), M.S., Kentucky

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

Graduate courses

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

412 Opinion Writing (3) Analysis of editorial pages, columns, and commentaries. Writing of editorials and columns for newspapers, magazines, and company publications. Study and use of rhetorical devices and logic. Prereq: Writing for Mass Communication or consent of instructor. (Same as Public Relations 412.)

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

510 Special Topics (3) May be repeated. Maximum 6 hrs.

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

535 Publications Management (3) Problems in management of general public for non-majors.

550 Writing and Editing Projects (3) Specialized writing for newspapers, magazines and company publications. Individualeditorial projects. Prereq: 420 or consent of instructor for non-majors.

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

544 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: means of cultural reporting with personal narrative style. Prereq: Consent of instructor.

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

551 Environmental Reporting (3) Writing for newspapers on such environmental issues as strip-mining, water pollution, air pollution, allergies, nuclear power, fossil fuel power, and solid wastes. Presentations from and interviews of experts in environmental science and reporting. Prereq: Consent of instructor. (Same as Information Sciences 450.)

560 Mass Communications History (3) Development of mass communication and role of mass communications in American history. Prereq: 420 or consent of instructor.

590 Advanced Photojournalism (3) Advantages of methods of black-and-white photography. Introduction to color photography. News and feature photography and color texts. Prereq: 441 or consent of instructor.

592 Press-Government Relations (3) Development of adversary relationship between journalists and government officials. Ethical and legal basis for open government and use of press by candidates and incumbents. (Same as Public Relations 520.)

595 Public Opinion (3) Role of press in shaping public opinion and influencing public consensus. Social theories of public opinion and analysis of mass media's role. (Same as Public Relations 525.)

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

595 Writing and Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science, technical, general publications.
Public Relations

GRADUATE COURSES

412 Opinion Writing (3) (Same as Journalism 412.)
416 Issues in Public Relations (3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

520 Press-Government Relations (3) (Same as Journalism 520.)
525 Public Opinion (3) (Same as Journalism 525.)

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

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.

At Education

GRADUATE COURSES

510 Issey and Isology o Art Education (3) United States from 1860's to present. Prereq: Consent of instructor.

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

530 Production and Critical Analysis of Art (3) Relation of production and critical analysis of works of art to disciplines and art education.

540 Instructional Materials and Production Related to the Teaching of Art (3) Development and use of instructional aids concerned with aspects of teaching art: videotapes, audiocassettes, slides, charts, and learning packets.

590 Special Topics in Art Education (3-6) Prereq: Consent of instructor. May be repeated. Maximum 5 hrs.

Language, Communication, and Humanities Education (College of Education)

MAJORS

DEGREES

Education ............... M.S., Ed.S., Ed.D., Ph.D.

Patricia Davis-Wiley, Leader

Professors:

Christensen, Mark A. (Emeritus), Ph.D. Kansas
Davis-Wiley, Patricia, Ed.D. .......... Houston
Hull, H. N., Ed.S. .................... Peabody
Watkins, J. Paul, M.S. ............... Tennessee

Associate Professors:

Hodge, R. L., Ph.D. .................. Texas
Ryan, Thomas K., Ed.D. .............. Ball State

The Language, Communication, and Humanities Education unit participates in graduate programs leading to degrees, majors, and concentrations in:

Master of Science

Education

Track 1-art education
Track 1-English education
Track 1-foreign language/ESL education
Track 2-art education
Track 2-secondary teaching

Doctor of Education

Education

English education
Foreign language/ESL education

Doctor of Philosophy

Education

English/foreign language/ESL education

GRADUATE COURSES

455 Teaching of Foreign Languages, Grades 7-12 (3) Instructional methods, lesson planning, peer-teaching, materials for teaching foreign language and culture; evaluation techniques. Required for certification in modern foreign languages and Latin. Prereq: Completion or near completion of foreign language hours for certification and Admission to Teacher Education Program.

459 Teaching English in the Secondary School (3) Techniques of teaching composition, language, and literature. Prereq: Admission to Teacher Education Program.

460 Teaching Reading and Literature in the Secondary School (3) Approaches for teaching basic reading skills and ways of teaching literature. Sp

461 Developing Reading Skills in Content Fields (3) Techniques for teaching reading and study skills in content areas of school program. Extensive assessment of textbooks. Middle school and high school. 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


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

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

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

518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only. E

521 Interdisciplinary Aesthetics (3) Discussions, visual and audio presentations concerned with aesthetic considerations of areas of study: geography, history, physics, literature, languages, music, visual arts and drama.

533 Reading in Community College: Research and Theory (3) Analysis of components of effective community college reading programs. Attention to research and theoretical bases. Prereq: Course in reading education or consent of instructor. Su

555 Foreign Language in the Elementary Schools Practicum (3) Experiences designing, implementing and assessing second language instruction in elementary school setting. Prereq: 587 or consent of instructor.

556 English as a Second Language Practicum (3) Experiences designing, implementing and assessing English instruction to non-native English speakers. Required course for ESL certification. Prereq: 578 or consent of instructor.

578 Teaching English as a Second Language (3) Instructional methods, utilization of assessment procedures to diagnose English proficiency levels and test results in context of K-12 classroom. Required for Tennessee ESL (K-12) licensure. Prereq: 587 or consent of instructor. Sp


590 Seminar in Teaching English in Secondary Schools (3) Content varies. Theoretical and practical approaches to teaching English in secondary school. May be repeated. Su

592 Linguistics and the Teaching of English (3) Grammar, usage, semantics, dialectology, history of language, and lexicology. Su

593 Independent Study (1-3) May be repeated. S/NC or letter grade. E

594 Supervised Readings (1-3) May be repeated. S/NC or letter grade. E

595 Special Topics (1-3) May be repeated. S/NC or letter grade. E

597 Teaching Drama Grades 7-12 (3) Strategies and materials for teaching creative dramatics, enacting and writing of plays, reading of scripts. Sp

598 Developing Speaking and Listening Skills, Grades 7-12 (3) Teaching approaches to nonverbal communication, interpersonal and group communication. Address and listening. Review of texts and materials. Sp

599 Teaching English as a Second Language Practicum (3) Experiences designing, implementing and assessing second language instruction in elementary school setting. Prereq: 587 or consent of instructor.

600 Teaching Reading and Literature in the Secondary School (3) Approaches for teaching basic reading skills and ways of teaching literature. Sp

601 Developing Reading Skills in Content Fields (3) Techniques for teaching reading and study skills in content areas of school program. Extensive assessment of textbooks. Middle school and high school. E

602 Thesis (1-15) P/NP only, E

603 Problems in Lieu of Thesis (2-3) May be repeated. Maximum 9 hrs. S/NC only. E

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

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

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

618 Educational Specialist Research and Thesis (3) May be repeated. P/NP only. E

621 Interdisciplinary Aesthetics (3) Discussions, visual and audio presentations concerned with aesthetic considerations of areas of study: geography, history, physics, literature, languages, music, visual arts and drama.

633 Reading in Community College: Research and Theory (3) Analysis of components of effective community college reading programs. Attention to research and theoretical bases. Prereq: Course in reading education or consent of instructor. Su

655 Foreign Language in the Elementary Schools Practicum (3) Experiences designing, implementing and assessing second language instruction in elementary school setting. Prereq: 587 or consent of instructor.

656 English as a Second Language Practicum (3) Experiences designing, implementing and assessing English instruction to non-native English speakers. Required course for ESL certification. Prereq: 578 or consent of instructor.

678 Teaching English as a Second Language (3) Instructional methods, utilization of assessment procedures to diagnose English proficiency levels and test results in context of K-12 classroom. Required for Tennessee ESL (K-12) licensure. Prereq: 587 or consent of instructor. Sp


690 Seminar in Teaching English in Secondary Schools (3) Content varies. Theoretical and practical approaches to teaching English in secondary school. May be repeated. Su

692 Linguistics and the Teaching of English (3) Grammar, usage, semantics, dialectology, history of language, and lexicology. Su

693 Independent Study (1-3) May be repeated. S/NC or letter grade. E

694 Supervised Readings (1-3) May be repeated. S/NC or letter grade. E

695 Special Topics (1-3) May be repeated. S/NC or letter grade. E

697 Teaching Drama Grades 7-12 (3) Strategies and materials for teaching creative dramatics, enacting and writing of plays, reading of scripts. Sp

698 Developing Speaking and Listening Skills, Grades 7-12 (3) Teaching approaches to nonverbal communication, interpersonal and group communication. Address and listening. Review of texts and materials. Sp
Associate Professors:
Aarons, Dwight, J.D. .......... UCLA
Anderson, Gary L., LL.M. ........... Harvard
Beitner, William J., J.D. ......... Miami
Black, Jerry P., J.D. ............... Vanderbilt
Bunker, Mary Grant, J.D. ......... George Washington
Cook, Joseph G., LL.M. ........... Yale
Cohen, Neil P., LL.M. .............. Harvard
Blaze, Douglas A., J.D. ............ Georgetown
Best, Reba, M.L.S. .................. Florida
Brown, Thomas E., J.D. .......... Maryland
Davis, Janice E., J.D. ............. Michigan
Medill, Colleen E., J.D. ......... Kansas
Nelson, Carol M., J.D. ............ Illinois
Pierce, Carl A., J.D. ............... Yale
Stein, Gregory M., J.D. ......... Columbia
Thorpe, Steven R., J.D. .......... Mercer
Wertheimer, Barrie M., J.D. .... Duke

Assistant Professors:
Browne, Kelly K., J.D. ............ Cincinnati
Davis, Melinda, M.S.L.S. ...... North Carolina

Concentration in Business Transactions
Students interested in a concentration in business transactions must complete all of the following law courses:
818 Fundamental Concepts of Income Taxation
826 Introduction to Business Transactions
827 Business Associations
972 Income Taxation of Business Organizations
940 Land Finance Law
940 Commercial Law
942 Contract Drafting Seminar
933 Representing Enterprises

None of the above courses may be taken on an S/NC basis (with the exception of 826).

*This course is not required for students who have an undergraduate major in accounting, finance, or business administration, who hold the MBA degree, or who are enrolled in the dual J.D.-MBA program.

*Waivers may also be granted to students who have acquired the requisite business knowledge through other coursework or through practical experience.

Concentration in Advocacy and Dispute Resolution
Students interested in a concentration in advocacy and dispute resolution must complete all of the following courses:
813 Evidence
815 Introduction to Advocacy and Professional Responsibility
905 Advocacy Clinic
920 Trial Practice
921 Pretrial Litigation
922 Advanced Trial Advocacy
928 Case Development and Resolution

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 conferment 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
that otherwise would be required. Students pursuing the dual degree program should plan to be enrolled 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 16 hours required for the M.P.A. degree.

Curriculum

A dual degree candidate must satisfy the requirements for both the J.D. and the M.P.A. degrees, as well as the requirements for the dual program. The College of Law will award a maximum of 9 semester hours of credit toward the J.D. degree for successful completion of approved graduate-level courses (500 or 600 level) offered in the Department of Political Science. The M.P.A. program will award a maximum of 6 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 program, as it is for all M.P.A. candidates, but an internship is not required. During the first year 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 included in the computation of the student’s grade average or class standing in the college where such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a College of Law course in which the student has earned a C+ 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 the 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 Arts and Sciences offer a coordinated dual degree program leading to the conferral of both the Doctor of Jurisprudence and Master of Public Administration degrees. In this program, a student may earn the M.P.A. and J.D. degrees in about four years rather than the five years that otherwise would be required. Students pursuing the dual degree program should plan to be enrolled in coursework or an internship for one summer term in addition to taking normal course loads for four academic years.

