585 Issues in Invention, Style, and Audience (3) Theoretical perspectives on contemporary research in rhetoric and composition.

586 History of Rhetoric I (3) Survey of rhetoric from Sophists to Rhetoric.

587 History of Rhetoric II (3) Survey of rhetoric from Bacon to present.

588 Readings in Applied Rhetoric (3) Content varies: Writing across curriculum, writing centers, technical communication, writing and linguistics. May be repeated. Maximum 6 hrs.

590 Topics in Critical Theory (3) Topics vary. 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.

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

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

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

611 Studies in Beowulf (3) Translation and critical study of Beowulf. Prereq: English 610 or consent of instructor. Sp.A.

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


630-31 Studies in Renaissance Literature (3,3) Seminar topics vary: particular literary figures or genres, theme, or other coherent focus. May be repeated. Maximum 9 hrs.

640-41 Studies in Restoration and Eighteenth-Century Literature (3,3) Seminar topics vary: particular literary figures or genres, theme, or other coherent focus. May be repeated. Maximum 9 hrs.

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

651-52 Studies in Victorian Literature (3,3) Seminar content varies: particular literary figure or genres, theme, or other coherent focus. May be repeated. Maximum 9 hrs.


670-71-72 Studies in Twentieth-Century Literature (3,3,3) Seminar content varies: particular literary figure or genres, theme, or other coherent focus. May be repeated. Maximum 9 hrs.

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

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

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


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

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

Entomology and Plant Pathology

(College of Agricultural Sciences and Natural Resources)

MAJOR DEGREE

Entomology and Plant Pathology ......... M.S.

Charles D. Pless, Acting Head

Professors:

Bernard, Ernest C., Ph.D. ............ Georgia Gerhardt, Reid R. (Liaison), Ph.D. ........ NC State Hilty, James W. (Emeritus), Ph.D. ........ Old State Johnson, Leander F. (Emeritus), Ph.D. ........ Louisiana State Lambdin, Paris L., Ph.D. ............. VPI Pless, Charles D., Ph.D. ............. Clemson

Associate Professors:

Grant, Jerome F., Ph.D. ............. Clemson Gwinn, Kimberly D., Ph.D. ........ NC State Reddick, Bradford B., Ph.D. ........ NC State Windham, Mark T., Ph.D. ............. Clemson

Assistant Professor:

Owley, Bonnie H., Ph.D. ............. NC State

The Department of Entomology and Plant Pathology offers a graduate program leading to the Master of Science with a concentration in entomology or plant pathology. Students in entomology may specialize in crop entomology, medical and veterinary entomology, insect biology, insect pest management, or biological control. Students in plant pathology may specialize in soil-borne, fungal, and viral diseases, disease physiology, biocontrol, plant pathology, and virology. For specific information, contact the department head.

THE MASTER'S PROGRAM

Admission Requirements

For admission to the M.S. degree program, a student must meet all requirements of The University of Tennessee Graduate School and have completed (1) a general botany or biology, 8 hours; (2) advanced biological sciences, 8 hours; (3) general inorganic chemistry, 6-8 hours; (4) organic chemistry, 3 hours. In addition, three completed rating forms and a written statement of career goals and interest in entomology or plant pathology are required.

Degree Requirements

The program requires a written thesis based on original research and the completion of a minimum of 24 hours of coursework for graduate credit, approved by the student's advisory committee. Included in the course requirements are two acceptable seminar presentations for 1 hour each. An oral final exam must be passed to the satisfaction of the advisory committee after the thesis has been completed. A minor is not required but may be selected at the option of the student. The minor will include at least 6 hours and not more than 10 hours of graduate-level credit in the minor department. The student's committee shall include a member of the faculty from the minor department to assist in designing courses required for the minor.

GRADUATE COURSES

410 Diseases and Insects of Ornamental Plants (3) Symptoms, identification and management of diseases and insects that affect plants in greenhouse, nursery, and landscape environments. Prereq: Plant Pathology or Economic Entomology or consent of instructor. Sp.A

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

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

510 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant pathogenic fungi. Isolation and identification of pathogenic fungi. Prereq: 315 or consent of instructor. 2 hrs and 2 labs. (Same as Ornamental Horticulture and Landscape Design 511.) F.A

512 Soilborne Plant Pathogens (3) Causal agents; host-parasite-soil environment interactions; epidemiology; and control. Prereq: Plant Pathology or consent of instructor. F.A

514 Bacterial Plant Diseases (4) Morphology, taxonomy, ecology, physiology, and genetics of bacterial plant pathogens; infection and disease development, resistance and management, diagnosis, detection, and control of bacterial plant diseases; beneficial and detrimental interactions. Prereq: Plant Pathology or consent of instructor. 3 hrs and 1 lab. Sp.A

515 Physiology of Plant Disease (3) Biochemical and physiological events involved in host-pathogen interactions. Mechanisms of disease resistance. Prereq: Introductory plant physiology and pathology, or consent of instructor. F.A

520 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships. Prereq: 6 hrs biological science or consent of instructor. 2 hrs and 2 labs. Sp.A

521 Plant Virology (3) Symptomatology, epidemiology, and management of virus infection; structure, morphology, replication, transmission, purification, characterization, and classification of plant viruses; vector biology, plant pathogens, viroids, mycoplasmas, and spiroplasmas. Prereq: 313 or consent of instructor. 2 hrs and 1 lab. Sp.A

523 Field Crop and Vegetable Insects (2) Identification, biology, and management of insects affecting commercial vegetable and home garden crops. Prereq: 321 or basic entomology course. 1 hr and 1 lab. F.A

525 Medical and Veterinary Entomology (3) Morphology, taxonomy, biology, and control of arthropod parasites and vectors of pathogens of humans and animals. Prereq: Entomology and Epidemiology of vectors in relation to pathogen transmission and control. Prereq: 321 or 325, or consent of instructor. 2 hrs and 1 lab. Sp.A

530 Integrated Pest Management (3) Principles and application of biological, cultural, genetic, behavioral, and chemical methods of control to prevent populations below economic threshold levels. Prereq: 321, or consent of instructor. (Same as Plant and Soil Science 530.) F.A

531 Special Problems in Entomology (1-3) Comprehensive individual study of current problems. May be repeated. Maximum 6 hrs. E

532 Special Problems in Plant Pathology (1-4) Comprehensive individual study of current problems. May be repeated. Maximum 6 hrs. E

533 Concentrated Study in Entomology (1-3) Selected subjects in entomology for advanced students, concentrated in time and subject matter. Prereq: 321 or basic
Environmental Engineering

See Civil Engineering

Exercise Science

(College of Education)

MAJORS DEGREES

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

W. Liemohn, Leader

Assistantships:

Capon, Edward K. (Emeritus), Ph.D. ...... Iowa
Howley, Edward T., Ph.D. ............... Wisconsin
Kozer, Andrew J. (University Prof.), Ph.D. Michigan
Liemohn, W. P., Ph.D. ...................... Washington (St. Louis)
Namey, T. C., M.D. ......................... Brown
Rockett, Ian R., Ph.D. ..................... Florida

Assistant Professor:
Bassett, David R., Jr., Ph.D. ............... Wisconsin

Assistant Professors:
Thompson, Dixie, Ph.D. .................... Virginia
Zhang, Songlin, Ph.D. ....................... Oregon

The Exercise Science unit participates in graduate programs leading to degrees, majors, and concentrations in:

Master of Science

Human Performance and Sport Studies

Exercise science

Doctor of Philosophy

Education

Exercise science

See Education under Fields of Instruction for full description of all degree requirements.

The unit promotes and integrates scientific approaches for preventing or controlling occurrence of injury and violence in both general population and high-risk sub-populations.

Department of Education

Human Performance and Sport Studies

Exercise science

Doctor of Philosophy

Education

See Education under Fields of Instruction for full description of all degree requirements.

is in addition to The Graduate School application.

The following retention policy applies to all graduate students seeking a degree in the Exercise Science unit:

1. Graduate students are required to maintain an overall 3.0 GPA.
2. Any student who falls below this standard will be advised in writing by the unit leader of the need to discuss the matter with his/her advisor.
3. If a student's overall GPA remains below 3.0 for a second semester, the student will have his/her degree status revoked.

GRADUATE ASSISTANTS

A limited number of graduate assistantships are available for qualified women and men who are graduates of accredited colleges or universities. These assistantships are open to students in the master's and doctoral programs. Students interested in these opportunities should file their applications before February. Letters should be addressed to Graduate Assistantships Coordinator, Exercise Science Unit, The University of Tennessee, Knoxville, TN 37996-2700.

GRADUATE COURSES

430 Physiology of Exercise (3) Functions of body in muscular work: physiological aspects of fatigue, training and adaptation to environment. Prereq: Human Physiology or general physiology. 2 hrs and 1 lab. (Same as Biochemistry and Cellular and Molecular Biology 480.)

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

501 Special Project (3) Culminating experience for non-theis major. Research study suitable for publication; or practicum requiring special written work.

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. Maximum 3 hrs. S/NC only. E

508 Research in Exercise Science (3) Research for writing of thesis and institutional review board proposals; presentation of research through free communications and poster presentations; calculation and interpretation of statistics related to common research designs used in research; and use of computer software.

509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 509, Nursing 509 and Social Work 509.)


516 Therapeutic Exercise (3) Therapeutic exercise programs designed for specific pathologies: McKenzie, neutral spine, based on specific biomechanical considerations: eccentric, closed kinetic chain; and more general in nature: Feldenkrais, myofascial release.

521 Analytic Epidemiology (3) Epidemiologic strategies for evaluating research questions concerning causes, prevention and treatment of morbidity and disability. Presentation of analyses by experts working with large population-based datasets. Research process: grant writing and protocol preparation. Prereq: Course in statistics or consent of instructor.

529 Epidemiology of Injury and Violence (3) Epidemiologic methods to describe magnitude and examine etiology of unintentional and intentional injury. Alternative approaches for preventing or controlling occurrence of injury and violence in both general population and high-risk sub-populations.

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

Finance

(College of Business Administration)

MAJOR DEGREES

Business Administration .................. MBA, Ph.D.

James W. Wansley, Head

Professors:
Black, Harold A. (James F. Smith, Jr., Prof.), Ph.D. ....................... Ohio State

ASSOCIATE PROFESSORS:


BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Finance.

The curriculum offers courses for those interested in careers in corporate financial management, security analysis and investments, banking and financial institutions, and real estate.

Minimum course requirements are three courses: Finance 510 (6 hours), plus two from the following: 512, 522, 532, 551, and 581.

Ph.D. Concentration: Finance.

Minimum course requirements are finance seminars 641, 642, 651, 652.

GRADUATE COURSES

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

510 Contemporary Concepts and Methods in Finance (3) Strategic issues and broad-based valuation concepts in finance; integrative approach in investments, corporate finance, and institutions areas. Prereq: Business Administration 504 and 505 or consent of instructor.

512 Problems in Financial Management (3) Readings and cases that apply finance theory to real-world investment, financing, and asset management problems. Prereq: Business Administration 504 and 505 or consent of instructor.

522 Portfolio Analysis and Management (3) Portfolio theory and evidence of behavior of security returns with view to determining rational investment policy. Statistical analysis of risk and of return of portfolios, portfolio evaluation and revision, capital market theory, and extensions of portfolio analysis. Prereq: Business Administration 504 and 505 or consent of instructor.

532 Financial Institutions (3) Analysis of management policies of financial institutions: asset, liability, and capital management. Legal, economic, and regulatory environment and implications for management. Financial institution structure and competition and changing trends in the U.S. financial system. Prereq: Business Administration 504 and 505 or consent of instructor.

551 Financial Management of a New Enterprise (3) Financial issues associated with formation, control, and long-term planning of new enterprise. Acquisition of venture capital. Prereq: Business Administration 504 and 505 or consent of instructor.