POLICY FOR GRADUATE STUDENTS TAKING LAW COURSES

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

PROFESSIONAL COURSES

801 Civil Procedure I (3) 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, unenforceability and other controls of promissory liability. Introduction to relevant portions of Article 2 of the Uniform Commercial Code.

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

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

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

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

808 Torts II (3) Vicarious liability and related concepts; strict liability for dangerous animals and abnormally dangerous activities; products liability; nuisance, defamation, misrepresentation and interference with contract and prospective opportunities; immunities: those of government, gov-
Educational Administration and Supervision

GRADUATE COURSES

513 Administrative and Organizational Theory in Education (3) Introduction to theoretical administrative and organizational foundations of management and leadership of educational programs and institutions. F, Su

515 Human Relations and Communication in Administration (3) Development and use of effective interpersonal communication skills and channels, intergroup relations, supportive work climates, personnel motivation, conflict management skills, and role of values, attitudes, and expectations in administration. F, Su

516 Research for School Administrators (3) Descriptive, experimental, and quasi-experimental designs to help students without quantitative backgrounds to read and understand technical professional literature. Introduction to inferential statistics, needs assessments, and evaluation procedures. Sp, Su

529 Politics of Education and Educational Environments (3) School/community relations in political context of modern, complex society. Administrator and supervisory competencies, political, social, cultural, and environmental influences in schools. Prereq: M.S. introductory core or consent of instructor. F, Su

535 Administrative Applications of Micro Computers (3) Word processing, data based management spreadsheets, and computer communications. Review and development of specific administrative applications: scheduling, attendance, student record systems, and accounting. F, Su

544 School Finance and Business Management (3) For prospective building level administrators. Financial and legal management tasks and procedures in individual school setting. Prereq: M.S. Introductory core or consent of instructor. F, Su

547 Educational Facility Planning (3) Concepts and skills for development, evaluation, construction, renovation, maintenance, and operations of quality educational environments and facilities. Prereq: M.S. introductory core or consent of instructor. Sp, Su

548 Introductory Supervision and Personnel (3) Basic supervisory and personnel concepts and related competencies; building (or micro-organizational) level; interviewing, personnel evaluation, collecting and maintaining employee information, supervision of instructional and non-instructional personnel, clinical supervision, evaluation, development. Prereq: Introductory M.S. core or consent of instructor. Sp, Su

553 Strategies of Educational Planning (3) Processes for making decision-making function through use of both quantitative and qualitative planning techniques. Policy analysis. CM, RM, REPORT. Prereq: Introductory M.S. core or consent of instructor. F, Su

554 School Law (3) Logical arrangement of case and statutory materials for public school administrators and teachers; problems concerning law and public education. Prereq: M.S. introductory core or consent of instructor. Sp, Su

580 Internship in Educational Administration (3) Field experience in appropriate educational setting working directly with administrator. At end of planned program of study, placement by department assignment. Some on-campus classes in conjunction with 583 or 582. Prereq: 21 hrs in educational administration and supervision or consent of instructor. E

582 Educational Leadership and District-Level (3) Role of central administration by analysis of central decision makers, behavior, concepts and competencies for developing and maintaining effective school organization. At end of planned program of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F, Su

583 Educational Leadership—Principalship (3) Knowledge, skills and relationships for principal to be effective educational leader. Administration materials and fiscal activities. Culminating course with internship at end of planned course of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F

590 Special Topics (1-3) May be repeated. E

592 Field Problems in Educational Administration and Supervision (3) Topic to be assigned. May be repeated. S/N or letter grade. E

595 Elementary Principals Seminar (1-3) For in-service training of elementary school administrators. Development, problems, programs, and trends of elementary schools and management skills of elementary school administrators. Prereq: Presently elementary school administrator or consent of instructor. May be repeated. S/N or letter grade. F, Sp

596 Middle School Principals Seminar (1-3) For in-service training of middle school administrators. Development, problems, programs, and trends of middle schools and management skills of middle school administrators. Prereq: Presently middle school administrator or consent of instructor. May be repeated. S/N or letter grade. F, Sp

604 Seminar in Educational Administration and Supervision (1) Current educational issues, problems and research. Required two consecutive semesters during doctoral residency. May be repeated. S/N only. E

605 Advanced Seminar in Administrative Theory (2) Interdisciplinary seminar. Readings selected by faculty for research and scholarly value from early to current classical theoretical studies and contemporary periodical literature in educational administration. Required of Ph.D. students in Education. Prereq: Doctoral student in Education.

610 Internship in Educational Administration (3) Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical tasks of educational administration under supervision of practitioner and University representative. May be repeated at discretion of student's committee. Maximum 12 hrs. S/N only. E

614 Statistical Methods for School Administrators (3) Descriptive and experimental research methods, parametric and non-parametric, statistical techniques used in research in educational settings. F

615 Research Designs (3) Statistical methods through multi-variate techniques and applications to various research designs. Prereq: 614 or consent of instructor. Sp

616 Research Methods (3) Overview of descriptive and experimental research designs: data collection, analysis, and interpretation for survey studies and school surveys. Conduct of survey. Prereq: Basic statistics and computer skills or consent of instructor. E

629 Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school system and higher educational institutions. Interdisciplinary discussion of community power structures and special interest groups, based on literature and research in education and political science. Field inquiry. Prereq: 526, 616 or equivalent or consent of instructor. F

644 Educational Finance and Business Management (3) Contemporary educational finance policies and their impact upon education, nation and citizens. Superintendency team concept, management of school logistical services. Prereq: 544 or consent of instructor. F, Su

646 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Prereq: 546 or consent of instructor. F, Su

653 State-Federal Relations in Education (3) Interrelationships of federal, state, and local responsibilities and organizations for education at state and local levels. Prereq: 547 or consent of instructor. Su


659 Conflict Management (3) Social conflict and its management. Causes of interpersonal, intergroup, and organizational conflict, skills and strategies used to manage conflict, conflict management models associated with different sectors of human activity, and current organizational practices for managing destructive conflict. F

670 Values and Ethics in Educational Leadership (3) Examination of moral and ethical dimensions of work of educational administrators; assistance to current and prospective administrators to deal with dimensions in knowledgeable, reflective, and principled ways. (Same as Higher Education 670.)

680 Administration of Complex Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational programs and organizations. Prereq: 513 or consent of instructor. Sp, Su

690 Special Topics (1-3) May be repeated. E

Higher Education

GRADUATE COURSES

530 Special Topics (1-3) May be repeated. E
Leadership Studies

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


518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only. E

691 Independent Study (1-3) May be repeated. S/NC or letter grade. E

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

606 Leadership Forum (2) Development of research, evaluation analysis skills and critical analysis and evaluation of philosophical principles undergirding American education. Continous enrollment for 2 years, on-campus, for students in Ed.D. alternative residence program. May be repeated. Maximum 12 hrs. S/NC only.

693 Independent Study (1-3) May be repeated. S/NC or letter grade. E

Life Sciences

(College of Arts and Sciences)

MAJOR

Life Sciences ................................................ M.S., Ph.D.

W. F. Harris, Chair

Coordinating Council:

Schwarz, O. J., Plant Physiology and Genetics

Harris, W. F., Biotechnology

The programs leading to the M.S. and Ph.D. degrees in Life Sciences are interdepartmental and intercollegiate and are designed to augment offerings of individual departments in the following concentrations: biotechnology, M.S. only, and plant physiology and genetics. Students interested in these areas should contact either the Life Sciences chairperson or the director of the area of interest. Each program is overseen by a committee and may have unique admission requirements.

ADMISSION REQUIREMENTS

1. A Bachelor's degree with a major in a biological, behavioral, or physical science.

2. GRE (general) scores.

3. Three letters of recommendation.

4. Coursework including a year of calculus (differential and integral), one year of chemistry, and a year of physics. Specific course deficiencies may be corrected during the first year.

DEGREE REQUIREMENTS

The master's degree requires a minimum of 30 semester hours of study approved by the student's committee, a thesis, and an oral examination. Within the biotechnology program only, a non-thesis M.S. option is available. Students choosing this option are expected to complete: (1) two summers' co-op experience in an appropriate industry. An evaluation by supervisor and a written report are required (529, Biotechnology Practicum Cooperative Experience, maximum 4 hrs); (2) a written report in the form of a scientific paper in an area of specialization chosen by the student and advisor. The minimum requirements for the doctoral degree include at least 6 hours above the 600 level, 24 semester hours of course 600, a pattern of courses approved by the student's committee; a comprehensive examination, a doctoral dissertation, and a defense of dissertation. Individual programs may have additional requirements.

CONCENTRATIONS

Biotechnology (M.S. only)

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

Required courses are Life Sciences 509, 511, 512, 531, 532; Biochemistry and Cellular and Molecular Biology 511; Microbiology 410; Botany 451; Chemical Engineering 475; and Ecology and Evolutionary Biology 507.

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 and Cellular and Molecular Biology 511, 512; Plant and Soil Science 471 or Ecology and Evolutionary Biology 550; Plant and Soil Science 552, Microbiology 410.

GRADUATE COURSES

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

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

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

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

511 Advanced Cellular Biology (3) Cell structures and functions at molecular and submolecular levels; membrane structure, function, and biogenesis; cellular communication; receptors and membranes; plant cell structure and function; contractility and motility; mitosis and meiosis; blood and immune cells.

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

525 Research Practicum in Life Sciences (1-3) Individual sections for each of biotechnology, cellular, mo-
BUSINESS ADMINISTRATION CONCENTRATIONS

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


Minimum course requirements for management—Three courses from the following: 511, 521, 522, 531, 541, 542, 551, 571, 581, 593, Business Administration 510, 590. Selection must be approved by the Management Department MBA advisor. For forest industries management—511, 521, 565, 566, 593. Environmental management—581 plus two approved courses from the following list: Ecology and Evolutionary Biology 520, 555, Environmental Engineering 510, 555, 556, Chemical Engineering 581; Economics 677, 678; Agricultural Economics 570; Sociology 560, 665; Law 866, 867; Geography 577. Additional courses may be approved subject to approval by the Management Department Chairperson or designated faculty. Ph.D. Concentration: Management.

Minimum course requirements are: For operations management -- 541 and 542; two semesters of 640 (may be repeated for credit); one additional semester of approved doctoral seminar work. For strategic management -- 610, 611, 612, 613.

MINOR IN ENVIRONMENTAL POLICY

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

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 a university facility and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

504 Management of Organizational Behavior (3) Integration of individual and group differences, organization theory and design, motivation, leadership, human resource planning, and career implications with strategy, planning, and decision making.

511 Organizational Theory: Integrated Structure and Behavior (3) Cases, group projects, discussion; organizational theories, organizational effectiveness; contextual factors of organizations: environment, size, technology; organizational structure configurations, organization design; social influences on organization effectiveness: motivation, leadership, group behavior, intergroup relations, organization change and development.

521 Personnel Administration (3) Personnel functions and human resources management. Community relations, recruiting, selection, training, performance evaluation, wage and salary administration, legal framework as it affects personnel.

522 Labor Relations and Collective Bargaining (3) American labor history, structure and philosophy of bargaining, dispute settlement, and contract administration. (Same as Economics 562.)

525-26 Industrial and Organizational Psychology (1-3, 1-3) Readings in industrial and organizational psychology. Available only with supervision of a psychology faculty member. May be repeated. Maximum 6 hrs. S/NCR or letter grade.

531 Management of Technology-Based Organizations (3) Role of technology and innovation in formulation and implementation of strategy. Management of research and development function and coordination with other functions. Management of scientists and engineers.

541 Operations Management I (3) Techniques applicable to design of systems in operations function.

542 Operations Management II (3) Operations planning and control function. Application of models to real-world problems.

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

567-68 Proseminar in Industrial/Organizational Psychology (3, 3) Basic thought, concepts, and issues required for advanced graduate study in industrial and organizational psychology. Must be taken in sequence during student’s first year of study in industrial and organizational psychology program. Consent of instructor required for all non-industrial/organizational psychology program students. (Same as Psychology 517-18.)

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

581 Environmental Management (3) Management frameworks for addressing environmental issues. Most pressing environmental challenges; options compatible with sustained business performance. Cases, field projects, research papers.

593 Directed Independent Study (1-3) Topic of mutual interest. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hrs. S/NCR or letter grade.

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

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

601 Research Methods (3) Seminar covering broad range of issues: research process as applied to study of strategic management. Literature and examples of research, research proposals.

610 Seminar in Advanced Organization Theory (3) Analysis of functioning of complex organizations. Classic and open systems models, organization growth and change, organizational effectiveness, and design of complex organizations.

611 Seminar in Strategic Management (3) Analysis of concepts and research in strategic management.

612 Seminar in Strategic Management II (3) Analysis of concepts and research in strategic management.

613 Seminar in Strategic Management III (3) Review and analysis of important books and monographs in strategic management. Literature and examples of thought and emergence of distinct paradigms.

625 Seminar in Organizational Psychology (3) In-depth analysis of current theories, concepts, and issues associated with psychology of organizational leadership and work motivation. Prerequisite: 567, 588, consent of instructor. May be repeated. (Same as Psychology 625.)

626 Seminar in Industrial Psychology (3) In-depth analysis of current issues and problems: performance appraisal/evaluation, development, and training and development. Prerequisites: 567, 588, consent of instructor. May be repeated. (Same as Psychology 626.)

627 Seminar in Applied Industrial Psychology (3) In-depth analysis of current issues, concerns, and methods: advanced quantitative psychometrics and psychometric selection. Prerequisites: 566, 588, consent of instructor. May be repeated. (Same as Psychology 627.)

638 Current Topics in Industrial/Organizational Psychology (3) In-depth analysis of various topics: organizational and psychological problems and trends of the workplace, consumer behavior. Prerequisite: 567, 568, consent of instructor. May be repeated. (Same as Psychology 638.)

690 Field Work in Industrial and Organizational Psychology (1-12) Supervised field work in industrial and organizational psychology. 1 hr per 30 hrs of practice. Maximum 12 hrs. (Same as Psychology 690.)
Management Science

(College of Business Administration)

MAJORS
Management Science M.S., Ph.D.
Business Administration M.B.A.

DEGREES
MBA

Majors:
Management Science
Business Administration
Electives selected from mathematics, computer science, business, management science, industrial engineering, or other approved area

A thesis option is available to qualified students. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student's first semester and must approve all courses on a semester-by-semester basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. The total course load will remain 40 hours for all students.

THE MASTER'S PROGRAM

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

Management Science coursework will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program requires concentrated study in a supporting area.

Supporting areas are available in other departments of the College of Business Administration as well as in computer science, public administration, geography, ecology, and other areas, subject to approval by the Management Science Committee.

Admission Requirements

The master's program requires three applicant recommendation forms and the GRE or GMAT. Applications are encouraged from all majors, but a mathematics background equivalent to 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 four semesters by full-time students. However, students may start the program in any semester and may pursue an M.S. degree program in Management Science on a part-time basis.

Course Requirements

Core Requirements
Management Science 531, 532, 533, 534, and 691 or 692
Statistics 563

Applied specialization area (approved by advisor)

Technical elective:
Statistics (500 level or above as approved by advisor)
Mathematics (400 level or above as approved by advisor)
Industrial Engineering (400 level or above as approved by advisor)
Other elective (as approved by advisor)

Elections selected from mathematics, statistics, computer science, business, management science, industrial engineering, or other approved area

Total

40

A thesis option is available to qualified students. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student's first semester and must approve all courses on a semester-by-semester basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. The total course load will remain 40 hours for all students.

THE DOCTORAL PROGRAM

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

1. To provide, through management science coursework, a thorough knowledge of common Management Science/Operations Research mathematical models and their uses;
2. To provide sufficient advanced study in a supporting area to qualify the graduate for a joint faculty position in the supporting area and management science. The candidate may choose from the business functional areas (accounting, finance, marketing, management, and transportation and logistics) or other disciplines, (e.g., computer science, forestry, ecology, and public administration);
3. To develop in the student, through coursework in management science, statistics and computer science, a high degree of mathematical maturity to enhance a potential career in management, research, or teaching.

Admission Requirements

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

Coursework

A minimum of 48 semester hours of coursework taken for graduate credit (exclusive of thesis or dissertation) is required. Some of this may be the coursework from a master's program although a master's is not a prerequisite for the doctorate. The candidate must complete a minimum of 24 semester hours at The University of Tennessee, Knoxville, at least 6 of which must be at the 600 level. Both of these requirements are also exclusive of thesis or dissertation credits. Entering students who have completed graduate studies in applicable fields will be granted course credits for work which is equivalent to required courses in the program.

The program includes approximately 16 to 20 semester hours of coursework in the applied area.

Qualifying Examinations

The student must demonstrate mastery of probability theory and statistical inference, Statistics 563, 564, by passing a written qualifying examination.

Mastery of 12 to 14 semester hours in management science coursework must be demonstrated by passing a written qualifying examination. Topics normally include numerical analysis, either Mathematics 471, 472, 453, or 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty may 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 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 requirements are 531, 532, and 534.

GRADUATE COURSES

500 Thesis (1-15) P/NP only, E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any
Marketing, Logistics and Transportation

GRADED COURSES

Marketing

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 analyses 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.

507 Global Marketing (3) Strategic issues related to international and multi-national marketing operations; identification and evaluation of opportunities in overseas markets; coordination of strategies in world markets.

Logistics and Transportation

GRADED COURSES

501 Survey of Logistics and Transportation (3) U.S. logistics and transportation: physical, economic, social, and political environment; financing, marketing, maintaining, and enhancing U.S. transport 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. Execu- tive level integration of logistics operations with market- ing and production. Postgraduate level. May be repeated. S/NC only. E

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 physical and mechanical behavior of materials. Specializations in electronic and ceramic materials are available. Areas of concentration within the polymer engineering program include rheology and polymer processing; polymer morphology; mechanical, physical and chemical behavior of polymers; and composite materials.

THE MASTER'S PROGRAM

Thesis Option

A total of 30 semester hours is required for the M.S. degree in either Metallurgical Engineering or Polymer Engineering. Additional requirements include:

1. A major consisting of 12 to 18 semester hours in 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 in any approved engineering, chemistry, mathematics, physics, or other related fields.

3. Master's thesis, 500 totaling 6 to 12 hours. All resident students are required to register for and participate in the graduate seminar in metallurgical engineering or polymer engineering, as appropriate, during each semester in which it is offered. Credits for seminars do not count towards satisfying the coursework requirements.

Non-Thesis Option

Under certain conditions, a candidate may apply for a non-thesis option. To be eligible, the candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience or research publications would be examples of such evidence. A departmental faculty meeting will consider each application individually. Upon acceptance, a supervisory committee of three will be appointed, at least two 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 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 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 totaling 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.

CADEMIE 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 Kentucky, Louisiana, 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.


422 Chemical Process Metallurgy (3) Application of chemical thermodynamics to metallic processing. Ferrous and nonferrous pyrometallurgical refining, slag-metal equilibria, solidification, gas-metal processing. Prereq: 303.

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 properties of joints; design of joints. Prereq: Introduction to Materials Science and Engineering.

429 Introduction to Ceramic Matrix Composites (3) Characteristics of composites: chemical matrix composites; macromechanics and materials design; overview of fabrication techniques; microstructural characterization; physical and mechanical property evaluation; current and potential applications. Prereq: Introduction to Materials Science and Engineering.
443 Polymer Processing (3) Rheological measurements; flow through tubes and slits, and effects and extrudate swell; selected application, screw extrusion, injection molding, syrting, spin forming, structure development, properties.

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


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. (Same as Engineering Science 429.)

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

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

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

502-506 Laboratory Methods in Polymer Engineering (1) Prereq: Admission to graduate program. May be repeated. S/N only. E

503 Graduate Seminar in Metallurgical Engineering (1) Prereq: Admission to graduate program. May be repeated. S/N only. E

504 Graduate Seminar in Polymer Engineering (1) Prereq: Admission to graduate program. May be repeated. S/N 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 alloying; polycrystalline behavior in terms of single crystal deformation mechanisms; texture formation. Prereq: 301, 320 or consent of instructor.

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

525-526 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.

528 Ceramic Matrix Composites: Material and Mechanics (3) (Same as Engineering Science 528.)

531 Advanced Corrosion (3) Analyses of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to pitting, crevice, fretting, wear, fatigue and stress corrosion. 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) Navier-Stokes equations and illustrative problems; applications in chemical engineering and polymer engineering; packed and fluidized bed, 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.

543 Basic Polymer Physics (3) Essential structure-property relations; Physical structure of polymers. Mechanical, electrical and thermal properties. Coreq: 540.

544 Polymer Solution Thermodynamics and Characterization (3) Theories of solutions, statistical thermodynamics; characterization of polymers. Mechanical, electrical and thermal properties. Coreq: 540.

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

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

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

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

571 Electron Microscopy (3) Operation of electron microscope; kinematical and dynamical diffraction theories; structure determination; analysis of lattice defects. Prereq: 405 or equivalent.

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

574 Formability of Materials (3) Modeling and analysis of thin 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) Topics of interest not otherwise offered. Prereq: Consent of instructor. May be repeated.


582-590 Mathematical Methods (3) Phenomenological and atomic mechanisms of deformation in solid state. Solution and applications of diffusion equations; random walk problem and mechanism of diffusion; diffusion in dilute and concentrated alloys; Kirkendall effect; high diffusivity paths.

590 Phase Transformations in Metallic Materials (3) Thermodynamics, nucleation, growth, solidification and microstructure development in solids and metals. Prereq: 470 or consent of instructor.

591 Advanced Thermodynamic and Phase Transformation (3) Advanced phase transformations, solidification, precipitation, quenching, transformation, nucleation, growth, segregation, and microstructure development. Prereq: Consent of instructor.

592 Modern Metallurgy and Materials Research (3) Modern metallurgy and materials research. Prereq: Consent of instructor.

593 Advanced Topics in Materials Science and Engineering (3) Advanced topics in materials science and engineering. Prereq: Consent of instructor. May be repeated.