581 Real Estate Investment and Finance (3) Financial and market analysis used to make real estate investment decisions. Effects of various financing options on rate of return on income-producing properties. Effect of various financing options on consumer's decisions to purchase.
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**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>Sensory Evaluation of Food</td>
<td>6</td>
</tr>
<tr>
<td>452</td>
<td>Dairy Foods</td>
<td>6</td>
</tr>
<tr>
<td>460</td>
<td>Meat Science</td>
<td>6</td>
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<tr>
<td>469</td>
<td>Meat Science Lab</td>
<td>6</td>
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<tr>
<td>470</td>
<td>Food Crop Products</td>
<td>6</td>
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<tr>
<td>480</td>
<td>Cereal Science and Bakery Products</td>
<td>6</td>
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<tr>
<td>495</td>
<td>Food Processing System Analysis and Evaluation</td>
<td>6</td>
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<tr>
<td>500</td>
<td>Thesis</td>
<td>6</td>
</tr>
<tr>
<td>501 Seminar</td>
<td>6</td>
<td>(1) Individual reports and discussion on topics from current literature. May be repeated. Maximum 3 hrs. F,Sp</td>
</tr>
<tr>
<td>502 Registration</td>
<td>6</td>
<td>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</td>
</tr>
<tr>
<td>503 Problems</td>
<td>6</td>
<td>In lieu of Thesis (2-3) May be repeated. S/N only. E</td>
</tr>
<tr>
<td>510 Instrumental Analysis of Food</td>
<td>6</td>
<td>Modern instrumental methods for control of food manufacturing processes. Prereq: Food Chemistry. 2 hrs and 1 lab. F</td>
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<tr>
<td>511 Color of Foods</td>
<td>6</td>
<td>(2) Chemical basis, measurements, and reactions involved in color changes in foods. Manufacture and application of materials used to modify color of foods. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. F,A</td>
</tr>
<tr>
<td>512 Flavor of Foods</td>
<td>6</td>
<td>(2) Chemical basis, measurements, and reactions involved in flavor changes in foods. Manufacture and application of materials used to modify flavor of foods. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. F,A</td>
</tr>
<tr>
<td>515 Food Carbohydrates, Proteins and Lipids</td>
<td>6</td>
<td>Advanced study of chemical and physical attributes of carbohydrates, protein, and lipid components of foods; effects of components on production and distribution of food products. Prereq: Food Chemistry or equivalent. 3 hrs and 1 lab. Sp</td>
</tr>
<tr>
<td>520</td>
<td>Food and Industrial Fermentations</td>
<td>6</td>
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<tr>
<td>521</td>
<td>Advanced Food Microbiology</td>
<td>6</td>
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<tr>
<td>540</td>
<td>Food Product Development</td>
<td>6</td>
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<tr>
<td>560 Advanced Meat Science</td>
<td>6</td>
<td>Physical and chemical changes that occur during muscle and meat processes in food industry. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. Sp,A</td>
</tr>
<tr>
<td>562 Food Oils and Fats</td>
<td>6</td>
<td>(2) Chemistry and technology of food oils/fats processing and use: oils from plants. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. Sp,A</td>
</tr>
<tr>
<td>580 Special Topics in Food Technology and Science</td>
<td>6</td>
<td>(1-3) Critical reviews of current research and production concerns of food industry. May be repeated. Maximum 9 hrs. F,Sp</td>
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<tr>
<td>593 Directed Studies</td>
<td>6</td>
<td>(3-1) Research on non-thesis topics chosen and major professor. Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 6 hrs. E</td>
</tr>
<tr>
<td>600 Doctoral Research and Dissertation</td>
<td>6</td>
<td>(3-15) P/NP only. E</td>
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<tr>
<td>601 Seminar</td>
<td>6</td>
<td>(1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hrs. F,Sp</td>
</tr>
<tr>
<td>620 Food Toxicology</td>
<td>6</td>
<td>(2) Basic and applied concepts in food toxicology: toxicological aspects of processed foods. Mode of action, metabolism and control of food toxicants in food supply. Prereq: Food Chemistry, 521, or consent of instructor. Sp,A</td>
</tr>
<tr>
<td>630 Advanced Food Processing</td>
<td>6</td>
<td>(3) Role of processing treatments in modification of food properties; texture, flavor and color characteristics. Prereq: Food Preservation, 510, 511, 512 or consent of instructor. Sp,A</td>
</tr>
</tbody>
</table>

**FORESTRY, WILDLIFE AND FISHERIES**

**DEGREES**

- MAJORS
  - MAJOR
    - Majors in Forestry and in Wildlife and Fisheries
  - MAJOR CONCENTRATIONS
    - Forest Science
    - Wildlife and Fisheries Science
    - Forest Resource Management
    - Wildlife and Fisheries Resource Management
  - MAJOR MINORS
    - Agricultural Economics
    - Wildlife and Fisheries Science
    - Wildlife and Fisheries Management
  - MAJOR OPTIONS
    - 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 must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis 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.

- NON-THESIS OPTIONS
  - Non-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 must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis 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 fall semester.
  - 4. An oral examination covering the thesis and coursework is required.
Forestry, Wildlife and Fisheries

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.
3. The committee will meet and schedule the student's program during the first semester in residence.
4. The student must take at least 3 hours of coursework in the department during each of the first two semesters.
5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 26 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 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 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-marketable products 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 or consent of instructor. F

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, site design projects; management strategies; methods of visitor and recreation site management; case studies. Week-end field trips. Prereq: Wildland Recreation or consent of instructor. 2 hrs and 1 lab. Sp

433 Wood Adhesives and Glued Wood Products (2) Theory and practice of adhesive bonding of wood; wood-adhesive interface for bonding; principles of adhesion; wood adhesives; gluing of solid wood and composite wood manufacturing practices; laboratory manufacture and testing of adhesives; adhesive bond strength; glued wood product performance; day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. F

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, planing, veneer cutting, and lumber machining; clay field trip. 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 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 Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before fee deadline. May be repeated toward degree requirements. May be repeated. S/N only. E

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identity, analyze and prepare written report. Topic and report must have approval of 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 in fall. May be repeated. Maximum 2 hrs. S/N only. F

520 Advanced Forest Tree Biology (3) Growth, reproduction, physiology of trees; forest ecology; 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 as exemplified in public agencies and private firms. Forest organization and management, regulations, financial, and operational planning tools, as applied to forest resource management. Prereq: Graduate-level forest management or consent of instructor. F, 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; tree cytology and tissue culture; use of biochemical variation; planning and conducting forest research. Prereq: Silvicultural methods and Biology 220 or consent of instructor. Sp, A

550 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development or forests and associated lands; analysis and critique of specific contemporary alternatives. Overnight field trips. Prereq: Senior level in forest recreation or consent of instructor. F, A

560 Management & Policy of Forest Resource Organization (3) Theory and application of management as applied to natural resource organizations: institutional 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 plantings and installations. Use of prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, structure, growth/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; lot sampling; Poisson sampling; regression estimators; multitag and multphase 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

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 the impact of alternative management plans on wildlife, fish, and associated plant species. Prereq: Senior standing 1 hr and 2 labs. E

525 Management of Forestry, Wildlife and Fisheries Resources (2) Current technologies and management strategies concerning use of forest, wildlife, and fisheries resources necessary for decision making and implementation. Prereq: 6 hrs 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) Current environmental problems impacting natural ecosystems: climatic change, acid deposition, air pollution, species declines, and introductions of exotic species. Management methodologies to mitigate environmental problems. Overnight field trips. Prereq: 416 or equivalent or consent of instructor. 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, forest, farmland, wildland wildlife habitat management, identification of wildlife field sign, wildlife capturing techniques and management plan preparation. Weekend field trip. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

442 Fisheries Techniques (2) Active and passive sampling techniques for fish and aquatic organisms, population estimation methods, fish handling and transport, food habits analysis, marking and tagging techniques, age determination and incremental growth analysis, stream assessment equipment and instrument calibration, and maintenance; safety in sampling methods. Weekend field trip. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

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. Sp

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

445 Ecology and Management of Wild Birds (3) Biological and ecological characteristics of game birds, endangered birds, and bird pests. Current principles and practices of wild bird management. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 2 hrs and 1 lab. Sp

490 Ethics in Wildlife and Fisheries Management (1) Ethical bases for decision-making and application of methodologies in practice of wildlife and fisheries management. Seminars by ethics in wildlife and fisheries scientists and managers, and foresters to acquaint students with diverse perspective of ethical behavior in wildlife and fisheries management.
practices of wildlife and fisheries management. Lectures, panel discussions, and case studies. Team taught. Prereq: Senior standing. Sp

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

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

512 Seminar in Wildlife and Fisheries Science (1) Current developments in wildlife and fisheries science. Required of all graduate students in residence in fall. May be repeated. Maximum 5 hrs. SNC only. F

520 Planning and Administration of Fisheries and Wildlife Programs (2) Factors influencing policy and program planning 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: 1st yr biology, 444 or 445, or consent of instructor. (Same as Comparative and Experimental Medicine - Veterinary Medicine 590). F

540 Predator Ecology (2) Dynamics of terrestrial vertebrate predator populations in human-altered and relatively unaltered environments. Prereq: 444 or 445 or consent of instructor. F, A

545 Population and Habitat Analysis (2) Detail characteristics, assumptions, and current technologies for fish and wildlife population analysis. Technologies, methodology and goals for wildlife habitat analysis. Use of computers. Prereq: Advanced 571 or Statistics 502 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

556 Recirculating Aquaculture (3) Growing fish in intensive, indoor systems with recirculated water. Techniques of solids removal, nitrification, and gas balances. Practical experience with operating system. Prereq: 443 or consent of instructor. 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 8 hrs. E

French
See Romance Languages

Geography
(College of Arts and Sciences)

MAJOR

DEGREES

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

Carol Harden, Head

Professors:
Aiken, Charles S., Ph.D. .......... Georgia
Bell, Thomas L., Ph.D. .......... Iowa
Foresia, Ronald, Ph.D. .......... Rutgers

Hammond, E. H. (Emeritus), Ph.D. .......... California
Jumper, Sidney R. (Liaison), Ph.D. .......... Tennessee
Long, Robert G. (Emeritus), Ph.D. .......... Northwestern
Minkel, C. W., Ph.D. .......... Syracuse
Paludan, C. T. (UTS), Ph.D. .......... Denver
Pusapher, Lynda, Ph.D. .......... Southern Illinois
Ralskin, Bruce, Ph.D. .......... Northwestern
Schmidtle, 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:
Bryan, Deborah (Visiting). Ph.D. .......... Ohio State
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 backgrounds in mathematics and computer science. The doctoral program is for those who have demonstrated proficiency in conducting independent research. The department is particularly well-equipped 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 a sound 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) 501. 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 hrs. of 600-level seminars, and (at each offering during residency) 501. A minimum of 9 hrs. 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 geographic data; analytical and cartographic data structures. Prereq: 310 and knowledge of language or consent of instructor. 2 hrs. and 1-2 hrs. lab.

412 Advanced Cartography Techniques (3) Cartographic design and display techniques for reference and thematic maps. Basic principles and methods of map reproduction. Prereq: Introduction to Maps, Aerial Photographs, and Cartography or consent of instructor. 2 hrs and 2 labs.

413 Remote Sensing: Types and Applications (3) Principles and uses of remote sensing in digital data, and spectral data; geographic interpretation and mapping techniques. Prereq: 310 or consent of instructor.

415 Quantitative Methods in Geography (3) Geographic application of statistical techniques, point pattern analysis and analysis of areal units. Basic probability and statistical techniques. Prereq: Mathematics 150 or two semesters of calculus or consent of instructor.

421 Geography of Folk Societies (3) Geographical study of folk culture, traditional material culture and rural settlement, examples from eastern North America and selected foreign areas. Prereq: 101-02 or 320 or consent of instructor.

425 Historical Geography of the United States (3) Survey of changing human geography of United States during four centuries of settlement and development. Changes in population patterns, development of agricultural and urban regions, and patterns of urban-industrial development. Prereq: 361 or consent of instructor.

433 The Land-Surface System (3) Characteristics of surfaces, weather, vegetation, and surface materials, and their regional interrelationships. People, evaluators, and agents of change. Prereq: Geography of the Natural Environment or consent of instructor.

434 Climatology (3) General circulation systems leading to world pattern of climates. Climatic change and modification, and interactions of climate and human activity. Prereq: Geography of the Natural Environment or Meteorology or consent of instructor.

435 Biogeography (3) Changing distribution patterns of plants and animals on variety of spatial and temporal scales. Effects of continental drift, Pleistocene climatic change, and human activity on world biota. Prereq: Geography of the Natural Environment or consent of instructor.

436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues from physical and economic geo-
520 Topics in Global Change (3) Emerging trends, anticipated problems, and methods in global change, research and response. Prereq: 434 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

533 Topics in Physical Geography (3) Examination of trends, problems, and methods in geography of land surface, or in modern climatology. Prereq: 434 or 435 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

534 Topics in Climatology (3) Trends, problems, and methods in area of climatology. Prereq: 434 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

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

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

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

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

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

591 Foreign Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. S/NC or letter grade.

592 Off-Campus Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. S/NC or letter grade.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. S/NC or letter grade.

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

600 Doctoral Research and Dissertation (3-15) S/NC only. E

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

631 Seminar in Natural Hazards (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

632 Seminar in Physical Geography (3) Prereq: 533 or consent of instructor. May be repeated. Maximum 6 hrs.

634 Seminar in Climatology (3) Prereq: 534, 535 or consent of instructor. May be repeated. Maximum 6 hrs.

635 Seminar in Biogeography (3) Prereq: 535 or consent of instructor. May be repeated. Maximum 6 hrs.

641 Seminar in Urban Geography (3) Prereq: 541 or consent of instructor. May be repeated. Maximum 6 hrs.

643 Seminar in Rural Geography (3) Prereq: 443 or consent of instructor. May be repeated. Maximum 6 hrs.

649 Seminar in Geography of Transportation (3) Prereq: 549 or consent of instructor. May be repeated. Maximum 6 hrs.

663 Seminar in Geography of the American South (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

673 Seminar in Geography of Latin American (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

677 Seminar in Biological Conservation (3) Conduct of original research. Prereq: 577 or consent of instructor. May be repeated. Maximum 6 hrs.
Group 2: 420, 520, 525, 545, 546, 556.
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 approval of advisor.

4. Eight hours of additional graduate coursework.

THE DOCTORAL PROGRAM

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

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

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

A minimum of 24 hours of graded coursework beyond the master's degree is required in addition to the 24 hours of Dissertation 600. The coursework includes the sum of 9 hours of 600-level geology courses, 9 hours of 500-level or higher geology courses, and 8 hours of additional graduate-level courses. Extra-departmental coursework is encouraged.