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

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

621-2 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, mag- netohydrodynamics of incompressible fluids, growth stability theory, thermodynamic applications, rapid solidification, metastability. Prereq: Consent of instructor.

641 Advanced Rheology and Viscoelastic Theory (3) Continuum mechanics, formulation of viscoelastic theories for describing deformation and flow of polymeric materials. Application to polymer processing problems. Recommended for MS candidates working in rheological areas. Prereq: 541.

642 Advanced Topics in Polymer Processing (3) Application of theories of rheological behavior and 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 state; annealing of polymeric glasses; crystalization of powder and nucleation, growth and morphology; secondary nucleation theory; solidification of copolymers; crystalization under stress. Prereq: 543.

671 Quantitative Microscopy (3) Principal acoustic, optical, chemical, electrical and field-ion techniques for examination of microstructures of materials. Prereq: 405.

676 Advanced Topics in Materials Science and Engineering (3) Latest developments and/or advanced specialized topics. Prereq: Consent of instructor. May be repeated.

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

Mathematics

MAJOR DEGREES

Mathematics

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

John B. Conway, Head

Professors:

Alexiades, V., Ph.D. ................. Delaware
Alilkakos, N., Ph.D. .................. Brown
Anderson, D. F., Ph.D. .............. Chicago
Baker, G. A., Ph.D. ................. Cornell
Bradley, John S. (Emeritus), Ph.D. .... Iowa
Carruth, J. H., Ph.D. ............... Louisiana State
Clark, C. E., Ph.D. ................. Louisiana State
Conway, J. B., Ph.D. ............... Louisiana State
Daverman, Robert J., Ph.D. ........ Wisconsin
Dobbs, D. E., Ph.D. ................. Cornell
Dydaik, J., Ph.D. ..................... Warsaw
Frandsen, Henry, Ph.D. ............ Illinois
Gross, L. J., Ph.D. ................... Cornell
Hall, L. T., Ph.D. .................... Missouri
Hanson, D. B., Ph.D. ............... Tennessee
Husch, L. S., Ph.D. ................. Florida State
Johannson, K., Ph.D. ............... Bielefeld
Jordan, G. Samuel, Ph.D. .......... Wisconsin
Karakashian, O., Ph.D. ............ Harvard
Kupershmidt, B.A. (UTSI), Ph.D. .... MIT
Lenhart, S., Ph.D. ................. Kentucky
McConnel, R. M., Ph.D. .......... Duke
Mathews, H. T., Ph.D. .......... Tulane
Mathematics

THE MASTER OF MATHEMATICS PROGRAM

Before admission to the Master of Mathematics program, the applicant must have either (a) certification for teaching secondary mathematics in at least one state, or (b) three years of elementary school, secondary school, or college teaching experience. The applicant must have successfully completed one year of calculus (141-42 or equivalent) and a course in matrix algebra (251 or equivalent).

The following requirements must be met:
1. Complete 30 hours of coursework of which 21 must be at the graduate level. The coursework must include 504, 505, 506, 507, and 6 hours in 509. At most, 6 hours may be taken outside the Department of Mathematics (selected in consultation with the advisor).
2. Pass a final examination upon completion of all coursework. In exceptional circumstances, part of admission requirement (b) might be satisfied concurrently with coursework. Normally Master of Mathematics degree students will start the program by taking 504 during the summer.

THE MASTER OF SCIENCE PROGRAM

The following requirements must be met:
1. Satisfy either the standard program or the interdisciplinary mathematics/ ecology concentration. Descriptions of both programs are given below.
2. Demonstrate proficiency in one foreign language, normally French, German or Russian. This requirement must be met prior to the examination in the area of specialization. A student's doctoral committee may require the student to pass a second language examination.
3. Pass an examination in the field of specialization. After the requirements in 1 and 2 have been met, this examination will be given by a committee appointed by the department head. A student may take this examination only twice.
4. Pass a one-year, 600-level sequence in mathematics outside the student's area of specialization. The sequences selected to fulfill this requirement must be approved by the department head and the student's doctoral committee. (Such approval may occur after completion of the sequence.)

Requirements 1-4 must be completed no later than the start of a student's seventh year (as a mathematics graduate student at UT Knoxville).

THE DOCTORAL PROGRAM

For the Ph.D. program in Mathematics, the student must meet the following requirements in addition to those of The Graduate School:
1. Satisfy either the standard program or the interdisciplinary mathematics/ ecology concentration. Descriptions of both programs are given below.
2. Demonstrate proficiency in one foreign language, normally French, German or Russian. This requirement must be met prior to the examination in the area of specialization. A student's doctoral committee may require the student to pass a second language examination.
3. Pass an examination in the field of specialization. After the requirements in 1 and 2 have been met, this examination will be given by a committee appointed by the department head. A student may take this examination only twice.
4. Pass a one-year, 600-level sequence in mathematics outside the student's area of specialization. The sequences selected to fulfill this requirement must be approved by the department head and the student's doctoral committee. (Such approval may occur after completion of the sequence.)

Requirements 1-4 must be completed no later than the start of a student's seventh year (as a mathematics graduate student at UT Knoxville).

Standard Program

Demonstrate knowledge in five subjects selected from the groups listed below by passing written examinations in three subjects and by earning grades of B+ or better each semester in the courses associated with two additional subjects. The three subjects selected for written examinations must be from Groups I, II, III. At least two groups must be represented in the three written examinations. At least three groups must be represented in the five subjects.


A student's five subjects may not include both Real Analysis and Applied Linear Analysis or both Mathematical Principles of Fluid Mechanics and Mathematical Principles of Continuum Mechanics. A student may not count examinations in both Ordinary Differential Equations and Partial Differential Equations, but both may be included in a student's five subjects. With prior approval of the graduate committee, a student may utilize as a Group IV course a year-long graduate-level sequence from outside the Department of Mathematics. At most one such utilization may be made. A student may take as many written examinations as desired at any time the examinations are given, subject to the following conditions:

a. The examinations to be taken must be approved in advance by the student's advisory committee.
b. At any one time a student may take at most only the number of examinations necessary to complete the requirements.
c. A student may take a collection of written examinations a maximum of 3 times, but no one
failing 4 examinations, counting possible repetitions, will be permitted to take another examination. An exception is that a student who does not have a master’s degree in mathematics and who has been enrolled in a UK graduate program in mathematics no longer than one year may take written examinations at one time during that year without having that sitting for any examinations or any incurred failure(s) count toward the limits imposed above.

At least two examinations must be taken and at least one must be passed before the start of a student’s fourth year. Three examinations must be passed before the start of a student’s fifth year.

In lieu of earning a grade of B+ or better each semester in a sequence from Group I, II, or III, a student may demonstrate proficiency in that subject by passing the associated written examination. For this purpose, only one examination is permitted for each of up to two subjects, and this use of a written examination must be declared before the examination is taken so that the sitting for the examination and any failure are not counted toward the limits in condition c.

Mathematical Ecology Concentration

The student must pass written examinations in three subjects:

1. Mathematical Ecology 581-82
2. A subject from Groups I, II, and III of the standard program
3. A subject represented by a year-long graduate-level sequence from outside the Department of Mathematics. The sequence may be approved in advance by the mathematical ecology faculty and by the departmental Graduate Committee. At least one member of the mathematical ecology faculty must be involved in the grading of the examination. The examination in this subject may be taken only twice.

The student also must earn grades of B+ or better each semester in the courses associated with two of the additional subjects from the groups listed in the standard program. This requirement may not be satisfied with courses from outside the department. At least one of the subjects used to meet this requirement or the written examination subject in 2 must be from Groups I and II.

Except for the privilege of utilizing as a Group IV course a course from outside the department, this concentration is subject to the constraints and privileges specified in the standard program, including the restrictions on related subjects, the conditions a through d. placed on the taking of written examinations, and the option to pass a written examination in lieu of earning a grade of B+ or better each semester in a sequence from Group I, II, or III.

GRADUATE COURSES

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

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

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

405 Models in Biology (3) Difference and differential equation models of biological systems. May not be counted toward graduate degree. Prereq: Calculus II or Bioculus II.


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

423 Probability I (3) Axiomatic probability, multivariate distributions, conditional probability and expectations, methods of moment generating functions. Law of large numbers and central limit theorem. Prereq: 300-level probability or consent of instructor.

424 Probability II (3) Elements of stochastic processes: Random walk, Markov chains and Poisson processes. Other topics as selected by instructor. Prereq: 423.

425 Statistics (3) Derivation of standard statistical distributions; I, F, and χ²; independence of sample mean and variance; basic limit theorems; point and interval estimation; Bayesian estimators; statistical hypotheses; Neyman-Pearson theorem; likelihood ratio and other parametric and non-parametric sufficient statistics. Prereq: Probability I or consent of instructor.


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

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

445-46 Advanced Calculus I, II (3, 3) Theory of sequences, series, differentiation, and Riemann integration, functions of one variable, and functions of several variables. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.


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

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


460 Geometry (3) Axiomatic and historical development of neutral, Euclidean, and hyperbolic geometry, stressing proof technique and critical reasoning. Models of Noneuclidean geometries. Prereq: Introduction to Abstract Mathematics, or consent of instructor.

461 Topology I (3) Topology of line and plane, separation properties, compactness, connectedness, continuous functions, homeomorphisms, and topological invariants. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.

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


475 Industrial Mathematics (3) Modeling, analysis, and computer applications of scientific and technical problems. Prereq: Differential Equations I and either Computer Science 404 or Numerical Algorithms I or consent of instructor.

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

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


502 Registration for Use of Facilities (3-15) Required for students in the M.S. degree program and for students in graduate programs in College of Education. May not count toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

505 Analysis for Teachers (3) Development of differential and integral calculus, proofs of basic theorems. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

506 Algebra for Teachers (3) Algebraic structures; integers and fields and their applications to algebra of integers and polynomials. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.


509 Seminar for Teachers (3) For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

510 Applied Mathematics Laboratory (1) Computer applications in applied mathematics: software packages for matrix analysis, symbolic algebra, and differential equations. Coreq: 511 or 512. May be repeated.


513-14 Mathematical Principles of Fluid Mechanics (3, 3) Equations of motion, irrotational and viscous flows, Navier-Stokes equations, Prereq: 431, 435, and 445-46, or 404, or consent of instructor.

515-16 Analytical Applied Mathematics (3, 3) Analysis of advanced techniques in modern context for applied mathematical problems: oscillations, wave phenomena and conservation laws, stability and bifurcation, distributions, integral equations. Prereq: 445 or 446, 453, and either 411-12 or both 431 and 435.