The student must demonstrate a reading knowledge of a foreign language in which there is a body of geological literature, as approved by the student's dissertation committee. 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 earth sciences. Examples of diffusion equation in hydrology, wave equation in geophysics; mechanical modeling and boundary conditions in structural geology and tectonics.
Prereq: The Dynamic Earth or Earth, Life, and Time, 2 semesters of Calculus.
Prereq: 310. 2 hrs and 1 lab.
420 Palaeoecology (4) Principles of ecological analysis as applied to fossils and fossil assemblages; data collection and interpretation. Laboratory designed around preparation of scientific reports based on field and laboratory analysis. Writing emphasis course.
Prereq: 3 hours and 1 lab.
421 Invertebrate Palaeontology (4) Survey of invertebrate animal phyla: skeletal structure and preservation, functional morphology, ecology, and stratigraphic distribution.
Prereq: Palaeobiology or consent of instructor. 2 hrs and 2-2.5 lab hrs.
440 Field Geology (5) Summer field course for advanced undergraduate geology majors. 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. Preparation of most core courses and consent of instructor.
450 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery.
Prereq: 101-02. (Same as Geography 450) 2 hrs and 1-2 lab hrs.
455 Basic Environmental Geology (3) Applications of geologic concepts toward comprehension of effects of geologic processes on humans and effects of human activities on earth's environment. Prereq: The Dynamic Earth 2 hrs and 1-2 hrs lab or field period.
460 Principles of Geochimistry (3) Application of chemical principles to geologic problems. Crystal chemistry and relation between basic atomic structure and distribution and behavior of elements in earth's crust.
Prereq: Chemistry 150-03. Recommend prereq: 330. 2 hrs and 1 lab.
470 Applied Geophysics (3) Basic principles of geophysical exploration: applications to environmental problems. Seismic and electromagnetic methods.
Prereq: 8 hours of geology courses numbered above 300. 300.
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 (6) Development of physical earth from solar nebula to present. Formation, composition and evolution of hydrosphere, crust, mantle, and core. Interdependence of earth's atmosphere, volcanism, plate tectonics, climate, chemical and isotopic processes of interior, and earth's temperature. Historical perspective on major controversies of past, and problems unresolved today. Recommended 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 emphasis on geologic setting, and metallogene.
Prereq: 310 and 330 or equivalents. Recommended prereq: 460. 1 hrs and 1-2 lab hrs.
485 Principles of Hydrogeology (3) Physical processes of flow, flow geology, geologic controls, aquifer analysis, water well design/testing, introduction to transport processes.
Prereq: The Dynamic Earth; Calculus; Fundamentals of Physics or equivalent, or consent of instructor. (Same as Civil Engineering 445).
500 Thesis (1-15) FNP 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
505 Structure of the Southern and Central Appalachianian (2) Structural development of Southern and Central Appalachianians from extensional Late Paleozoic to Early Paleozoic rift-platform margin through processes related to compressional events producing accretionary elements that formed Appalachianians throughout the Paleozoic. Comparisons to similar orogens. Prereq: Structural Geology.
510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques in clay mineral studies.
Prereq: 310 and 568 or equivalent. 2 hrs and 1 lab.
521 Data Analysis in Geology and Environmental Science (3) Application of statistical and other quantitative techniques using computers to analyze geological data: environmental problems.
530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metasedimentary rocks, magmatic and metamorphic processes. Laboratory involves petrographic study of crystalline rocks in thin section. Prereq: 410. 3 hrs and 1 lab.
535 Ground Water Hydrology (3) (Same as Environmental Engineering 535.)
540 Seminar in Local Geology (1) Introduction of geology of Southern Appalachians. 1 hr plus field trip.

545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of foraminiferal clastic rock types; physical processes of sedimentation, transportation, and transformation of sedimentary structures.
Prereq: 340 or equivalent. 3 hrs and 1 lab.
546 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonate sediments and diagenesis of resultant rocks; field and laboratory analysis of sample material and preparation of scientific reports. 3 hrs and 1 lab.

550 Regional Geomorphology (3) Integrative approach to study of natural geomorphological regions stressing links and similarities across boundaries, unique characteristics of major divisions, provinces, sections, and districts. May be repeated with consent of instructor. Maximum 6 hrs. (Same as Geography 550).
556 Ice-Age Environments and Global Climate Change (3) (Same as Ecology and Evolutionary Biology 556.)

557 Quaternary Palaeoecology (3) Perturbation, process, and pattern within Quaternary ecosystems; climatic change and vegetation development during last 2.5 million years.
Prereq: Consent of instructor.
563 Stable Isotope Geochemistry (3) Theoretical aspects of isotope fractionation and applications to geochemical systems. Isotope exchange, variations in natural waters, diagenetic, hydrothermal and metamorphic systems.
Prereq: General Chemistry or equivalent.
565 Chemical Petrology (3) Application of thermodynamics to geologic materials. Thermodynamics of conventional phases, solution, reaction, stability, heterogeneous multicomponent phase equilibria, and of heat through earth.
568 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, X-ray fluorescence, and atomic absorption spectrophotometry techniques.
Prereq: 310 or consent of instructor. 2 hrs and 1 lab.
570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; re-cent literature. Prereq: 370 or equivalent, or consent of instructor. 3 hrs and 1 lab or seminar.
572 Fracture Analysis (3) Field and subsurface characterization, and mechanical development of natural fractures: role in groundwater flow.
Prereq: Structural Geology or equivalent, or consent of instructor.
575 Tectonics (4) Evolution of Earth's lithosphere in context of plate tectonics. Formation of continents through comparative anatomy of mountain belts, including Appalachians, Alps, Urals, Canadian, Cordilleran, Andes, and Himalayas.
Prereq: Structural Geology or consent of instructor. 3 hrs and 1 lab.
576 Reflection Seismology (3) Imaging subsurface features using refraction seismic waves. Energy sources, modes of wave propagation, field procedures, computer data processing, and pitfalls. Applications to tectonic and environmental problems.
Prereq: 470 or consent of instructor.
585 Contaminant Hydrogeology (3) Physical transport processes, isotopes and groundwater age dating, processes influencing inorganic, organic and microbial contaminants, sampling and monitoring methods, remediation of contaminated groundwater, aquifer protection.
Prereq: 485 or 535; 460 or 581; or Environmental Engineering 535 or equivalent; and consent of instructor.
586 Field and Laboratory Methods in Hydrogeology (3) Research methods. Measurement of hydraulic properties, drilling, sampling and instrumentation, tracer experiments. Field and laboratory techniques. Prereq or coreq: 485 or Environmental Engineering 535; and consent of instructor.

590 Special Problems in Geology (1-3) Directed study or special topics. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.
591 Foreign Study (1-15) See College of Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
595 Independent Study (1-15) See College of Arts and Sciences.
595 Selected Topics in Geology (1) Presentation of research by faculty and visiting scientists. Registration required each semester for course credit. Six hours of credit will count as six hours of Thesis 500. German 510 and 519-90 are required, as are three courses on German literature or culture, one of which may be at the 400-level. In addition, students must take three further courses, only one of which may be chosen from 411-12 or 485. All Graduate Teaching Assistants should take 512, and other candidates may take 512 or any other 500-level course. With the instructor's permission, M.A. candidates may take 600-level courses. A maximum of six 400-level courses may be counted toward the 24 semester hours of course credit.

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

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

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

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

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

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

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

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

### THE MASTER'S PROGRAM

The minimum requirements are 24 semester hours of course credit and six hours of Thesis 500. German 510 and 519-90 are required, as are three courses on German literature or culture, one of which may be at the 400-level. In addition, students must take three further courses, only one of which may be chosen from 411-12 or 485. All Graduate Teaching Assistants should take 512, and other candidates may take 512 or any other 500-level course. With the instructor's permission, M.A. candidates may take 600-level courses. A maximum of six 400-level courses may be counted toward the 24 semester hours of course credit.

### THE DOCTORAL PROGRAM

The Ph.D. in Modern Foreign Languages is offered jointly by the Department of Germanic, Slavic and Asian Languages and the Department of Romance 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 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 have the equivalent of an undergraduate major in one of them.

#### Degree Requirements

Candiates 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 36 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. These 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 must take German 426, 435, 510, or 512, 3 courses in German linguistics, such as 426, 436, 631, or 632, and 6 hours of linguistics electives in English or German. The student's graduate advisor must approve the electives chosen.

3. Cognate Field: Six hours in graduate courses numbered 400 and above in a field outside the department of the first concentration but related to the student's principal area of research. Students choosing applied linguistics as a second concentration are strongly urged to take their cognate work in a second language.

#### Additional requirements:
For any languages taken as a first or second concentration, a student must demonstrate competence by passing 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 M.A. 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. In 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 concentrations, subject to staffing needs.

Doctoral students are strongly encouraged to reside and study abroad and will be assisted in identifying potential sources of financial support (e.g., Fulbright, McClure, Rotary fellowships). For additional courses, see Romance Languages.

### ACADEMIC COMMON MARKET

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

### Asian Languages

#### GRADUATE COURSES

451 Readings in Chinese Literature (3) Prereq: Mastery of Intermediate-level Chinese or consent of instructor. May be repeated. Maximum 8 hrs.

451 Readings in Japanese Literature (3) Prereq: Mastery of intermediate-level Japanese or consent of instructor. May be repeated. Maximum 9 hrs.
German

GRADUATE COURSES

331-32 Elements of German for Upper-Division and Graduate Students (3,3) Elements of language, elementary and advanced readings, and a final 10,000 word translation project. Open to graduate students preparing for language examinations, and upper-division students desiring reading knowledge of the language. No credit for students having completed 101-02 or 107. Prerequisite: May be repeated. Maximum 6 hrs. Undergraduate credit only.

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

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

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

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

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

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

424 German Literary Movements (3) Survey of major periods in development of German literature since 1750. Prerequisite: courses and permission.

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

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

433 Structure of the German Language (3) Contrastive English-German segmental and suprasegmental phenomena, contrastive English-German linguistic structures, selected topics in advanced German grammar and syntax analysis. Prerequisite: 6 hrs of upper division German language courses (excluding courses in translation and graduate reading courses). (Same as Linguistics 433.)

436 History of the German Language (3) Development of German language from Indo-European through Proto-Germanic, Old High German, Middle High German to New High German. Internal and external historical linguistics of German speech. Prerequisite: 6 hrs of upper division German language courses (excluding courses in translation or graduate reading courses). (Same as Linguistics 436.)

465 Business German (3) Survey of German used in fields of business, government, administration, and economics. Prerequisite: 6 hrs of upper division German excluding courses in translation and graduate reading 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 taken toward degree requirements. May be repeated. S/NC only. E

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

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

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

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

541 Medieval German Language and Literature (3) Introduction to Middle High German.

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

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

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

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

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

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

560 German Literary Theory and Criticism (3)

561-52 Directed Readings In German Language and Literature (3,3)

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

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

Russian

GRADUATE COURSES

401-02 Advanced Grammar, Conversation, and Composition (3,3) Prerequisite: Russian Composition and Conversation or equivalent. (Same as Russian and East European Studies 401-02.)

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

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

430 Selected Topics in Russian Literature (3) Content varies. May be repeated. Maximum 9 hrs.

451-52 Senior Seminar (3,3) May be repeated. Maximum 18 hrs.

532 Seminar in German and Germanic Philology (3,3)

Health and Safety Sciences

Health and Safety Sciences (College of Human Ecology)

MAJORS

DEGREES

Health Promotion and Health Education ... M.S.
Human Ecology ................................... Ph.D.
Public Health ......................... M.P.H., M.S.-M.P.H.
Safety Education and Service ........... M.S.

Charles B. Hamilton, Head

Professors:

Gorski, June, Dr.P.H. ................. UCLA
Hamilton, Charles B. (Liaison).
Dr.P.H. .................................. Oklahoma
Kirk, Robert H., H.S.D. ................ Indiana
Wallace, Bill C. (Liaison), Ed.D. .... Northern Colorado

Associate Professors:

Pursley, R. Jack, Ph.D. ............ Iowa
Zemel, Paula, Ph.D. ............... Wayne State

Assistant Professors:

Ellison, Jack S. (Liaison), Ed.D. ..... Tennessee
Fitzhugh, Eugene C., Ph.D. ....... Alabama

Smith, Susan M. (Liaison), Ed.D. .... Tennessee

The Health and Safety Sciences Department offers graduate programs leading to the Master of Science with majors in Health Promotion and Health Education; 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 unifying of disciplines that contribute to a holistic approach to healthy living and the enjoyment of life. The academic disciplines focus on assisting students, clients, and faculty to develop a healthful and safe lifestyle that considers the dimensions of disease and injury prevention; and to prepare persons for competent practice of their respective disciplines, including scholarly, creative, and management endeavors. The department is committed to the educational value of community-based experiential learning.

The P.H.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 scholars 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.
2. Minimum 21 hours in primary specialization:
   - 530, 540, 650, 655, 660 and 6 hours of electives.
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.) F, Sp

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

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 science of human sexuality. Trends, issues, and content of sex education. E

423 Women's Health (3) Factors influencing women's health and the ways in which they are treated. Women as consumers in the nation's health service delivery systems. Health problems/concerns of women and techniques for prevention, maintenance and/or correction. (Same as Women's Studies 423.) E

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

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

465 Aging and Health (3) Aging process in health perspectives as related to health promotion and wellness of aged. Fall, 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 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

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

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

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

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

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

593 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.) F

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

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

655 Seminar: In Nation's Health (3) Comprehensive study of definition, determinants, resources and health status of nation. (Same as Public Health 665.) F

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

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

Public Health

Graduate study with a major in Public Health leads to the Master of Public Health (M.P.H.). Three professional preparation concentrations are available: community health education, gerontology, 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 required. Request application packet from the department. Preference 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 9 weeks of field practice. The field internship provides a full-time experience with an affiliated health agency or organization offering one or more health programs. Of importance, this experience 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.

Requirements include:
2. Internship (6 hours): 587, 588.
3. Concentration of Study (16 hours).

Required and recommended electives will be selected by the student in consultation with the major advisor. A list of courses is available for each concentration: community health education, gerontology, and health planning/administration.

DUAL M.S.-M.P.H. 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 than four years.

The program is designed to meet the needs of students who are interested in the fields 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 and Safety Sciences for the M.P.H., and the Public Health Academic Program Committee.

Students who have been accepted by both departments may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both departments. Such approval will be granted, provided that dual program studies be started prior to entry into the fourth semester of the M.S. and M.P.H. programs.

Curriculum

A dual degree candidate must satisfy the requirements for both the M.S. (public health nutrition concentration) and the M.P.H. degrees, as well as the requirements for the dual program. All candidates for the dual degree must successfully complete Health and Society (PH 555), two credits of Seminar in Public Health (PH 509), and a minimum of 60 credits. The Department of Nutrition will award a maximum of 9 semester hours of credit toward the M.S. degree for successful completion of approved graduate level courses offered in the Department of Health and Safety Sciences. The Department of Health and Safety Sciences will award a maximum of 11 semester hours of credit toward the M.P.H. degree for successful completion of approved courses offered in the Department of Nutrition. All courses for which such cross-credit is awarded must be approved.
by the Public Health Academic program Committee and the student's graduate committee. A single block field experience (or public health internship) is required of all students and the analytical field paper incorporates public health nutrition and the student's public health concentration.

Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit towards the M.S. or M.P.H. degree for courses taken in the other program, except as such courses qualify for credit without regard to the dual program.

Approved Dual Credit
M.S. courses to be counted toward the M.P.H. program must include 10 semester hours of Field Study in Community Nutrition (NTR 515) and 1 semester hour of Graduate Seminar in Public Health (NTR 509). M.P.H. courses to be counted toward the M.S. include Public Health Administration (PH 520), Biostatistics (PH 530), and Epidemiology (PH 540).

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

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

GRADUATE COURSES

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

410 Health in the Work Environment (3) Fundamental activities in field of industrial health aimed at reducing health problems for employees. Workplace health hazards and problems of concern to nurses, medical staff, management, engineers and others in industrial health and safety fields. Prereq.: Consent of instructor. May not be taken for credit by occupational health concentration majors. Sp

493 Directed Independent Study (1-3) Individual in-depth study of selected issues. Prereq.: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

509 Graduate Seminar in Public Health (1) In-depth discussion of timely topics reflecting scope of public health as discipline and its integration with many other academic and professional disciplines. Speakers both internal and external. May be repeated. Maximum 4 hrs. Same as Nutrition 509, Exercise Science 509 and Social Work 509. S/NC only. E, Sp

510 Environmental and Occupational Health (2) Complexity of personal and environmental approaches to assessing the health of the individual. May be repeated. Maximum 6 hrs. E

511 Fundamentals of Industrial Hygiene (3) Occupational health, theory, practice and regulations; recognition, evaluation, and control of workplace health hazards. Prereq.: Consent of instructor. Sp

520 Public Health Policy and Administration (3) Administrative consideration 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 hospitals. Case discussions and problem-solving exercises, managerial functions and skills. F, Sp

523 Management in Extended Care Settings (3) Management and organization theories, and the evaluation of extended care facilities. Prereq.: Consent of instructor. F

525 Financial Management of Health Programs (3) Financial management concepts and practices related to health services programs. Prereq.: Consent of instructor. F

530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Prereq.: Consent of instructor. F

540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of health problems. Historical origins of the discipline, hypothesis formulation, research design, and data and error sources, measures of frequency and association, etiologic reasoning, disease screening, and injury control. Prereq.: Consent of instructor. F

542 Advanced Epidemiologic Methods (3) Statistical methods to public health problems, with emphasis on data analysis and interpretation of data pertaining to cohort and case-control studies. Prereq.: Consent of instructor. F

552 Community Health Problem Solving (4) Dynamics of community organization, community needs assessment, educational interventions, and application of program planning techniques. Prereq.: Consent of instructor. F


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

564 Physical Activity and Positive Health (3) (Same as Exercise Science 564.)

569 Fitness Testing, Programming, and Leadership for Diverse Populations (3) (Same as Exercise Science 569.)

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

585 Seminar in Gerontology (1) (Same as Human Ecology 585, Counseling Education and Counseling Psychology 585, Exercise Science 585, Nursing 585, Physical Education 585, Social Work 585, and Sociology 585.)

587-88-89 Internship (1,3,3) Internship (community health education, gerontology, or health planning/administration) in either a public organization or research setting under supervision of designated preceptor. Prereq.: M.P.H. major, one semester advance notice and consent of major advisor. S/NC only. E

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

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

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

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

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

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 30 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.

The graduate program contributes to The University of Tennessee's mission of health protection by preparing safety professionals with the knowledge and skills necessary to create and maintain safer human environments in the workplace (industrial and commercial), home, school, and community. The offering of all core classes on an evening class schedule enables those working full-time in a safety-related field to pursue the M.S. degree with a major in Safety Education and Service on a part-time basis.

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain graduate 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 interrela-
History

(College of Arts and Sciences)

MAJOR

DEGREES

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

John R. Finger, Acting Head

Professors:
Bergeron, Paul H., Ph.D. ............ Vanderbilt
Chmielewski, Edward V. (Emeritus), Ph.D. ............ Harvard
Cutler, E. Wayne, Ph.D. ............ Texas
Farriss, W. Wayne, Ph.D. ............ Harvard
Finger, John R., Ph.D. ............ Washington
Haas, Arthur G., Ph.D. ............ Chicago
Hao, Yan-Ping (Lindsay Young Prof.), Ph.D. ............ Harvard
Haskins, Ralph W. (Emeritus), Ph.D. ............ California
Klein, Milton M. (Emeritus) (Distinguished Profl.), Ph.D. ............ Columbia
Moser, Harold, Ph.D. ............ Wisconsin
Patzer, Lormon A., Ph.D. ............ Cornell
Ullrey, Jonathan G. (Emeritus), Ph.D. ............ Illinois
Wheeler, W. Bruce, Ph.D. ............ Virginia

Associate Professors:
Becker, Susan D., Ph.D. ............ Case Western
Bing, J. Daniel, Ph.D. ............ Indiana
Bohstedt, John, Ph.D. ............ Harvard
Brummett, Palmina R. (Liaison), Ph.D. ............ Chicago
Diacon, Todd A., Ph.D. ............ Wisconsin
Johnson, Charles W., Ph.D. ............ Michigan
Muldowney, John, Ph.D. ............ Yale
Pinckley, 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, Lorn, Ph.D. ............ Kentucky
Haiken, Elizabeth, Ph.D. ............ California
Higgs, Catherine A., Ph.D. ............ Yale
Lieulevicius, Vejas 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.

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

THE MASTER'S PROGRAM

Admission Requirements
1. Successful completion of the M.A. degree from an accredited institution.
2. Acceptable scores on the Graduate Record Examination (general).

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

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

Comprehensive Examination
The comprehensive examination is to be taken no later than the semester following the term in which the student has completed the residence, coursework, and language requirements. A student stands examination in one field selected from Group I and one field selected from Group II below. Both parts are 4-hour written examinations. A student oral examinations are separate examinations, and Group I must be passed before taking Group II, and the latter must be taken in the fall of the examination. 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)
- East Asia
- World History

**Group II:**
To be defined by the student's doctoral committee from within one of 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 500 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, economic history of European nations. Focus may vary. May be repeated. Maximum 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 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 only.

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

521 M.A. Readings (3) Directed readings in preparation for M.A. examinations. Open only to master's candidates in history. May be repeated. Maximum 6 hrs. S/NC only.

531 Topics in Premodern Europe (3) Reading seminar: secondary sources on premodern European movements and trends. Focus varies. May be repeated. Maximum 15 hrs.

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 U.S. Focus varies. May be repeated. Maximum 15 hrs.

551 Topics in the History of Foreign Relations (3) Reading seminar: secondary sources on foreign relations. Focus varies. May be repeated. Maximum 15 hrs.

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

553 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.

555 Topics in European Social and Economic History (3) Reading seminar: secondary sources on or economic history of European nations. Focus varies. May be repeated. Maximum 15 hrs.

556 Topics in European Political History (3) Reading seminar: secondary sources on political history. Focus varies. May be repeated. Maximum 15 hrs.

557 Topics in Intellectual and Cultural 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. Focus varies. May be repeated. Maximum 15 hrs.

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 analysis of two or more world cultures. Focus varies. May be repeated. Maximum 15 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 fault. 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.


651 Seminar in Military and Foreign Relations History (3) Research seminar in primary sources culminating in scholarly paper in military or foreign relations history. Focus varies. Not restricted by national grouping. May be repeated. Maximum 15 hrs.


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

**Holistic Teaching/Learning**

(College of Education)

**MAJORS**

**DEGREES**

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

L. Knight, Leader

Professors:


Davis, A. R., Ph.D. .................. Ohio State

Hargis, Charles H. (Emeritus), Ed.D. ........... Alabama

Huff, P. (Emeritus), Ph.D. .................. Michigan

Jost, Karl J., Ed.D. .................... Oklahoma

Knight, Lester N., Ph.D. ................. Texas

Rowell, C. Glennon, Ed.D. ............ George Peabody

Schindler, W. Jean, Ph.D. .............. Kent State

Turner, T. N., Ed.D. ............... Penn State

**Associate Professors:**

Chance, Charles A., Ph.D. .................. Ohio State

Harriss, Michael C., Ed.D. ............. Northern Colorado

Huff, P. (Emeritus), 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 in Education
  Track 1--elementary education
  Track 1-modern and comprehensive education
  Track 1-social science education
  Track 2--elementary teaching
  Track 2-modified and comprehensive education

- Education Specialist

Education

Elementary education

Reading education

Social science education
454 Teaching Strategies and Issues in Social Studies Education (3) Goals, objectives, techniques, materials, and evaluation; current research; 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) Speech and language impairments in school-age children; speech integration skills into existing curriculum, especially for high-functioning children; instruction and management of 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 individuals. 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 degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

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 (1-6) Recent trends, current materials, and issues for language development in children. Prereq: Elementary school language arts course or consent of instructor. F

505 Elementary and Middle School Teaching Methods II (0) Applied methods of teaching reading, language arts, science, social studies, and mathematics; accommodation strategies for students with diverse needs. Prereq: Elementary or Middle School Teaching Methods I. Coreq: 575. F

506 Internships in Teaching in Special Education and Rehabilitation. In professional settings in public schools or agencies under supervision of master practitioners. Enrollment limited to those in fifth-year program. SNC only.

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 curriculum, development of concepts and generalizations, integration of social sciences. Prereq: Consent of instructor.

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 Elementary Social Studies (3) Analysis of new and innovative social studies programs and techniques. Exploration of current trends in social studies education. Prereq: Previous course in teaching of social studies or consent of instructor. Sp

527 Elementary School Curriculum (3) Examination, evaluation and application of curriculum in elementary school teachers and issues which affect elementary education. Prereq: Consent of instructor. F, Su

528 Teaching Language Arts Elementary and Middle School (3) Recent trends and current materials and methods in teaching language arts (except reading). Prereq: Course in language arts elementary education. Coreq: Teaching of social studies program. Sp

529 Practicum in Diagnosis and Remediation of Difficulties in Learning Mathematics (3) Assessment and practical 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.

536 Psychology of Reading (3) Reading act, relationship between learning theory and 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.

537 Diagnosis and Correction of Classroom Reading Problems (3) Procedures, methodologies and materials for diagnosing and correcting classroom reading problems. Prereq: Consent of instructor. F

538 Practicum in Diagnosis of Reading Problems (3) Theoretical and practical applications of specific reading diagnostic instruments: testing of elementary and/or secondary school students, preparing case study reports, and conducting parent conferences. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor.

553 Assessment of Exceptional Students (3) Current issues related to assessment; advanced study of evaluation models for special education; dynamic and other innovative assessment approaches. Advanced study of application to educational programming and statistics in application in assessment.

554 Developmental Reading Practicum (2) Diagnostic and teaching children having developmental and corrective needs. May be repeated. Maximum 6 hrs.

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

556 Instructional Systems for Affective/Motivational Education for Children with Disabilities. Educational strategies and methods of instruction; simulation, demonstration, and media. Teaching techniques, materials, and classroom organization. Theoretical and practical forms of education through art, music, role play, puppetry, bibliotherapy, and group interactions. Prereq or coreq: 555 or consent of instructor.


562 Seminar in Research Techniques in Special Education (3) Evaluation of research and theoretical issues. Prereq: Consent of instructor.

568 Seminar in Research Techniques in Special Education (3) Evaluation of research and theoretical issues. Prereq: Consent of instructor.

590 Application of Microcomputer Technology in Special Education and Vocational Rehabilitation (3) Application of microcomputer technology with all types of exceptionalities and across all chronological and educational disabilities and educational strategies appropriate for these persons. Prereq: Special Education Principles and Special Education Strategies. Admission to Teacher Education and Curriculum and Instruction 422. Coreq: 430, SNC 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 these persons. Prereq: Special Education Principles and Special Education Strategies. Admission to Teacher Education and Curriculum and Instruction 422.