517-18 Mathematical Methods in Physics (3, 3) (Same as Physics 571-72)
Mechanical and Aerospace Engineering and Engineering Science

(College of Engineering)

MAJOR

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

D. W. Dareing, Head

Professors:
Antar, B. (UTSI), Ph.D. ........................................ Texas
Arimilli, R. V., Ph.D. ........................................ VPI
Baker, A. J., PE, Ph.D. ........................................ New York
Braun, G. W. (Emeritus) (UTSI), Ph.D. .................... Gottingen
Carley, T. G. (Liaison), Ph.D. ................................ Illinois
Collins, G. F. (UTSI), Ph.D. ................................ California
Crawford, R. A. (UTSI), Ph.D. .......................... Tennessee
Darasing, D. W., Ph.D. .......................................... Illinois
Dubey, R. V., Ph.D. ............................................. Clemson
Edmondson, A. J., PE, Ph.D. .............................. Texas A&M
Flandro, G. A (UTSI), Ph.D. ............................. Cal Tech
Forrester, J. H., PE, Ph.D. ................................ Iowa State
Fortey, J. W. (Emeritus), Ph.D. .............................. VPI
Frankel, J. I., Ph.D. ............................................ VPI
Garrison, G. W. (UTSI), Ph.D. ......................... North Carolina State
Hodges, J. W. (Fishier Professor), PE, Ph.D. .............. Georgia Tech
Holland, R. W. (Emeritus), PE, M.S. ...................... Tennessee
Jendrucco, R. J., PE, Ph.D. .................................. Virginia
Johnson, W. S., PE, Ph.D. .................................. Clemson
Keever, D. R. (UTSI), Ph.D. .......................... Florida
Keyhani, M. (Liaison), Ph.D. ................................ Ohio State
Kim, K. H., Ph.D. ................................................. NC State
Krane, R. J., Ph.D. ............................................. Oklahoma
Krieg, R. D. (Condra Chair of Excellence), Ph.D. ........ New Mexico
Landes, J. D., Ph.D. ............................................ Laigh
Lee, C. W. (Emeritus), Ph.D. ................................ Illinois IT
Liston, H., Jr. (Emeritus), M.E.A. ......................... George Washington
Lo, C. F. (UTSI), Ph.D. ....................................... Cornell
McCay, M. H. (UTSI), Ph.D. .............................. Florida
McCay, T. D. (UTSI), Ph.D. ................................. Auburn
Maxwell, R. L. (Emeritus), Ph.D. .................. Case Western Reserve
Milligan, M. W., PE, Ph.D. ................................. Tennessee
Newman, M. K. (Emeritus) (UTSI), Ph.D. .............. PE
Ph.D. ................................................................. Columbia
Parang, M., PE, Ph.D. ......................................... Oklahoma
Parsons, J. R., PE, Ph.D. ......................................... NC State
Peters, C. E. (UTSI), D.A.S. ................................. Brussels
Ph. H. (Emeritus), PE, Ph.D. ................................. Illinois IT
Pitts, D. R. (Emeritus) Ph.D. ............................... Georgia Tech
Remenyik, V. J. (Emeritus), Ph.D. .......................... Johns Hopkins
Schulz, R. J. (UTSI), Ph.D. ................................ Tennessee
Scott, W. E. (Emeritus), Ph.D. ........................... Johns Hopkins
Shahroki, F. (UTSI), Ph.D. ................................. Oklahoma
Shobe, G. R. (Emeritus), Ph.D. ............................ Northwestern
Smith, G. V., PE, Ph.D. ....................................... Pennsylvania
Snyder, W. T., Ph.D. ............................................ Northwestern
Soloman, O., PE, Ph.D. ......................................... Tennessee
Speckhart, F. H. (IBM Prof.), PE, Ph.D. ......... Georgia Tech
Stair, W. K. (Emeritus), MS .................................... Tennessee
Stoneking, J. E., PE, Ph.D. ................................ Illinois
Tucker, J. M. (Emeritus), M.S. ............................... Illinois
Wasserman, J., Ph.D. ........................................... Cincinnati
Weitsman, Y. J., Ph.D. ........................................... Tennessee
Wilson, C. C. (Emeritus), Ph.D. .......................... Purdue
Wu, J. M. (UTSI), Ph.D. ....................................... Cal Tech
Young, R. L. (Emeritus) (UTSI), PE, Ph.D. ............... Northwestern

Associate Professors:
Boulet, J. A. M., Ph.D. ....................................... Stanford
Caruthers, J. E. (UTSI), Ph.D. ............................. Georgia Tech
Engel, R. C. (UTSI), Ph.D. ................................. VPI
Hamel, W. R., Ph.D. ........................................... Tennessee
Kawiecki, G., Ph.D. ........................................... West Virginia
Madhu, M. S., Ph.D. ........................................... Drexel
Mathews, A., PE, Ph.D. ....................................... Illinois
Moulden, T. H. (UTSI), Ph.D. .............................. Tennessee
Nguyen, K., Ph.D. .............................................. Colorado
Steinhoff, J. S. (UTSI), Ph.D. ............................... Chicago
Vakili, A. D. (UTSI), Ph.D. ................................. Tennessee

Assistant Professors:
Cezanne, J. L., Ph.D. ......................................... Rensselaer
Iannelli, G. L., Ph.D. ........................................ Tennessee
Lynx, J. E., M.D., Ph.D. ....................................... North Carolina State
Pionke, C. D., PE, Ph.D. ................................ Georgia Tech
Rosch, R. L. (UTSI), Ph.D. ................................. Georgia Tech
Yun, N., Ph.D. ............................................. California (San Diego)

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy are available with majors in Mechanical Engineering, Aerospace Engineering, and Engineering Science. Changing from one of these programs to another requires departmental approval. Each applicant is advised as to any prerequisites before entering a program.

In Mechanical Engineering, program concentrations include energy conversion and utilization; propulsion; heat transfer and fluid mechanics; thermodynamics; space engineering; gas dynamics; machine design; dynamics, control, and robotics; power generation; and stress analysis.

In Aerospace Engineering, program concentrations include energy conversion and utilization; propulsion, heat transfer, and fluid mechanics; thermodynamics; space engineering; aerodynamics; and structures and stress analysis.

In Engineering Science, program concentrations include solid mechanics, fluid mechanics, computational mechanics, mechanics of composite materials, biomechanical engineering, industrial engineering, and optical engineering (UTSI only).

In each of these concentrations, interdisciplinary programs are arranged to meet individual needs or interests. The flexibility and interdisciplinary aspect of the program concentrations are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering and can best be met by interdisciplinary study in engineering. The program's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics or in related interdisciplinary studies such as biomechanics.

In Mechanical Engineering or Aerospace Engineering, entrance into the Master of Science program is available to qualified graduates of recognized curricula in mechanical or aerospace engineering and to qualified graduates of other curricula who satisfy the necessary prerequisites. Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds. The general GRE is required of all international applicants for admission.

In Engineering Science, entrance into the graduate program is available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. A program application is required in addition to the Graduate School application. The names and addresses of four references must be included with the program application. The general GRE is required of all international applicants for admission.

Each student must satisfactorily complete a program of study that has been approved by his/her advisory committee and complies with the requirements of the Graduate School. In Engineering Science, the student's major professor may be selected from a department other than the Department of Mechanical and Aerospace Engineering. A graduate program is available to qualified graduates of other science program is available to qualified graduates of other disciplines.

The MAJOR'S PROGRAM

In both Mechanical Engineering and Aerospace Engineering, three M.S. options are offered. Option I requires a thesis, while options II and III do not. Option I is the normal program for recent graduates. Options II and III provide graduate students with significant professional experience the opportunity to focus their programs in special areas through either greater course work or selected engineering problems. Credit requirements for these three options are summarized below.

<table>
<thead>
<tr>
<th>Course Areas</th>
<th>Hours Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option I</td>
<td>1</td>
</tr>
<tr>
<td>Option II</td>
<td>1</td>
</tr>
<tr>
<td>Option III</td>
<td>24</td>
</tr>
<tr>
<td>Coursework</td>
<td>20</td>
</tr>
<tr>
<td>Courses in department (500 level or above)</td>
<td>12 (minimum)</td>
</tr>
<tr>
<td>Mathematics (400 level or above)</td>
<td>6 6 6</td>
</tr>
</tbody>
</table>
The Doctoral Program

All students must complete a minimum of 72 semester hours beyond the Bachelor’s degree, exclusive of credit for the master’s thesis. These shall include a minimum of 24 semester hours in Doctoral Research and Dissertation and a minimum of 46 semester hours in other courses.

In Mechanical Engineering or Aerospace Engineering, the courses must include:

1. 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.
2. A minimum of 24 semester hours in the department in courses numbered 500 and above, with at least 12 of these semester hours in the major. A minimum of 9 semester hours of courses is required at the 600 level. These are exclusive of thesis, problems, or dissertation credit. The student’s advisory committee can approve a student’s petition to replace one 600-level course with one or more 500-level courses(s) that are more appropriate.

In Engineering Science, the courses must include:

1. A minimum of 24 semester hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 500 and above, with at least 9 semester hours of 600-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.
2. A minimum of 12 semester hours in mathematics or computer science in courses numbered 400 and above, exclusive of a first course in ordinary differential equations.

Additional requirements for all students include:

1. Participation in the departmental seminar program.
2. Meet all departmental examination requirements, which include passing a written and oral comprehensive examination.
3. Presentation of a dissertation proposal to the student’s advisory committee and approval of that proposal by that committee.

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 or Kentucky. The M.S. in Aerospace Engineering is available to residents of Kentucky. The Ph. D. program in Engineering Science is available to residents of the state of Florida (concentration in biomedical engineering only). Additional information may be obtained from the Office of Graduate Admissions.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Students majoring in Mechanical Engineering or Aerospace Engineering may not normally use more than one 400-level engineering course to meet their advanced degree requirements. For students majoring in Engineering Science, four hundred-level courses in engineering may be used for graduate credit at the discretion of the advising committee. However, at least two-thirds of minimum required credit hours in a master’s degree program must be at or above the 500 level. With the approval of the student’s major department, a student whose major is outside the Department of Mechanical and Aerospace Engineering and Engineering Science may take senior (400-level) courses in the Department for graduate credit. Such students should consult with instructors regarding prerequisites for undergraduate courses.

Aerospace Engineering

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

**GRADUATE COURSES**

421 Materials of Engineering (3) Mechanical properties of engineering materials; data collection and processing; time-dependent and cyclic dependent properties. Prereq: 321, Materials Science and Engineering 201. 3 hrs or 2 hrs and 1 lab.


426 Fundamental Principles of Composite Materials (3) (Same as Materials Science 472.)

429 Introduction to Ceramic Matrix Composites (3) (Same as Materials Science 429.)

433 Dynamic Systems (3) Three dimensional dynamics of particles and rigid bodies; gyroscopes; variable mass systems; central force motion; Lagrange's equations; stability; transfer functions. Prereq: Dynamics.

435 Engineering Acoustics (3) Concepts of acoustics, measures of sound and their units; noise generation and transmission, noise control principles and applications, materials and procedures for noise abatement. Prereq: Senior standing or consent of instructor.

442 Fluid Mechanics II (3) Integral forms of linear and angular momentum equations for inviscid and viscous flow (fluids, compressible and incompressible); turbomachinery, performance, efficiency, similarity, differential conservation equations; internal one-dimensional incompressible and compressible flows, potential flow, method of characteristics. Prereq: Fluid Mechanics I, Differential Equations I, Calculus III. 3 units.

461 Experimental Stress Analysis (3) Theory, techniques, and instrumentation of resistance strain gauges; theory and techniques of brittle fracture method; introduction to high strain rate and shock wave phenomena. Prereq: 321, Electrical and Computer Engineering 301, 2 hrs and 1 lab.

465 Dynamic Data Acquisition (3) Use and calibration of instrumentation for measuring and recording dynamic data. Fourier analysis and function analysis, digital signal processing, transduction, experimental parameter estimation with applications to modal vibration analysis. Prereq: ChE and Electrical Engineering 304.