434 Topics in Reading Education (1-8) Prereq: Admission to teacher education and course in reading education. May be repeated. Maximum 6 hrs.

590 Application of Microcomputer Technology in Special Education and Vocational Rehabilitation (3) Application of microcomputer technology with all types of exceptionalities and across all chronological and...
functioning age ranges. Microcomputer adaptive software, special switch access, authoring systems, telecommunication, and strategies for cognitive development.

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

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

596 Clinical Experience in Assessment and Instruction (3-9) Academic remediation applied in lab/field settings; tasks related to teaching; assessment, preparation of lessons, and delivery of instruction. Coreq: 593. S/NC or letter grade. E

599 Seminar in Social Studies Education (3) Research, trends, and issues in secondary social studies. Su

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 learning processes are constructed. Prereq: 500-level courses in reading education or consent of instructor. Sp

604 Seminar in Curriculum and Instruction (1) Required 2 consecutive semesters. S/NC only. E

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

610 Internship in College Teaching and Supervision (3-9) Supervised practice in college teaching and supervision. Prereq: Admission to doctoral program or consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

617 Trends and Issues in Curriculum and Instruction - An Interdisciplinary Perspective (3) Current trends and issues in field of curriculum and instruction. Prereq: Admission to Ed program.

620 Internship in Research in Special Education and Rehabilitation (3-9) Placement with professional engaged in theoretically-based research: public school, institutions, agencies or university settings. Prereq: 9 hrs in statistical and research methods. May be repeated. Maximum 9 hrs. S/NC only.

621 Seminar in Social Studies Research and Theory (2) Status of research and theory. Needed research related to research from other field, and application of research. Prereq: Recent course in teaching of social studies or consent of instructor. May be repeated. Maximum 4 hrs. E

630 Internship in Institutional Leadership in Special Education and Rehabilitation (3-9) Advanced level field experiences under supervision of practitioner. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

651 Advanced Studies in Elementary School Language Arts (3) Selected issues in elementary school language arts. Prereq: Graduate course in elementary school language arts or consent of instructor. Sp

679 Special Topics (1-3) Prereq: Admission to doctoral program. May be repeated. Maximum 8 hrs. S/NC or letter grade.

689 Internship (1-3) Experiences in application of principles and practices of curriculum development and instructional improvement. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

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

694 Supervised Reading (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

Human Ecology

(College of Human Ecology)

MAJOR

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, Consumer and Industry Services Management; Health and Safety Sciences; Human Resource Development; Nutrition. 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, Public Health 650, Nutrition 513, 515, 517, Public Health 523, Retail and Consumer Studies 560, Social Work 586, Sociology 415, Psychosocial Education 504, 522, 525, 528.

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

3. Human Ecology 585, 1 hour required. Cross-listed with participating departments.

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

Graduate Committee

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

Admission to Candidacy

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

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Human Ecology is available to residents of Alabama, Kentucky, Mississippi, and 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 (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

520 Directed Study in Human Ecology (1-3) Integrative topics. Prereq: At least 9 hrs of graduate study in college...
Human Resource Development

(College of Human Ecology)

MAJORS DEGREES

Human Ecology Ph.D.

Human Resource Development Ph.D. M.S.

Gregory C. Petty, Head

Professors:

Campbell, Clifton P., Ed.D. ...... Maryland
Cheek, Gerald D. (Emeritus). ....... Ohio State
Coakley, Carroll B. (Emeritus). ...... Kansas State
Craig, David G. (Emeritus). Ed.D. ...... Cornell
DeJonge, Jacqueline O., Ph.D. ...... Iowa State
Haskell, Rebecca W. (Emeritus). ...... Ohio State
Petty, Gregory C., Ph.D. ...... Purdue
Wagoner, George A. (Emeritus). M.S. ....... Indiana

Associate Professors:

Bremer, Ernest W. (Liaison), Ph.D. ...... Tennessee
Dean, Peter J., II, Ph.D. ...... Iowa
Hanson, Robert, Ph.D. ...... Purdue
McNinis, Jacqueline H., Ph.D. ...... Florida State

Assistant Professors:

Mims, Cheryl A., Ph.D. ...... Virginia Tech
Pierce, Randal, Ph.D. ...... Ohio State

THE MASTER'S PROGRAM

The Master of Science degree with a major in Human Resource Development provides a flexible graduate program for professionals wishing to pursue their academic studies within and across subject areas of Human Resource Development: those who work with individuals to help them enter the workforce; those who train individuals already in the workforce; and those who help individuals in the workforce advance their potential.

The M.S. degree with a major in Human Resource Development offers two concentrations, each providing opportunities for special interests. The training and development concentration is designed to meet the needs of professionals who work in programs encompassing all areas of human resource development. Applicants without an undergraduate degree in an area related to human resource development may be required to take 501 as a prerequisite and to complete an internship as part of their program. The teacher licensure concentration is specifically for students who seek initial teacher licensure in family and consumer sciences education, business and marketing education, and technology education. This program requires admission and has specific prerequisites. Thesis and non-thesis options are available for both tracks.

Admission Requirements

Training and Development Concentration applicants are to submit an application for admission to The Graduate School, and three letters of reference from individuals familiar with their potential for success in academic work, and a statement describing personal career objectives directly to the Department of Human Resource Development. Applicants must meet the admission requirements of The Graduate School and present evidence of ability to do graduate work, including a GPA of at least 2.7 on a 4.0 scale for the last two years of undergraduate work. Any student below this level of academic quality must justify admission via other exceptional credentials. If the applicant has prior work experience in human resource development, a reference letter should also be provided by the work supervisor. Recent Graduate Record Examination or Miller's Analog Test scores are required of all applicants except those applying for the teacher licensure concentration. Students who have not taken an appropriate undergraduate statistics course will be required to take one as part of their graduate program. All applicants are required to be interviewed by the department admissions board.

Teacher Licensure Concentration applicants are to submit an application for admission to The Graduate School, and a reference letter should also be provided by the work supervisor. Graduate Record Examination scores are required of all applicants. All applicants are required to be interviewed by the department admissions board.

Any person whose native language is not English must submit results of the Test of English as a Foreign Language (TOEFL). A minimum score of 600 is required for admission consideration.

Degree Requirements

Training and Development Concentration - The 36-hour thesis option (33 hours if statistics is waived) includes 3 hours of research methodology (504) and depending on the student's prior coursework, may also require 3 hours of statistics. The core (9 hours) of the internship program is 521, 522, HE 574 and 559 (1 hour). The internship experience (575) is 12 hours of credit and is the culminating experience. Students choose another 3 hours of coursework to support the teaching field. The thesis option requires six hours of Thesis 500 and an oral comprehensive examination. The 39-hour non-thesis option (36 hours if statistics is waived) is the same as described above except for an additional three hours of specialization coursework and a six-hour (503) internship experience (575). The 39-hour non-thesis option (36 hours if statistics is waived) is the same as described above except for an additional three hours of specialization coursework and a six-hour (503) internship experience (575). The non-thesis option requires a comprehensive written and oral examination.

Note: For students in the Nashville area, only the training and development concentration is available.

THE PH.D. CONCENTRATION

Admission Requirements

Applicants are to submit an application for admission to The Graduate School, five letters of reference from persons familiar with their potential for success in doctoral work, and a statement describing personal career objectives directly to the Department of Human Resource Development. Applicants must hold a master's degree from an accredited institution and present evidence of ability to do Ph.D. work, including having maintained a graduate GPA of 3.3 on a 4.0 scale or better. If the applicant has prior work experience in human resource development, a reference letter should also be provided by the work supervisor. Graduate Record Examination scores are required of all applicants. All applicants are required to be interviewed by the department admissions board.

Any person whose native language is not English must submit results of the Test of English as a Foreign Language (TOEFL). A minimum score of 600 is required for admission consideration.
Degree Requirements
The Doctor of Philosophy degree with a major in Human Ecology and a concentration in human resource development is for graduate students who seek careers in higher education or as managers/administrators of HRD. The curriculum is designed to enable students to achieve professional objectives, develop needed competencies, and gain desirable experiences and understanding of human resource development. Students must possess a master's degree before acceptance to the program. A minimum of 95 hours beyond the baccalaureate is required.

Concentration (15 hours): Must include courses to support Human Resource Development and may be taken from the master's degree.

Departmental Core (17 hours): Must include 510, 511, 512, 557, 559 or equivalents and 604.

Specialization (12 hours): Must support a career path of 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 application, 9 hours minimum; research methodology must include 504 and 610 or equivalents, 8 hours minimum.

Internship (6-8 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.

Note: For latest update, check the homepage of Department of Human Resource Development (http://hrd.he.utk.edu).

GRADUATE COURSES
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 development needs. Principles of vocational education in business and marketing, curriculum implications: establishing, evaluating, and improving programs.
455 Learner and Program Evaluation (3) Assessing effectiveness of training or educational programs; developing performance-based measures; evaluating job performance; and measuring learner progress. Prereq: Program Planning for Training, Development, and Education.
476 Supervised Occupational Experience (3) Practical field experience in business/industry/community-based settings related to area of study. Prereq: Senior standing and consent of advisor. May be repeated. Maximum 9 hrs. E
500 Thesis (1-15) P/NP only. E
501 Survey of Human Resource Development (3) Training and development as practiced in organizations: needs assessment; development of workplace skills, evaluation, development of training program proposals, assessment of personal competencies, values, goals, and training program design and administration.
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 (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 to train selection and placement in instructional programs and in jobs. Collecting, analyzing, and reporting follow-up data appropriate for making improvement. Prereq: Consent of instructor. Sp, Su
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 practitioner and departmental representative. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
512 Human Resource Management (3) Process-systems approach to human resource management; interdisciplinary 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) Specific objectives, activities, and evaluation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E
514 Individual Study in Human Resource Development (3) 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) MINITAB 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 experience in education or training, or consent of instructor.
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.
521 Design and Development of Instruction (3) Curriculum development and program planning: design of instruction; development of teaching materials for classroom and educational purposes. Intended for students in family and consumer sciences, business, marketing, technology and/or industrial education.
531 Organization and Supervision of VOE and Marketing Programs (3) Developing 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/S
550 Administration of Industrial Education Programs (3) Developing, staffing, administering and evaluating trade, industrial and technical education programs in secondary and post-secondary school settings. 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: 456 or equivalent. F/S
552 History and Philosophy of Industrial Education (3) Social, political, and economic events that impact development of industrial education. Philosophical problems and historical development of education. Prereq: Consent of instructor. F/S
553 Planning Technical Education Facilities (3) Preparation of educational specifications, site selection, and working relationships with other professionals involved in process of planning technical education facilities. Prereq: Consent of instructor. Sp, Su
554 Technical Program Planning (3) Instructional systems attending to analysis, design, development, implementation, and evaluation of trade, technical supervisor and related training. Prereq: Curriculum development course and consent of instructor. F/S
555 Curriculum Planning for Industrial Education Programs (3) Developing performance-based, criterion-referenced 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 Methods of Teaching Conceptual Content (3) Proper selection and effective application of methods for teaching and learning conceptual content. Communication strategies for conceptual content comprehension, retention, and application.
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.
559 Program Evaluation (3) Concepts, principles, practices, theories, and trends related to program evaluation. Planning and conducting a comprehensive program evaluation in variety of settings. Fundamentals of design, measurement, return-on-investment (ROI), and presentation and dissemination of results to stakeholders.
560 International Perspective of Workforce Training (3) Examination and comparison of workforce systems in high industrialized countries. Developing training programs, out-of-school training systems, update training 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.
562 Grant Writing and Project Implementation (3) Writing grant proposals, negotiating with funding sources, implementing and maintaining funded programs, and closing out projects at end of funding support.
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) Curriculum theory, models, contents, planning evaluation and implementation of specialized program areas. Prereq: 555 or equivalent.
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.
Inclusive Early Childhood Education

(Dept. of Education)

MAJORS

DEGREES

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

Susan Benner, Leader

Professors:

Benner, Susan M., Ed.D. .........., Columbia
Blank, Kemfi, Ph.D. .............. Ohio State
Coleman, 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, majors, and concentrations in:

Master of Science

Education

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

Doctor of Philosophy

Early childhood special education

See Education under Fields of Instruction for full description of all degree 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, with disabilities, with advanced development and "mainstreamed" children.

GRADUATE COURSES

445 Early Childhood Education: Program Development and Teaching in Kindergarten (3) Curriculum planning, classroom organization and management practices for teaching young children; relationship of kindergarten to total early childhood setting. Prereq: Admission to teaching education, E

464 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, E

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

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

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

504 Clinical Experience in Teaching and Supervision of Exceptional Children (3-9) Placement in educational setting. May be repeated. Maximum 8 hrs, S/N or letter grade. (Same as Rehabilitation and Deafness 504.)

515 Seminar (1-3) May be repeated. Maximum 6 hrs, S/N only, E

518 Educational Specialist Research and Thesis (3) May be repeated. S/N only, E

535 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 roles. Prereq: Admission to graduate program.

554 Assessment in Early Childhood Special Education (6) Development of knowledge and skills in appropriate formal and informal assessments of handicapped infants and young children: screening, identification, diagnosis, placement and program implementation issues. Prereq: 553 or consent of instructor.

555 Neuromuscular and Health Disorders: Educational Implications (3) Neurological impairments, physical disabilities and special health conditions, autism. Investigation of instructional techniques and adaptations.

556 Psychosocial Development of Gifted and Talented Children (3) Phenomena of talent development in context of home, school, and society. Implications of maladjustment, precocity, and emotional development. Prereq: 481 and 482 or equivalent or consent of instructor.

557 Instructional Systems for the Gifted and Talented (3) Instructional methods and systems evaluated in terms of effectiveness in various educational environments. Prereq or coreq: 554 or consent of instructor.

566 Curriculum for Early Childhood Education (K-3) (3) Theoretical foundations and current research in content and skill areas of curriculum for kindergarten, grades 1-3. Application to local school setting. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. Sp/Su

567 Application of Theory in Early Childhood Education (K-3) (3) Principles and practices from selected theoretical orientations. Prereq: Course in early childhood education or consent of instructor. May be repeated. Maximum 6 hrs. F/Su

568 Early Childhood Special Education: Theories and Interventions (3) Theoretical perspectives of early childhood special education: exploration of programmatic models, family-focused concepts and curriculum development.

575 Creative Problem-Solving Strategies for Special Educators (3) Techniques for solving problems encountered by special educators in any setting.

579 Special Topics (1-3) Prereq: Admission to graduate program. May be repeated. Maximum 9 hrs. S/N only, E


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

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

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

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

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

604 Seminar in Curriculum and Instruction (1) Required 2 consecutive semesters. S/N only. E

610 Internship in College Teaching and Supervision (3-9) Supervised practice in college teaching and supervision. Prereq: Admission to doctoral program or consent of instructor. May be repeated. Maximum 9 hrs. S/N only.

620 Internship in Research in Special Education and Rehabilitation (3-9) Advanced level field experiences in educational supervision. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/N only.

630 Internship in Institutional Leadership in Special Education and Rehabilitation (3-9) Advanced level field experiences under supervision of practitioner. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/N only.


650 Advanced Studies in Early Childhood Education (3) Prereq: 2 graduate courses in early childhood education and consent of instructor. May be repeated. Maximum 9 hrs S/N only. E

679 Special Topics (1-3) Prereq: Admission to doctoral program. May be repeated. Maximum 9 hrs. S/N only, E

689 Internship (1-3) Experiences in application of principles and practices of curriculum development and instructional improvement. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs S/N only, E

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

694 Supervised Reading (1-3) May be repeated. S/N or letter grade, E

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

Industrial and Organizational Psychology

(Dept. of Business Administration)

MAJOR

DEGREES

Psychology ................................................... Ph.D.

Robert T. Ladd (Liaison), Director

Committee:

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

593 Independent Study (1-3) May be repeated. S/N or letter grade, E
The doctoral program is 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 program is administered by a committee appointed by the Associate Vice Chancellor and Dean of The Graduate School on recommendations from the Management Department head and the program director.

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

ADMISSION REQUIREMENTS

Applicants for admission should request information and application forms from both the Office of Graduate Admissions and Records (218 Student Services Building) and the Director, Industrial and Organizational Psychology Program, (408 Stickley Management Center, The University of Tennessee, Knoxville, TN 37996).

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

The master's degree in Industrial and Organizational Psychology is generally not required of individuals pursuing a doctoral degree.

General Requirements

At least one year of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade-point average of 3.5 or above is required with no evidence of special weakness in mathematics and physical sciences.

Test scores on each section of the general portion (verbal and quantitative) of the Graduate Record Examination (GRE) are required. Customarily, these students admitted to the program have performed at or above the 69-76 percentile on the general tests. (This corresponds to a raw score of approximately 600 on each of the tests.)

THE DOCTORAL PROGRAM

The Ph.D. degree with a major in Industrial and Organizational Psychology can be completed with a minimum of 90 semester hours in the major. Students must be in residence full time for one year; must maintain an overall 3.0 grade-point average with no more than one grade below B in the I/O Psychology, General Psychology, and Statistics core; must complete an applied research project prior to beginning dissertation work; must pass a comprehensive examination; and must pass a final oral examination on their dissertation research.

Course Requirements: Hours
I/O Psychology Core 9
567, 568, & 569
Research Core 12
Statistical Principles (Statistics 537 & 538 or equivalents)
Multivariate Statistics (Statistics 579, 679 or equivalent)
Advanced Research Methods (605 or equivalent)
General Psychology Core 9
One course in each of the following areas: biological bases of behavior, cognitive bases of behavior, history and systems of psychology.
I/O Psychology Seminars 9
600 level IOPSY courses, from a program committee approved list.
Approved Electives 9
Courses supporting the student's course of study.
Supervised practicum, internship, or field training (690) 15
Ethics (635 or equivalent) 3
Dissertation (600) 24
TOTAL 90

The Program Committee may require any student in the doctoral program to prepare a master's thesis and complete the master's degree. This policy will be implemented by the committee at such time as a review of the student's record suggests that additional evidence is required regarding the student's qualifications for pursuing a Ph.D. degree.

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 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 and Records.

GRADUATE COURSES

500 Thesis (1-15) P/NP only: E
562 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 complete. May not be used toward degree requirements. May be repeated. S/NC only. E
525 Research in Industrial/Organizational Psychology (1-3) Available only to students admitted to program or by prearrangement with program director. Maximum 6 hrs. S/NC or letter grade.
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 during first year of study in program. Consent of instructor required for non-program students.
569 Applied Measurement for Industrial/Organizational Psychology (3) Basic techniques for collection and evaluation of individual and organizational data using both classical and modern psychometric techniques. Relevant statistical models: reliability analysis, exploratory and confirmatory factor analyses.
600 Doctoral Research and Dissertation (3-15) P/NP only: E

605 Advanced Research Methods in Psychology (3) Critical analysis of new and evolving techniques for psychological research; new statistical and psychometric methods.
610 Individuals in Organizations Seminar (3) Bridging principles and processes which link individual attributes within macro organization concern: culture, climate, and group decision-making.
611 Seminar in Organizational Leadership (3) Current theories, concepts, and issues associated with psychology of organizational leadership. Prereq: 567-68 or consent of instructor.
612 Seminar in Work Motivation (3) Current theories, concepts, and issues associated with psychology of work motivation. Prereq: 567-68 or consent of instructor.
613 Seminar in Performance Appraisal (3) Current issues, problems, and research in performance appraisal and criterion development; applications in compensation. Prereq: 567-68 or consent of instructor.
614 Seminar in Employee Selection (3) Current issues, concerns. and methods used in employee selection. Prereq: 567-68 or consent of instructor.
615 Seminar in Organizational Training and Development (3) Current issues, problems, and research in training and development. Prereq: 567-68 or consent of instructor.
625 Topics in Organizational Psychology (3) Topics vary.
626 Topics in Industrial Psychology (3) Topics vary.
627 Structural Equation Models in Organizational Research (3) Issues related to analysis of organizational data using structural equation and related techniques.
628 Personality Assessment (3) Review of key domains of social cognition: measurement systems which use individual differences in social-cognitive bases as basis for measuring personality.
635 Ethical and Professional Issues in Industrial/Organizational Psychology (3) Issues involved with ethical practice in research, academic, organizational, and consulting situations.
690 Supervised Practicum, Internship or Field Training in Industrial/Organizational Psychology (1-15) One credit hour per 30 hours of practice. S/NC or letter grade.

Industrial Engineering (College of Engineering)

MAJOR

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), Ph.D. .......... NC State
Schmitt, H. W., Ph.D. .......... Texas

Associate Professors:

Aikens, C. H. (Liaison), Ph.D. .......... Tennessee
Hailey, M. L. (UTSI), Ph.D. .......... Tennessee
Hungerford, J. C., Ph.D. .......... Ohio State
Jackson, D. F., Ph.D. .......... Tennessee
Kirby, K. E., Ph.D. .......... Tennessee

Assistant Professors:

Coleman, G. D. (UTSI), Ph.D. .......... VPI
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, engineering management, and manufacturing systems. 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 industrial engineering, engineering management or manufacturing systems engineering. Admission is open to graduates of ABET-accredited undergraduate curricula in engineering, or to graduates of other technical curricula who satisfy prerequisites depending on their academic backgrounds. 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, 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' 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 a 3-hour capstone project. This concentration is fully supported off-campus utilizing electronic media for video taping and interactive distance teaching methods.

**Manufacturing Systems Engineering**

Under this manufacturing engineering concentration, students may select either the thesis or non-thesis option when taking the M.S. degree program, or the non-thesis option only when taking the dual M.S.-MBA program. The thesis option requires 27 hours of coursework and 6 hours of thesis. The non-thesis option requires 30 hours of coursework (33 hours in the dual M.S.-MBA program) plus a 3-hour design or industrial problem project.

**DUAL M.S.-MBA PROGRAM**

The College of Engineering and the College of Business Administration offer a coordinated program leading to the conferral of the Master of Science degree with a major in Industrial Engineering (concentrations in manufacturing systems engineering) and the Master of Business Administration degree (concentration in manufacturing management). The dual program saves the student one or two semesters over the time that would be required to earn both degrees independently.

The establishment of the dual program addresses the critical need for personnel trained in both engineering and management who can integrate this increasingly complex body of knowledge in achieving the efficient operation of manufacturing and production firms. The program is designed to accommodate the interests of students who desire a career leading to a leadership position in a manufacturing organization.

**Admission Requirements**

Applications are accepted for fall semester only. Applicants for the M.S.-MBA program must make separate application to, and be competitively and independently accepted by, The Graduate School for the Master of Business Administration degree program and the Master of Science degree program with a major in Industrial Engineering, and by the Dual Program Committee. Students will initially apply for the MBA program, indicating on that application the intent to pursue the dual M.S.-MBA program in manufacturing (refer to the MBA program for separate instructions). Students accepted for both degree programs will be assigned by the Dual Program Committee advisors who will be responsible for supervision of the student’s progress through the dual program.

Applications by U.S. citizens and permanent residents received prior to the MBA application deadline (March 1) will be considered as space allows. Additional information is required, and different application dates are established by The Graduate School for International students.

**Curriculum**

The curriculum in the first academic year of the dual M.S.-MBA program is the two-course core of the MBA program (two 15-hour courses, one each semester). A 1-hour seminar course each semester in manufacturing will also be taken concurrently during the first two semesters (not for graduate credit). A 3-hour design or industrial problem project will be accomplished in the summer term of the first year. This will be part of a summer internship in industry, and the project will be academically supervised by a faculty member associated with the dual program.

During the second year, 27 hours of coursework will be completed in the manufacturing systems engineering concentration in Industrial Engineering plus an additional 9 hours of graduate courses in the College of Business Administration acceptable in meeting the requirements of the MBA program. Fifteen hours will be taken during each of the first two semesters of the second academic year. A culminating 6-hour integrated case study requiring use of previous material, and a final examination as required by the Dual Program Committee, will be taken during the first session of summer term of the second year.

The dual degree candidate must satisfy the curriculum and graduation requirements of both the Department of Industrial Engineering and the College of Business Administration. Dual degree students withdrawing from the dual program before completion of both degrees will not receive credit toward graduation in either degree program for courses in the other degree program, except as such courses qualify for credit without regard to the dual degree program. The M.S. and the MBA degrees will be awarded upon successful completion of the requirements of the dual program.

**Approved Dual Credit**

A maximum of 6 semester hours of approved graduate-level courses completed in the College of Business Administration may be counted toward the M.S. degree program with a major in Industrial Engineering. A maximum of 15 semester hours of approved graduate-level courses completed in the Department of Industrial Engineering may be counted toward the MBA degree program. The approval of courses is the responsibility of the Dual Program Committee and the student’s assigned advisor.

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**

**401 Integrated Manufacturing Systems (3)** NC and CNC machine tools, robotics and related materials handling systems, hard tooling, alternative integrated manufacturing systems and manufacturing information control systems. Prereq: 400.


**403 Production Facilities Design and Material Handling (3)** Design of production facilities: plant layout, analysis and planning for overall moving, packaging and storage of materials. Office layout and service areas. Design of facilities for such diverse groups as hospitals, banks, industry. Prereq: 402, 461.

**405 Engineering Economic Analysis (3)** Engineering economy and application in engineering practice. Time value of money and discounted cash flow techniques. Delineation among engineering alternatives: design options, equipment selection, break-even points, and similar situations. Cost estimating and consideration of taxes and inflation. Analyzing uncertainty in economic estimates using probabilistic techniques. Prereq: Junior standing or consent of instructor.

**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 analysis. Multi-project control, computer applications, and PERT methods of handling uncertainty in activity time estimates.

421 Information Systems Analysis and Design (3) Systems analysis and design. Analysis, design, implementation and management of information systems. Prereq: Consent of instructor or equivalent.

430 and 431 Probability and Statistics for Engineers and Scientists, or equivalent.

519 Human Factors Engineering and Ergonomics (3) Application of human factors and ergonomic principles. Prereq: Consent of instructor.

520 Human Factors and Product Safety Engineering (3) Human factors and safety engineering, including human factors, product safety, system safety, and system failure analysis techniques. Prereq: Consent of instructor.


522 Optimization Methods in Industrial Engineering (3) Optimization methods applied to industrial engineering problems. Prereq: Consent of instructor.

523 Mathematical Programming (3) Application of mathematical programming techniques to industrial engineering problems. Prereq: Consent of instructor.

524 Advanced Integrated Manufacturing Systems (3) Special topics in manufacturing systems. Prereq: Consent of instructor.

525 Lean Production Systems (3) Characteristics and performance of lean production systems. Prereq: Consent of instructor.

526 Systems Modeling and Simulation (3) Modeling of discrete, continuous, and combinatorial systems. Prereq: Consent of instructor.