471 Clinical Engineering and Biointerface Measurement (3) Function and characteristics of health care delivery systems; hospital organization and health care economics. Development and testing of interfaces for hospital-based clinical engineering program. Biomedical instrumentation system operational characteristics; perforation and compatibility; transducer, user interface, read-out and storage devices; evaluation of commercially available systems, selection and procurement methods, custom-designed system, equipment maintenance and control programs. Prereq: 322, Mechanical Engineering 322.

473 Biomechanics (3) Mechanical properties of living tissues; biomechanics of injury; mechanics of prosthetic and cardiac assist devices; biomechanical problems related to implant. Prereq: 321.

475 Design of Artificial Internal Organs (3) Design, development and evaluation of artificial internal organs; analysis of transport processes in artificial devices for design optimization; review of currently available devices, federal regulation and ethical considerations. Prereq: 341, Mathematics 231.

476 Transport Phenomena in Living and Life Support Systems (3) (Same as Materials Science and Engineering 476.) Prereq: Continuum and heat transport theory to quantitative analysis of in vivo physiological function; introduction to analysis of transport phenomena in life support systems, design considerations for artificial organs: application to blood and tissue, cardiovascular dynamics, mass diffusion in biomembrane systems, and heat transfer in living systems and extracorporeal blood flow devices. Prereq: 271, Mathematics 231.

494-95 Special Engineering Science Topics (1-3) Problems related to recent developments and practices. Open to juniors or seniors. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

495 Theory of Elasticity (3) Equations of equilibrium; strain-displacement relations compatibility, and constitutive equations in three dimensions. Beams, disks, thick-walled tubes, plates with holes, stress concentrations. Air and compressible fluid flow, plane stress and strain in rectangular and polar coordinates. Thermal stresses in beams, rings, plates, and shells; thermal buckling problems.

525 Theory of Plates (3) Classical bending theory of thin plates; thick plates; buckling and large deflection problems. Prereq: 523 or 635.


528 Ceramic Matrix Composites: Material and Mechanics (3) Micromechanics and microstructural design; fabrication of ceramic matrix composites; interface characterization and mechanics; electron microscopy and non-destructive evaluation of ceramics, fiber composites. Prereq: 429 or consent of instructor. (Same as Materials Science and Engineering 528.)


536 Advanced Engineering Acoustics (3) Introduction to theory and application of acoustic analysis; vibration of continuous systems, plane and spherical waves, transmission line theory, radiation, transmission loss, resonators, filters, absorption mechanisms, microphones, ultrasound, sonar transducers. Prereq: 435 or undergraduate vibrations course.

539 Continuum Mechanics (3) Cartesian tensors, transformations, strain, stress, strain rate, constitutive equations. Conservation laws for mass, momentum, energy, Applications in solid and fluid mechanics.

582 Experimental Mechanics of Composite Materials (3) Stress-strain relationships for orthotropic and transversely isotropic materials; analysis of composite lamina and laminate; stress and strain transformation; laminate theory; Fiber-Matrix Interface, and composite mechanical properties (tensile, flexure, compressive, shear); physical properties; notch-lip stress field, stress intensity factor, notch sensitivity; strain energy release rate, composite fracture toughness; failure
NOTE: Not all the courses listed below are available at both the UT Knoxville and the UTSI campuses.

GRADUATE COURSES


507 Application of Numerical Linear Algebra in Systems and Control Engineering (3) (Same as Chemical Engineering 507 and Electrical Engineering 507.)

451 Systems and Controls (3) Analytical models of physical systems comprised of combinations of mechanical, fluid, electrical, and thermal components; feedback systems; transfer functions; frequency response; stability; analysis; non-linear control of linear systems; sampled data systems; digital filters. Prereq.: Mechanical Engineering Instrumentation and Measurement, Circuits and Electro Mechanical Components. F, Sp

455 Introduction to Design (2) Engineering economy, optimization, design for automation, reliability, patents and product liability; design of mechanical engineering solid mechanics systems. Participation in team design effort; design report. Prereq.: Dynamics and Vibrations of Machines.

456 Introduction to Thermal Design (2) Engineering economy, optimization, design for automation, reliability, patents and product liability; design of mechanical engineering solid mechanics systems. Participation in team design effort; design report. Prereq.: Mechanical Engineering Instrumentation and Measurement, Circuits and Electro Mechanical Components. F, Sp


522-523 Thermodynamics I and II (3,3) Microscopic thermodynamics, including First and Second Law analysis; chemical and physical properties, chemical reactions, equilibrium, phase diagrams, cycle analysis, combustion, gas mixtures, and property relations, determination of thermodynamic properties from molecular structure, statistical mechanics, quantum mechanics. F, Sp

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

525 Combustion and Chemically Reacting Flows I (3) Fundamentals of internal and external flows, forced and buoyancy driven flows, gas turbine and rocket propulsion. Prereq.: 522, 531, or consent of instructor.

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

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

553 Development of Superior Products and Processes (3) Case studies of latest techniques of superior product and process development practiced in industry. Comparing and selecting good product and process improvement projects. Prereq.: Consent of instructor.

581 Rocket Propulsion I (3) Rocket propulsion fundamentals: thermodynamics of nonreacting and chemical equilibrium ideal gases. Standard nozzle design; ideal rocket performance parameters; rocket heat transfer; scaling of propellant rocket engines; nozzle geometry; introduction to solid propellant rockets. Prereq.: Consent of instructor.
582 Rocket Propulsion II (3) Solid propellant rocket performance, homogeneous and heterogeneous propellant chemistry and combustion, system performance, thermal design, and gas-phase reaction models; effect of chamber pressure and additives on solid propellant burn rates, erosive burning; analysis of two-phase solid rocket exhaust flow. Introduction to nuclear and electric propulsion, electrical resistance and magnetic and electric field (ion) engine performance, magnetohydrodynamic thrusters, traveling wave thrusters; exotic propulsion systems.

Pre rect: Consent of instructor.

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


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

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

610 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer: natural convection, multiphase flow, high-speed reacting and nonreacting flows; advanced boundary layer techniques, combustion, perturbation and variational methods of analyses, heat exchange theory and design. May be repeated. Maximum 9 hrs. Pre rect: Consent of instructor.

611 Advanced Convection Heat Transfer, Fluid Mechanics and Mass Transfer (3) Stagnation point and high speed viscous boundary layer flows; problems in heat transfer at high supercritical and hypersonic speeds; laminar and turbulent boundary layer heat transfer with surface melting, ablation, sublimation; effects of gas species recombination; stagnation point heat transfer, Lennard-Jones integral and nonintegrable boundary layers; heat flux scaling rules; mass transfer and radiation cooling techniques. Pre rect: 512 and consent of instructor.


624 Advanced Topics in Thermodynamics (3) Comparison of macroscopic thermodynamic approaches: equilibrium of pure substances, metastable states, nonequilibrium thermodynamics. Pre rect: Consent of instructor.


**Mechanical and Aerospace Engineering and Engineering Science**

**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 the student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E


560-61 Advanced Topics in Computational Fluid Dynamics (3,3) Approximation theory; analysis of accuracy, convergence, and efficiency; numericallinear algebra procedures. Extension to three-dimensional, compressible viscous and inviscid flows; potential, Euler and complete Navier-Stokes descriptions; mixed subsonic-supersonic flows. Algorithm constructions: finite difference, finite element, approximate factorization, flux vector splitting, finite volume, generalized coordinate and adaptive grids; steady flows including second-order turbulence closure. Thin layer and parabolic Navier-Stokes equations, reports on current research at UTK and UC. May be repeated. S/NC only.

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

576 Measurement Science I (3) (Same as Nuclear Engineering 588.)

578 Measurement Science II (3) (Same as Nuclear Engineering 588.)

581 Seminar (1) All phases of mechanical and aerospace engineering and engineering science, reports on current research at UTK and UC. May be repeated. S/NC only.

589-90 Selected Engineering Problems (2-6) Enrollment limited to students in problems programs. Pre rect: Consent of advisor. May be repeated. S/NC only.

590-91 Selected Engineering Problems (2-6) Enrollment limited to students in problems programs. Pre rect: Consent of advisor. May be repeated. S/NC only.

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

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

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

661 Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer: natural convection, multiphase flow, high-speed reacting and nonreacting flows; advanced boundary layer techniques, combustion, perturbation and variational methods of analyses, heat exchange theory and design. May be repeated. Maximum 9 hrs. Pre rect: Consent of instructor.


**Microbiology**

See College of Veterinary Medicine and Comparative and Experimental Medicine

**Metallurgical Engineering**

See Materials Science and Engineering

**Microbiology**

See College of Arts and Sciences and College of Veterinary Medicine

**MAJOR DEGREES**

Microbiology ........................................... M.S., Ph.D.

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

Robert Moore, Head

Professors:

Beck, Raymond W. (Emeritus), Ph.D. Wisconsin

Becker, Jeffrey M., Ph.D. ......................... Cincinnati

Brian, D. A., Ph.D., D.V.M. ...................... Michigan State

Monte, T. C., Ph.D. ................................. Maryland

matrix iteration techniques. Applications in beams, plates and shells; use of representative computer models to predict structural behavior; solid mechanics, applied mechanics, computer simulation; finite differences, finite elements, boundary element method; structural mechanics and vibrational behavior of structural systems; experimental mechanics, experimental stress analysis, and advanced computer techniques; instructional training and development.

558 Measurement Science I (3) (Same as Nuclear Engineering 588.)

559 Measurement Science II (3) (Same as Nuclear Engineering 588.)

560-61 Advanced Topics in Computational Fluid Dynamics (3,3) Approximation theory; analysis of accuracy, convergence, and efficiency; numericallinear algebra procedures. Extension to three-dimensional, compressible viscous and inviscid flows; potential, Euler and complete Navier-Stokes descriptions; mixed subsonic-supersonic flows. Algorithm constructions: finite difference, finite element, approximate factorization, flux vector splitting, finite volume, generalized coordinate and adaptive grids; steady flows including second-order turbulence closure. Thin layer and parabolic Navier-Stokes equations, reports on current research at UTK and UC. May be repeated. S/NC only.

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

576 Measurement Science I (3) (Same as Nuclear Engineering 588.)

578 Measurement Science II (3) (Same as Nuclear Engineering 588.)

581 Seminar (1) All phases of mechanical and aerospace engineering and engineering science, reports on current research at UTK and UC. May be repeated. S/NC only.

589-90 Selected Engineering Problems (2-6) Enrollment limited to students in problems programs. Pre rect: Consent of advisor. May be repeated. S/NC only.

590-91 Selected Engineering Problems (2-6) Enrollment limited to students in problems programs. Pre rect: Consent of advisor. May be repeated. S/NC only.

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

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

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

661 Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer: natural convection, multiphase flow, high-speed reacting and nonreacting flows; advanced boundary layer techniques, combustion, perturbation and variational methods of analyses, heat exchange theory and design. May be repeated. Maximum 9 hrs. Pre rect: Consent of instructor.