527 Lean Production Systems (3) Characteristics and performance of lean production systems. Prereq: Consent of instructor.

528 Systems Modeling and Simulation (3) Special topics in systems modeling and simulation. Prereq: Consent of instructor.

591-92-93 Advanced Topics in Industrial Engineering (3,3,3) Special topics in industrial engineering. Prereq: Consent of instructor. May be repeated with consent of instructor.

590-91-92-93 Advanced Topics in Industrial Engineering (3,3,3,3) Special topics in industrial engineering. Prereq: Consent of instructor. May be repeated with consent of instructor.

601 Operations Research Models in Engineering Systems (3) Application of operations research models to engineering systems. Prereq: Consent of instructor.

602 Nonlinear Optimization (3) Advanced optimization techniques. Prereq: Consent of instructor.

606 Advanced Topics in Human Factors, Safety and Biomechanical Engineering (3) Advanced topics in human factors, safety and biomechanical engineering. Prereq: Consent of instructor.

635 Management of Technology (3) Applications of technology management. Prereq: Consent of instructor.

639 New Venture Formation (3) Applications of new venture formation. Prereq: Consent of instructor.

653 Theory and Practice of Engineering Management (3) Applications of management theory and practice in engineering management. Prereq: Consent of instructor.

655 Management of Technology (3) Applications of technology management. Prereq: Consent of instructor.

656 Project Management (3) Application of project management techniques to engineering projects. Prereq: Consent of instructor.

690-92-93 Advanced Topics in Industrial Engineering (3,3,3) Special topics in industrial engineering. Prereq: Consent of instructor. May be repeated with consent of instructor.
agement in practice; corporate vision and mission; product, market, organizational, and financial strategies; external factors; commercialization of new technologies; and competition and beyond. Preq: 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; performance measurement and application of statistical techniques in continuous improvement. Team building and leadership issues, and case studies. Preq: 518.


Information Sciences

(Office of the Vice Chancellor for Academic Affairs)

MAJOR DEGREE

Information Sciences M.S.

C. W. Minkel, Interim Director

Professors:
Penniman, W. David, Ph.D. Ohio State
Tencor, Carol, Ph.D. University of Illinois
Wilson, P. (Emeritus), Ph.D. Michigan

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

Assistant Professors:
Bilal, Dania, Ph.D. Florida State
Raber, Douglas, Ph.D. Indiana
Wang, Peiling, Ph.D. Maryland
Watson, Jinx, Ed.D. Vanderbilt
Whitney, Gretchen, Ph.D. Michigan

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.

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.
4. 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 of all applicants unless a graduate degree has been completed prior to application for admission. Applicants should take the GRE on or before the date the graduate program deadline, 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 submitted 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 33 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 18 semester hour sequence of six courses required of all students: 490, 520, 550, 560, 580. These courses address the evolving information environment; foundations of information sciences and technologies; information resources selection, acquisition and evaluation; information access and retrieval. The core curriculum includes a one-hour electronic information and communications laboratory experience required of students during their second 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.

Individualized Curriculum Approach

Students, in consultation with an advisor, may wish to pursue a curricular focus to develop an individualized program of study. Graduates of the school have prepared themselves for a variety of careers, including positions as: corporate information specialist, public librarian, records manager/archivist, information retrieval specialist, medical or law librarian, reference librarian, youth services specialist and many others. Once the core courses have been completed, students are encouraged to take advantage of the individualized curricular approach.

Whatever individualized curriculum is chosen, all students who complete the program receive an M.S. degree accredited by the American Library Association (ALA).

For those pursuing Tennessee Department of Education licensure as a school library information specialist, stipulated requirements apply. See following section.

Tennessee State Department of Education School Library Information Specialist Requirements

The requirements for the Tennessee State Department of Education School Library Information Specialist Initial Endorsement include the following:

1. The 16-hour core plus 551, 567, 571, 572, 585, 595 (9 hours), and 573. IS 595 and 573 must be taken concurrently in the student's final semester. Students pursuing the endorsement must follow the non-thesis option.

The Tennessee State Department of Education School Library Information Specialist Initial Endorsement is also available to candidates who have earned an ALA-accredited Master's degree. Students are required to take 24 hours consisting of 551, 571, 572, 567 or 593 (upon approval of the faculty advisor), 595 (9 hours), and 573. IS 595 and 573 must be taken concurrently in the student's final semester.

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 48 hours required for graduation. (Students may register for IS 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 all courses, all students who elect the non-thesis option must take and pass a written comprehensive examination. A culminating experience 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); 595 Student Teaching in School Library Information Center (S/NC only); 599 Practicum.

FINANCIAL ASSISTANCE OPPORTUNITIES

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

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

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

For application forms and information about financial aid and other information about the M.S. in Information Sciences, write to Admissions, 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. program in Information Sciences is available to residents of the states of Arkansas, Georgia, Virginia, or West Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

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

475 Utilization of Instructional Media (3) (Same as Education in the Sciences, Mathematics, Research and Technology 475.) E

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

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

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

502 Registration and Use of Facilities (3-15) Required for the student not otherwise registered during any semester when using student facilities and/or for 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 electronic information resources. For GSLS 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 entries, subject heading work, general classification, authority control, bibliographic utilities, online library catalogs. F


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

530 Information Access and Retrieval (3) Media for information storage, logical and physical information structures, query 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,Su

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

532 Sources and Services at the University (3) Information sources in engineering, physical and life sciences.

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

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

535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, e.g., non-bibliographic formula and structure databases, content deep, full-text databases, print and electronic delivery alternatives, evaluation, and testing. Sp

537 Information Industry (3) Issues and trends concerning information industry: products and services.

540 Research Methods (3) Research methods in variety of information environments: primary and secondary research; research project design; research resource identification; literature review; the opportunity for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students usually work at least 20 hours each week and thus may extend the period required for the degree. Similar opportunities exist with some other libraries and information agencies in the Knoxville area.

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

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GRADUATE COURSES

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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 the Internet (3) Exploration of worldwide information and communication resources including e-mail, gopher, Archie, Veronica, WAIS, WWW, and newsgroups. F,Sp

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

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

502 Registration and Use of Facilities (3-15) Required for the student not otherwise registered during any semester when using student facilities and/or for 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 electronic information resources. For GSLS 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 entries, subject heading work, general classification, authority control, bibliographic utilities, online library catalogs. F


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

530 Information Access and Retrieval (3) Media for information storage, logical and physical information structures, query 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,Su

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 at the University (3) Information sources in engineering, physical and life sciences.

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

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

535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, e.g., non-bibliographic formula and structure databases, content deep, full-text databases, print and electronic delivery alternatives, evaluation, and testing. Sp

537 Information Industry (3) Issues and trends concerning information industry: products and services.
569 Advanced Production of Audiovisual Software (3) (Same as Education in the Sciences, Mathematics, Research and Technology 569). F,Sp
572 Resources for Young Adults (3) Critical survey of books and related materials for young adults; personal, vocational, and recreational needs and interests. Evaluation, selection, and utilization for school and public libraries. Su
573 Programming for Children and Young Adults (3) Philosophy and objectives of public and school library services for children and young adults. Reading, listening, and viewing guidance for individuals and groups. Program planning, implementation, and evaluation. Pre: 571 or 572.
574 Adult Materials and Services (3) Popular informational and recreational materials and services to meet adult interests in variety of formats. Development of specialized collections.
580 Foundations of Information Sciences and Technologies (3) Definitions of information, information sciences, and information technology; theories of information, information representation, retrieval, and transfer; standards and technologies for information processing and distribution; research front: bibliometrics and informetrics; relationships with other disciplines. F,Sp,Su
581 Seminar in Radio and Television (3) (Same as Broadcasting 580.)
582 Library Automation (3) Computer-based applications and systems for libraries including MARC, bibliographic utilities, retrospective conversion, circulation systems, online catalogs, computer-based reference services, acquisitions and serials control, systems planning and implementation.
583 Information Systems (3) Systems concept, defining system, analysis and design of information systems. Selecting and using information systems to support various activities. User involvement in the development process. F,Sp
584 Database Management Systems (3) Defining data needs, data structures, role of operating systems in data management, file organization, database management systems, logical data models, internal data models, database administration and evaluation, design and implementation of application using database management system. Sp
585 Information Technologies (3) Evolution, trends, capabilities, and limitations of technologies applied to information capture, storage, preservation, access, and distribution. F,Sp
586 Information Retrieval Systems (3) Historical perspective on information retrieval research; statistical and probabilistic retrieval techniques; cognitive user modeling; expert intermediary systems; associations, relations and hyperlinks.
587 Information System Design Project (3) Supervised and structured experience in design and development of computer-based information systems. Pre: 583, 584, 586, 589, and 589. F,Sp
588 Psychology of Human-Computer Interaction (3) Survey of human-computer interaction and introduction to psychological and behavioral science knowledge and techniques useful in design of computing systems for human use. Basic psychological phenomena of human cognition, memory, problem solving, and language and how these processes relate to and condition interaction between humans and interactive computing systems.
590 Problems in Information Sciences (3-6) Pre: Consent of instructor. May be repeated. Maximum 6 hrs.
591 Supervised Readings in Information Sciences (3) Pre: Consent of instructor. May be repeated. Maximum 6 hrs.
592 Seminar in Information Sciences (3-6) Pre: Consent of instructor. May be repeated with consent of advisor. Maximum 6 hrs.
593 Independent Study (3-6) Prerequisite: Consent of advisor. Maximum 6 hrs. F,Sp
594 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose area coincides with interests of student. Pre: Consent of advisor and research director. S/N only. F,Sp
595 Student Teaching in School Library Information Center (9) Planned professional semester: full day school library work and classroom observation activities. S/N only.
599 Practicum (3-6) Opportunity to translate theory into practice under guidance of qualified information professionals. Prereq: Completion of core and pertinent advanced courses relevant to student's practicum design. Minimum 3.0 cumulative GPA. Written consent of advisor and approval of practicum coordinator. May be repeated. Maximum 8 hours. E
601 Advanced Seminar in Information Sciences (3) Theories, research, and traditional practices of information representation, organization, and access and retrieval. Research opportunities and methods. Relationship to and interaction with other disciplines.

Interdisciplinary Programs

(College of Arts and Sciences)

The College of Arts and Sciences offers a series of interdisciplinary undergraduate majors and minors through its Interdisciplinary Programs. These programs include American and African-American Studies, Ancient Mediterranean Civilizations, Asian Studies, Cinema Studies, Comparative Literature, Environmental Studies, Latin American Studies, Legal Studies, Judaic Studies, Linguistics, Medieval Studies, Urban Studies and Women's Studies. Certain courses within these programs are available for graduate credit as listed below. See the Undergraduate Catalog for program descriptions and directors.

African and African-American Studies

GRADUATE COURSES

450 Issues and Topics in African-American Studies (3) Problems, topics, issues, and individuals. May be repeated. Maximum 6 hrs.
452 Black African Politics (3) (Same as Political Science 452.)
483 African-American Women in American Society (3) Historical and contemporary socio-eco-political factors in American society as related to Black women. (Same as Women's Studies 483.)
510 Special Topics (3) May be repeated. Maximum 6 hrs.

American Studies

GRADUATE COURSES

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

Asian Studies

GRADUATE COURSES

471 Selected Topics in Asian Studies (3) Content varies. May be repeated. Maximum 9 hrs.
510 Special Topics (3) May be repeated. Maximum 6 hrs.

African-American Studies

GRADUATE COURSES

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

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

Judaic Studies

405 Modern Jewish Thought (3) (Same as Religious Studies 405.)
425 Early Christian and Byzantine Art, to 1350 (3) (Same as Art History 425.)
431 medieval Art of the West, 800-1400 (3) (Same as Art History 431.)

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 8 hrs.

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

423 The Development of Diachronic and Synchronic Linguistics (3) Development of Western linguistic thought from Hebrews and Greeks through modern times. Readings from Boas, Sapir, Bloomfield, and others. Prereq: 9 hrs of courses required for Linguistics major (300-level or above) 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 French 426, Spanish 426, and German 426.)

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

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

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

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

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

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

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

476 Second Language Acquisition (3) (Same as English 476.)

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

490 Language and Law (3) (Same as English 490.)

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

Medieval Studies

GRADUATE COURSES

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 of the United States (3) (Same as Geography 441.)

464 Urban Ecology (3) (Same as Sociology 464.)

Women's Studies

GRADUATE COURSES

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

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

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

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

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

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

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

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:

Adamson, June N. (Emeritus), M.S., Tennessee
Ashdown, Paul G., Ph.D. ........ Bowling Green
Bovles, Dorothy, Ph.D. ......... Wisconsin
Cade, Dozier C. (Emeritus), Ph.D. ... Iowa
Caudill, C. Edward, Ph.D. ....... North Carolina
Crook, James A., Ph.D. ......... Iowa State
Everett, George A., Ph.D. ......... Iowa
Haskins, Jack B. (Emeritus), Ph.D. ...... Minnesota
Leiter, B. Kelly (Emeritus), Ph.D. ....... Southern Illinois
Littmann, Mark (Chair of Excellence), Ph.D. ........ Northwestern
Miller, M. Mark, Ph.D. ............ Michigan State
Sinajety, Michael W., Ph.D. ....... Southern Illinois
Teeter, Dwight L., Jr., Ph.D.,........ Wisconsin
Tennor, Carol (Adjunct), Ph.D. .... Illinois
Tucker, Willis C. (Emeritus), M.S., ...... Kentucky

Associate Professors:

Dinmock, Susan L., Ph.D. .......... Tennessee
Heller, Robert B., M.A. .......... Syracuse
Morrow, Jerry L., Ph.D. .......... Toledo

Assistant Professors:

Foley, Daniel, M.S.J. .............. Northwestern
White, Candace L., Ph.D. .......... Georgia

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.