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 allied fields, to teach both oral and written communication of the results of research to the scientific community, and to train effective teachers. Students may enter the program after receiving either a bachelor's or master's degree. Students who enter with a bachelor's degree usually 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 attempted before the end of the fifth semester in the program and 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
420 Medical Microbiology (3) Disease-producing microorganisms, including bacteria, fungi, and viruses. Prereq: Introduction to Microbiology. Sp
423 Medical Microbiology Laboratory (2) Laboratory exercises in medically important areas of microbiology: microorganisms, pathogenesis and immunology. Prereq: Introduction to Microbiology Lab. 430. Coreq: 420. Sp
430 Immunology (3) Principles of inflammation and immunity; immunoglobulin structure and theories of formation and diversity; complement, hypersensitivities, cell cooperation and recognition in immune mechanisms, soluble factors. Prereq: General Genetics. F
470 Microbial Ecology (3) Physiological diversity and taxonomy of microorganisms from natural environments. Functional role of microorganisms in natural and simulated ecosystems. Prereq: 310. 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/N only. E
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 Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
593 Independent Study (1-15) See College of Arts and Sciences.

595 General Seminar (1) Lectures and seminars by invited speakers, faculty, and graduate students. May be repeated. Maximum 18 hrs. S/N only. E
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/N only. E
601 Journal Club in Microbial Physiology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/N only. E
602 Journal Club in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/N only. E
603 Journal Club in Immunology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/N only. E
604 Journal Club in Virology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/N only. E
605 Journal Club in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/N only. E
610 Topics in Microbial Physiology (1-3) Prereq: 410 or consent of instructor. May be repeated. Maximum 12 hrs.
620 Topics in Microbial Pathogenesis (1-3) Prereq: 420, 430 or consent of instructor. May be repeated. Maximum 12 hrs.
630 Topics in Immunology (1-3) Prereq: 430 or consent of instructor. May be repeated. Maximum 12 hrs.
640 Topics in Virology (1-3) Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hrs.
550 Topics in Microbial and Molecular Genetics (1-3) Prereq: 411 or consent of instructor. May be repeated. Maximum 12 hrs.
670 Advanced Topics in Environmental Microbiology (1-3) Prereq: 570 or consent of instructor. May be repeated. Maximum 12 hrs.

Microbiology-Veterinary Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Music

(College of Arts and Sciences)

MAJOR

DOCTORS

Music ......................................................... M.M.

Dolly Davis, Acting Head

Professors:
Ball, Charles H. (Emeritus), Ph.D. ......... Peabody
Bilazza, George C., M.M. ....................... Converse
Brock, John P. (Liaison), M.M ..................... Alabama
Carter, W. J. (Emeritus), D.M.A. ............... Eastman
Cocker, J., M.A. ........................................ Sam Houston
Combs, F. M., M.A. ...................................... Missouri
DeVine, George F. (Emeritus), Diploma ......... Shurz
Dom, W. (Emeritus), M.A. .......................... Columbia
Fred, Herbert W. (Emeritus), Ph.D. .................. North Carolina
Holford, A. G. (Emeritus), M.M. ................. Northwestern
Applicants for admission to the Master's Program in Music at the beginning of each semester are required to take the Diagnostic Examinations in music theory, ear-training, and sacred music. These examinations are given by the Department of Music at the beginning of each semester.

The concentration in Music Education is designed for persons who hold a Bachelor's degree in 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.

A three-credit research problem and three extra hours of 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.

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 core 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 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 S; 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.

Music General

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 Foundational Studies in 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 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.
560 Psychology of Music Teaching (3) Research on musical perception and cognition and its application to teaching of music. Definition and measurement of musical ability. Prereq: Course in general psychology and 1 yr of music theory or consent of instructor.
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.
589 Accompanying (1) May be repeated. Maximum 6 hrs.
Music Instrumental

GRADUATE COURSES

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

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

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

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

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

490 Church Music Methods and Administration (3)

510 Music Bibliography (3) Bibliographic methodology in music.

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, chansons, 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 projects.

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

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.

420 Seminar in Jazz (3) Topic varies.

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)

406 Oboe (1-4)

410 Bassoon (1-4)

415 Clarinet (1-4)

420 Saxophone (1-4)

425 Trumpet (1-4)

430 Trombone (1-4)

435 Baritone (1-4)

440 Guitar (1-4)

445 Ukulele (1-4)

450 Viola (1-4)

455 Violin (1-4)

460 Harpsichord (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)

494 Composition (1-3)

495 Composition with Electronic Media (1-3)

496 Composition for Media (2)

499 Improvisation (1-2) May not be used toward applied music requirement.

503 Flute (1-4)

505 Oboe (1-4)

510 Bassoon (1-4)

515 Clarinet (1-4)

520 Saxophone (1-4)

525 Horn (1-4)

530 Trumpet (1-4)

535 Trombone (1-4)

540 Baritone (1-4)

545 Tuba (1-4)

550 Percussion (1-4)

551 Accompanying and Coaching (1-4)

555 Voice (1-4)

560 Violin (1-4)

565 Viola (1-4)

570 Cello (1-4)

575 String Bass (1-4)

576 Electric Bass (1-4)

579 Guitar (1-4)

580 Piano (1-4)

585 Harpsichord (1-4)

586 Organ (1-4)

584 Composition (1-3)

595 Composition with Electronic Media (1-3)

599 Improvisation (1-4)

Music Theory

GRADUATE COURSES

430-40 Counterpoint I (3,3) 430--Study of species counterpoint in modal and tonal styles, works of Palestrina and J.S. Bach. Prereq: 220. 440--Writing of contrapuntal forms of 18th century and fugue; analysis of works from 18th through 20th centuries. Prereq: 430.

450 Choral Arranging (2) Analysis of scores and writing of arrangements for choirs. 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 Arts and Sciences. Prereq: Consent of department head.

Music Voice

GRADUATE COURSES

425 Functional Diction for Singers (3) Comprehensive survey of singing diction in six languages: English,
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 radiological engineering concentration at the master's level. The radiological engineering concentration prepares students for careers in the radiation safety field (health physics). The program is designed for students with a background 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 for undergraduate credit. The department head is the contact for all interested students, both those with nuclear engineering degrees and those from other disciplines.

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 project or engineering practice projects as described below:

Thesis - The student performs independent research on a topic approved by the graduate committee. He/she submits a thesis on the research for oral examination 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 project reports and all graduate coursework. The student must enroll for six semester hours of NE 596 (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.
2. A minimum of 24 semester hours in doctoral research, NE 600.
3. A minimum of 30 semester hours in nuclear engineering courses numbered 500 and above (or the equivalent), with at least 6 semester hours of 600-level courses.
4. A minimum of 12 semester hours in mathematics, computer science, or statistics courses beyond nuclear engineering undergraduate requirements numbered 400 or above.
5. A minimum of 6 semester hours in courses numbered 500 or above from a department other than nuclear engineering. The choice depends on the student's overall program and should expand his/her knowledge in a given field.

A reading knowledge of one foreign language may be specified by the student's doctoral committee.

The comprehensive examination is prepared by the nuclear engineering faculty and consists of 12 hours of written examinations. All examinations are taken in the library, and students are encouraged to review them.

Students are invited to take the comprehensive examination after completing approximately 30 semester hours of coursework. A student who fails the written part of the examination must take and pass the examination the next time it is offered to remain in the Ph.D. program.

Registration for NE 600 is not permitted until the written examination is passed. The comprehensive examination is completed with a successful oral defense of the dissertation proposal.

A candidate must successfully defend, in an oral examination, all work presented for the degree—all coursework and the dissertation.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

400-level courses in nuclear engineering may be used for graduate credit. However, students must recognize that at least two-thirds of the minimum requirements of the master's degree program must be taken in courses numbered 500 or above.

GRADUATE COURSES

403 Nuclear Engineering Laboratory (3) Cross-section measurement, diffusion properties of neutrons, criticality evaluation, control rod calibration, statistical weight, shielding, xenon poisoning, dynamics and control of experiments. Prereq: Nuclear Engineering Laboratory or equivalent. Coreq: 471, 405.


406 Reactor Dynamics, Control and Safety (3) Reactor models, transient analysis, safety analysis, control systems and safety systems. Prereq: 470.

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.
Nursing

(College of Nursing)

MAJOR

DEGREE

Nursing........................................ M.S.N., Ph.D.
Joan L. Creasia, Dean
Sandra Thomas, Director of Ph.D. Program
Martha Alligood, Director of M.S.N Program

Professors:
Alligood, Martha R., Ph.D., New York
Creasia, Joan L., Ph.D., Maryland
Droppleman, Patricia G., Ph.D., Tennessee
Farr, Glen, Pharm.D., Delaware
Goodfellow, Dale H., Ph.D., Pennsylvania
Mozingo, Johnie N., Ph.D., Waiden
Pierce, Joan U., Ph.D., Utah
Savoir, Carol E., Ed.D., Massachusetts
Thomas, Sandra P., M.D., Ph.D., Tennessee

Associate Professors:
Bowen, Sheila, Ph.D., Tennessee
Davis, Mitzi, Ph.D., Tennessee
Dyer, Theresa, Ed.D., Tennessee
Fenske, Mildred L., Ph.D., Vanderbilt
McGuire, Sandra, Ed.D., Tennessee
Modrin-McCarthy, Mary Anne, Ph.D., Tennessee
Smith, Helen, Ph.D., Maryland
Tuck, Inez, Ph.D., North Carolina (Greensboro)
Wallace, Debra C., Ph.D., South Carolina

Assistant Professors:
Brown, Allie J., M.S.N., Alabama (Birmingham)
Conlon, Kathleen P., M.S.N., SUNY (Buffalo)
Evans, Ginger W., M.S.N., Tennessee
Evans, Maude M., M.S.N., Tennessee
Fox, Marie X., M.S.N., Tennessee
Heiton, Sally M., M.S.N., Texas Women's
Kollar, Mary, Ph.D., Tennessee
Pierce, Margaret, M.S.N., Tennessee
Pullen, Lisa, Ph.D., Mississippi

THE MASTER'S PROGRAM

The College of Nursing offers the Master of Science in Nursing degree with concentrations in adult health nursing, family nurse practitioner, mental health nursing, nursing administration, and nursing of women and children. The program is accredited by the National League for Nursing and is unconditionally approved by the Tennessee Board of Nursing.

The purpose of the Master's program in nursing is to prepare leaders, managers, and practitioners who facilitate clients' achievement of optimal health in the dynamic health care system. The program prepares advanced practice nurses with role preparation as nurse practitioners, clinical nurse specialists or nursing administrators. Advanced practice nursing involves the delivery of care, management of
resources, interdisciplinary collaboration, and application of technology, information systems, knowledge, and critical thinking.

**Admission Requirements**

1. Meet requirements for admission to The Graduate School.
2. Hold a Bachelor's degree in Nursing from a National League for Nursing accredited program or complete the equivalent of an upper division undergraduate major in nursing in addition to meeting all M.S.N. degree requirements.
3. Have an undergraduate GPA of 3.0 or higher or a GPA of 3.3 for courses in the undergraduate major.
4. Submit scores of the general portion of the Graduate Record Examination.
5. Submit Graduate Program Data Form.
6. Submit Graduate School Rating Forms from three individuals familiar with the applicant's current work performance or academic aptitude.
7. New students normally are admitted to the program only at the beginning of fall semester. However, under special circumstances and on a space available basis, a B.S.N. graduate may be admitted at the beginning of spring or summer terms in a temporary non-degree status. Applications for fall admission must be received by February 1.

**Special Requirements**

1. Each student must hold personal professional liability insurance.
2. Registered nurses must be licensed to practice nursing in Tennessee.
3. Each student must present proof of hepatitis B vaccination and rubella and rubeola immunization or sufficient titer for immunity; TB status.
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 semester 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 Project or 582 Supervised Research.

**Program Requirements**

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

<table>
<thead>
<tr>
<th>Core (12 credits)</th>
<th>503-04 Advanced Clinical Reasoning I, II</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>510 Theoretical Foundations of Nursing</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>520 Advanced Practice Nursing and Health Delivery Systems</td>
<td>3</td>
</tr>
<tr>
<td>Research (9-12 credits)</td>
<td>501 Graduate level statistics course</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>501 Nursing Research: Methods, Design &amp; Analysis</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>500 Thesis</td>
<td>6</td>
</tr>
<tr>
<td>OR</td>
<td>580 Nursing Project</td>
<td>3</td>
</tr>
<tr>
<td>OR</td>
<td>582 Supervised Research</td>
<td>3</td>
</tr>
<tr>
<td>Concentration (12-17 credits)</td>
<td>choose one [530-31 Adult Health Nursing I, II]</td>
<td>12</td>
</tr>
</tbody>
</table>

**Elective (3 credits)—waived for those who choose the thesis option except the family nurse practitioner concentration who take 505 and 515 and for nursing of women and children concentration who are required to take 505 and recommended to take 515.

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

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>301 Clinical Pharmacology</td>
<td>3</td>
</tr>
<tr>
<td>302 Introduction to Professional Nursing</td>
<td>5</td>
</tr>
<tr>
<td>304 Nursing Assessment and Health Promotion</td>
<td>3</td>
</tr>
<tr>
<td>306 Health Deviation Concepts I</td>
<td>3</td>
</tr>
<tr>
<td>316 Health Deviation Concepts II</td>
<td>4</td>
</tr>
<tr>
<td>330 Nursing of Adults</td>
<td>6</td>
</tr>
<tr>
<td>415 Community/Systems Health Nursing</td>
<td>6</td>
</tr>
<tr>
<td>416 Family/Community Health Nursing</td>
<td>6</td>
</tr>
<tr>
<td>434 Nursing of Children</td>
<td>4</td>
</tr>
</tbody>
</table>

Registered nurses whose bachelor's degrees are not in nursing must have completed courses in chemistry, nutrition, microbiology, anatomy, and physiology plus 12 hours of behavioral science courses. They must also complete 305, 332, 405, and 433 and complete or successfully challenge the following:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>301 Clinical Pharmacology</td>
<td>3</td>
</tr>
<tr>
<td>304 Nursing Assessment and Health Promotion</td>
<td>3</td>
</tr>
<tr>
<td>306 Health Deviation Concepts I</td>
<td>4</td>
</tr>
<tr>
<td>316 Health Deviation Concepts II</td>
<td>4</td>
</tr>
<tr>
<td>330 Nursing of Adults</td>
<td>6</td>
</tr>
<tr>
<td>401 Family Health Nursing</td>
<td>6</td>
</tr>
<tr>
<td>411 Psychosocial Long Term Nursing</td>
<td>6</td>
</tr>
<tr>
<td>431 Nursing of Children</td>
<td>4</td>
</tr>
</tbody>
</table>

A total of 16-18 credits can be obtained by successful completion of the NLN Nursing Mobility Profile Examination. See undergraduate catalog for other challenge options. RNs who are in the process of completing a BSN at UT with the intent of enrolling in the MSN program follow the same plan with the addition of 313.

**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 other written 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 "D" or "F" for the course.
2. If a student achieves a final grade of "D" or "F" for any required undergraduate or graduate nursing course, he or she will not be permitted to repeat the course and will be required to withdraw from the program.
3. If the clinical performance of any student is characterized by unethical, unprofessional or unsafe behavior, or behavior that places the client in jeopardy, the student will be required to withdraw from the program.

**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 specialty, and/or research will be integrated into the formal program of doctoral degree requirements.
3. Have a minimum cumulative graduate grade-point average of 3.3 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 the applicant's professional work.
9. Submit a sample of scholarly writing (e.g., thesis, published paper).
10. Submit an essay describing personal and professional aspirations.
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 February 15.
*Note: A minimum of 1 hour per semester must be taken for 4 semesters.

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 student's comprehensive examination committee 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.

Special Policies
1. A maximum of 6 graduate hours taken before acceptance into the doctoral program may be applied toward the degree.
2. Minimum grades of B in all nursing doctoral courses and a 3.0 cumulative GPA are required for continuation in the program.

MINOR IN GERONTOLOGY

Graduate students in the College of Nursing may pursue a specialized minor in gerontology. This interdisciplinary/interdisciplinary minor gives the student an opportunity to combine the knowledge of 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, Arkansas, 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) P/NP only, E

501 Nursing Research: Methods, Design, and Analysis (3) Basic principles of research process in application to clinical questions, critical evaluation of research findings, and health-related research. Prereq or coreq: 510, graduate level statistics. F, Sp

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student intends to use 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 Advanced Clinical Reasoning I (3) Principles of health promotion, education, and innovative strategies for achievement of wellness: health habits, psychological (cultural), and other dimensions of whole person as related to risk for health problems. Prereq: 301 or equivalent or consent of instructor. F

504 Advanced Clinical Reasoning II (3) Development of advanced clinical reasoning skills for assessment of client health status and needs: physiological and pathological concepts as dimensions of whole person. Prerequisite for specific nursing interventions. Prereq or coreq: 503. F

505 Advanced Clinical Pharmacology (3) Pharmacological agents utilized to treat common, recurrent health problems; indications, contraindications, side and interaction effects of selected drugs. Prereq: 301 or equivalent or consent of instructor. F

509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Exercise Science 509, Nutrition 509, and Social Work 509.)

510 Theoretical Foundations of Nursing (3) Historical evolution of nursing science; nursing's metaphors and selected philosophies, conceptual models and theories as structures which guide critical thinking in analysis, reasoning, and decision making for advanced practice nurse. F

515 Advanced Pathophysiology for Nursing Practice (3) Advanced physiologic and pathophysiologic concepts, principles, and theories applied to deviations of human systems. Sp

520 Advanced Practice Nursing and Health Delivery Systems (3) Nursing's role in dynamic health care system: health policy and organizational, social, ethical, political, economic and technological factors which impact advanced practice nursing and delivery of health care. Prereq: 504. Coreq: First course in concentration. Sp

530 Adult Health Nursing I (6) Advanced nursing practice for health promotion, restoration, and maintenance of young, middle-aged, and older adults. Prerequisites and research to advanced practice with individual clients in variety of settings. Prereq: 504. Prereq or coreq: 501. Coreq: 520. Didactic (2) and practicum (4). Sp

531 Adult Health Nursing II (6) Continuation of 530. Delivery of care for acute, chronic, and episodic illness. Prereq: 530. Didactic (2) and practicum (4). F

540 Family Nurse Practitioner I (4) Application of advanced health/physical assessment and diagnostic reasoning in nursing management and primary care and of individuals and their families with actual and potential acute health problems; clinical experience in role of family nurse practitioner in variety of settings. Prereq: 504, 515, Coreq: 520. Didactic (2) and practicum (2). Sp

541 Family Nurse Practitioner II (6) Continuation of 540. Nursing management and primary care of individuals and their families in all developmental life stages; clinical experience in variety of settings. Prereq: 540, 504 or coreq: 501. Coreq: 520. Didactic (2) and practicum (4). F

542 Family Nurse Practitioner III (7) Continuation of 541. Nursing management of chronic health problems of individuals and families in all developmental life stages; role related to family dynamics in the role of family nurse practitioner; clinical experience in variety of settings. Prereq: 541. Didactic (2) and practicum (5). Sp

543 Nurse Practitioner I (9) Exploration and application of holistic nursing concepts to nursing management of common and chronic health problems. Role refinement and exploration of major issues in delivery of holistic primary nursing care. Clinical experiences vary depending on student's interest in pursuing certification as family or adult nurse practitioner. Prereq: MSN in clinical concentration, S/NC or equivalent, and consent of instructor. 3hrs and 6 labs. Sp

550 Nursing of Women and Children I (6) Advanced practice nursing for women and children; clinical experiences in role of nurse practitioner for women and children. Specialization in a variety of settings. Health promotion and nursing interventions for actual or potential health problems of women, children, and families. Prereq: 504. Prereq or coreq: 501. Coreq: 520. Didactic (2) and practicum (4). Sp


552 Parent Child Nursing Field Work and Seminar (5) Seminar and intensive clinical practicum designed to facilitate further development of student's knowledge and skills utilized for advanced parent-child nursing practice. Prereq or coreq: 551. 1 hr and 4 labs. Sp

557 Nurse Midwifery Seminar I (1) Exploration of art and science of midwifery, nature and scope of midwifery practice, professional and ethical issues in advanced practice. Prereq or coreq: 500, 510. F

558 Nurse Midwifery Seminar II (1) Exploration of psychological, developmental, and sociocultural theories as related to individual and family patterns of illness and adaptation. Role of nurse practicing advanced practice promoting optimal wellness within clients and community. Prereq: 501, 510, 570. Coreq: 520. Sp

559 Nurse Midwifery Seminar III (1) Exploration of state of science in nurse midwifery, innovative practice options and related researchable problems for nurse-midwifery practice. Prereq: 570, 571, Coreq: 500, 580 or 582. F

560 Mental Health Nursing I (6) Theories of advanced therapeutic interventions for clients experiencing actual and potential mental health problems; advanced practice nursing in specialty of mental health; clinical practice with clients of various ages in acute care and community settings. Prereq: 504. Prereq or coreq: 501, 505. Coreq: 520. Didactic (2) and practicum (4). Sp

561 Mental Health Nursing II (6) Continuation of 560. Advanced practice nursing in community settings for families and groups with actual and potential mental health problems. Prereq: 560. Didactic (2) and practicum (4). F

565 Teaching Practicum (1-6) Independently designed teaching experience in collegiate nursing program or nursing practice setting. Objectives to be developed collaboratively by student and faculty. Prereq or coreq: 504 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. Role of theories as applied to instruction and learning strategies of graduate nursing students, staff development, and patient education. Prereq: Consent of instructor. Su

577 Special Topics (1-3) Topic is determined by faculty and student interest. Prereq or coreq: Consent of instructor. May be repeated. Maximum 6 hrs. E

580 Nursing Project (3) Student-initiated scholarly project with faculty supervision. Review and critical evaluation of literature in specified area of advanced practice nursing. Culminating in a scholarly paper. Prereq or coreq: Consent of instructor, first course in concentration. S/NC or letter grade. F

582 Supervised Research (3) Supervised research culminating in scholarly paper. Experiential learning of research process. Participation in on-going faculty research project by completion of a specified portion of the project under faculty guidance. Prereq: Consent of instructor, 501, 510. Maximum 6 hrs. E

583 Directed Clinical Practice (1-9) Additional opportunities for advanced practice nurse practitioner. Objectives to be developed collaboratively by student and faculty. Prereq: Enrollment in or completion of graduate level courses in clinical nursing. Maximum 9 hrs. S/NC or letter grade. E

585 Seminar in Gerontology (1) (Same as Human Ecology 585, Counseling Education and Counseling Psychology 585, Exercise Science 585, Public Health 585,