Journalism

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. Prereq: 6 hrs mathematics and/or accounting and senior standing. Sp

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

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


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

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

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

460 Mass Communications History (3) Development of journalism as a discipline and the role of mass communications in American history. Prereq: Consent of instructor.

500 Mass Communications History (3) Development of press and role of mass communications in American history. Prereq: Consent of instructor.

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

525 Public Opinion (3) Role of public opinion in journalism and influence of public opinion on mass communications. Prereq: Consent of instructor.

535 Publications Management (3) Development of management, production, marketing, and design for individual newspaper, magazine, and company publications. Prereq: Consent of instructor.

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

570 Seminar in Visual Communication (3) Behavioral aspects of communication with images. In-depth study of visual components and theories of psychological effect in color, shape, texture, and other design elements. Prereq: Editing or Advertising Creative Strategy or Electronic Field Production or equivalent.

590 Communications and International Development (3) Relationship between mass communications and development of nations. Role of communications media of developed nations in "Third World" regions of globe. Prereq: Consent of instructor.
## Language, Communication, and Humanities Education

(College of Education)

### Majors

| Degree | 
| --- | --- |
| M.A., Ed.S., Ed.D., Ph.D. | 

### Professors:

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

### Associate Professor:

- Hodge, R. L., Ph.D.

### The Language, Communication, and Humanities Education unit participates in graduate programs leading to degrees, majors, and concentrations in Master of Science.

#### Education

| Education | 
| --- | --- |
| Track 1-foreign language/ESL education | 
| Track 2-foreign language/ESL education | 
| Educational Specialist Education | 
| English education | 
| Foreign language/ESL education | 
| Doctor of Education Education | 
| English/foreign language/ESL education | 
| Doctor of Philosophy Education | 
| English/foreign language/ESL education | 

#### Art Education

### Graduate Courses

- History and Philosophy of Art Education (3) United States from 1860's to present. Prereq: Consent of instructor.

### Language, Communication, and Humanities Education

### Graduate Courses

- 466 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 of foreign language hours for certification and Admission to Teacher Education Program.

### Teaching English in the Secondary School (3)

#### Techniques of teaching composition, language, and literature. Prereq: Admission to Teacher Education Program.

### Teaching Reading and Literature in the Secondary School (3)

#### Approaches for teaching basic reading skills and ways of teaching literature. Sp

### Developing Reading Skills in Content Fields (3)

#### Techniques for teaching reading and study skills in content areas of school programs. Extensive assessment of textbooks, Middle school and high school. E

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

### 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

### Problems in Musical Composition (2-3) May be repeated. Maximum 9 hrs. S/NC only. E

### Teaching Poetry Grades 7-12 (3)

#### Research and theory in application to teaching of poetry. Design of strategies and materials for teaching and reading of poetry. Review of tests and materials. F

### Teaching Composition in the Secondary School (3)

#### Teaching narration, description, exposition, and argumentation; writing process and marking of student papers. Sp

### Teaching Fiction in the Secondary School (3)

#### Teaching of novels and short stories. F

### Educational Specialist Research and Thesis (3)

#### May be repeated. P/NP only. E

### 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. F

### 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

### Foreign Language in the Elementary Schools Practicum (3)

#### Experiences designing, implementing and assessing second language instruction in elementary schools. Prereq: Consent of instructor.

### English as a Second Language Practicum (3)

#### Experiences designing, implementing and assessing English instruction to non-native speakers. Required course for ESL certification. Prereq: Consent of instructor. Sp

### Teaching English as a Second Language (3)

#### Instructional methods; utilization of assessment procedures to diagnose English proficiency; materials for non-native speaker in K-12 classroom. Required for Tennessee ESL (K-12) license. Prereq: Consent of instructor. Sp

### Teaching Foreign Languages in Secondary Schools (3)

#### Advanced instructional techniques and evaluation procedures; materials analysis and preparation; trends, issues, and research in modern foreign languages and Latin. Prereq: Consent of instructor. Su

### Seminar in Teaching English in Secondary Schools (3)

#### Content varies. Theoretical and practical approaches to teaching English in secondary school. May be repeated. Su

### Linguistics and the Teaching of English (3)

#### Grammar, usage, semantics, dialectology, history of language, and lexicography. Su

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

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

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

### Teaching Drama Grades 7-13 (3)

#### Strategies and materials for teaching creative dramatics, enabling and writing of plays, reading of scripts. Sp

### Developing Speaking and Listening Skills, Grades 7-12 (3)

#### Teaching approaches to nonverbal communication, interpersonal and group communication, public address and listening. Review of tests and materials. Sp

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

### Studies in English Education (3)

#### Issues and research in teaching of English. Su

### Seminar in Curriculum and Instruction (1)

#### Required of 2 consecutive semesters. S/NC only. E

### Organizing and Administering Reading Programs (3)

#### Analyzing and synthesizing instructional, learning, and materials components into classroom, school and system programs. Prereq: 200-level courses in reading education or consent of instructor. Su
Large Animal Clinical Sciences

See College of Veterinary Medicine and Comparative and Experimental Medicine

Law

(College of Law)

MAJOR

DEGREES

Law.......................... J.D., J.D.-MBA, J.D.-M.P.A.

Richard S. Wirtz, Dean

Professors:

Anisley, Frances Lee, LL.M. Harvard
Best, Reba, M.L.S... Florida
Blaze, Douglas A., J.D. Georgetown
Cohen, Neil P., LL.M. Harvard
Cook, Joseph G., LL.M. Yale
Hardin, Patrick, J.D. Chicago
Hess, Amy M., J.D. Virginia
Jones, Durward S. (Emeritus), J.D. North Carolina
King, Joseph H., J.D. Pennsylvania
Lacey, Forrest W. (Emeritus), S.J.D. Michigan
Le Clerc, Frederic S. (Emeritus), LL.B. Duke
Lloyd, Robert M., J.D. Michigan
Overton, Elwin E. (Emeritus), S.J.D. Harvard
Phillips, Jerry J., J.D. Yale
Picquet, Creny, M.S.L.S. Tennessee
Reynolds, Glenn H., J.D. Yale
Rivkin, Dean H., J.D. Vanderbilt
Sewell, Toxey H. (Emeritus), L.L.M. George Washington
Sobieski, John L., J.D. Michigan
Wirtz, Richard S., J.D. Stanford

Associate Professors:

Aarons, Dwight, J.D. UCLA
Anderson, Gary L., LL.M. Harvard
Beintema, William J., J.D. Miami
Black, Jerry P., Jr., J.D. Vanderbilt
Bunker, Mary Garrett, J.D. George Washington
Cornett, Judy M., J.D. Tennessee
Davies, Thomas Y., J.D. Northwestern
Gray, Grayford B., J.D. Vanderbilt
Kennedy, Deserlee A., LL.M. Temple

Leatherman, Don A., LL.M........ New York
McAlpine, Janice E., J.D. Michigan
Medill, Colleen E., J.D. Kansas
Parker, Carol M., J.D. Illinois
Pierce, Carl A., J.D. Yale
Plank, Thomas E., J.D. Maryland
Stark, Barbara, J.D. New York
Stein, Gregory M., J.D. Columbia
Thorpe, Steven R., J.D. Mercer
Wertheimer, Barry M., J.D. Duke

Assistant Professors:

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

The College of Law offers the Doctor of Jurisprudence degree program; a dual degree program with the College of Business Administration leading to the J.D. and the Master of Business Administration degree; and a dual degree program with the Department of Political Science, College of Arts and Sciences, leading to the J.D. and Master of Public Administration. In addition graduate students may be eligible to take a limited number of law courses to count toward a graduate degree.

Current information regarding admission, financial aid, course requirements, academic policies, extracurricular activities, and student services is available from the Admissions Office, The University of Tennessee, College of Law, 1505 W. Cumberland Ave., Knoxville, Tennessee 37996-1810. Completed application should be received before February 1 of the year of requested admission.

DEGREE OF DOCTOR OF JURISPRUDENCE

The degree of Doctor of Jurisprudence will be conferred upon candidates who complete, with the required average, six semesters of resident law study and who have 89 semester hours of credit, including all required courses. The required average is 2.0 and that average must be maintained on the work of all six semesters and also for the combined work of the grading periods in which the last 28 credit hours taken in residence were earned. Averages are computed on weighted grades. Grades are on an alphabetical scale from A+ to F. No credit toward the J.D. degree is awarded for grades of D- or F.

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

Refer to the Law Catalog and Student Handbook for current degree requirements.

Concentration in Business Transactions

Students interested in a concentration in business transactions must complete all of the following law courses:

862 Introduction to Business Transactions
818 Concentration in Business Transactions
972 Income Taxation of Business Organizations

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

Students electing a concentration in advocacy and dispute resolution may not take any of the above courses on an S/NC basis.

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

Curriculum

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

The College of Law will award a maximum of nine (9) semester hours toward the J.D. degree for acceptable performance in approved graduate-level courses offered by
the College of Business Administration. Three of the 9 semester hours must be earned in Accounting 501, 503, or a more advanced accounting course.

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

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

**Awarding of Grades**

For grade recording purposes in the College of Law for graduate business courses and in the College of Business Administration for law school courses, grades awarded will be converted to either Satisfactory or No Credit and will not be included in the computation of the student’s grade average or class standing in the college where such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B+ grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a College of Law course in which the student has earned a 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 grade 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.-M.BA 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.

**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. Applicants may be accepted on a non-competitive basis and must meet eligibility and financial aid criteria set by the College of Law.

**Awarding of Grades**

For grade recording purposes in the College of Law and the Department of Political Science, grades awarded in courses of either college may be used on a regular grade 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.

**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 grade level courses (500 or 600 level) offered in the Department of Political Science. The M.P.A. program will award a maximum of 9 semester hours of credit toward the M.P.A. degree for successful completion of approved courses offered in the College of Law. All courses for which such cross-credit is awarded must be approved by the J.D.-M.P.A. coordinators in the College of Law and the Department of Political Science. All candidates for the degree must successfully complete Administrative Law (Law 821) and are encouraged to take Local Government (Law 824). An internship is strongly recommended for students in the dual degree program, as it is for all M.P.A. candidates, but an internship is not required.

During the first two years in the dual program, students will spend one academic year completing the required first year of the College of Law curriculum and one academic year taking courses solely in the M.P.A. program. During those first two years, students may 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.

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.

**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.-M.BA 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 Grading 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, unconscionability and other controls of promissory liability. Introduction to relevant portions of Article 2 of the Uniform Commercial Code.

804 Contracts II (3) Continuation of Contracts I. Issues arising in contract formation; warranty; 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 of land; defenses based on plaintiff's conduct; contributory and comparative negligence, assumption of risk, failure to take precautions, and avoidable consequences; causation, proximate cause; duty rules; and questions of arrest and several or several liability.

808 Torts II (3) Vicarious liability and related concepts; strict liability for dangerous activities and abnormally dangerous activities; products liability; nuisance, defamation and invasion of privacy; economic torts: misappropriation of trade secrets and unfair competition; protection of business opportunities; immunities: those of government, governmental employees, charities and family members, and damages.

809 Criminal Law (3) Substantive aspects of criminal law; general principles applicable to all criminal conduct; specific analysis of particular crimes; defenses to crimes.
The Leadership Studies in Education unit participates in graduate programs leading to degrees, masters, and concentrations in:

Master of Science

Leadership Studies in Education

Educational administration and supervision

College Student Personnel

Specialist in Education

Education

Educational administration and supervision

Doctor of Education

Education

Leadership studies (educational administration and supervision; higher education)

See Education under Fields of Instruction for full description of all degree requirements. The Leadership Studies unit focuses on the preparation and development of administrative and instructional leaders who will serve in diverse settings of schools and colleges, community and human service agencies, adult and continuing education organizations, and educational units of government and corporate organizations.

The unit offers an alternative approach to residence for the Doctor of Education degree program. This alternative residence involves, among other requirements, a two-year, on-campus, continuous enrollment in Leadership Studies 606, Leadership Forum. Interested students should contact the unit for further information.

The annual admission deadline is March 15 for the Ed.S. and doctoral programs, and November 1 and March 15 for the master's program.

ADMISSION REQUIREMENTS

General test of the Graduate Record Examination; writing sample if GRE verbal is below 50th percentile; leadership potential judged by activities in organizations; and rating forms or letters of recommendation. The Ed.D. applicant must also interview with all faculty members on campus or elsewhere.

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, democratic, and supervisory competencies: political, social, ethnic, cultural, and racial environments in which schools operate. Prereq: M.S. introductory core or consent of instructor. F, Su

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

544 School Finance and Business Management (3) For prospective building level administrators. Financial and planning 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 management and (or micro-organizational) level: interviewing, personnel planning, collecting and maintaining employee information, supervision of instructional and non-instructional personnel, classroom supervision, staff evaluation, and staff development. Prereq: Introductory M.S. core or consent of instructor. Sp, Su

553 Strategies of Educational Planning (3) Processes for improving decision-making function through use of both quantitative and qualitative planning techniques. Policy analysis, CPM,PERT, Delphi. 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 legal and public education. Prereq: M.S. introductory core or consent of instructor. F, Su

580 Internship in Educational Administration (3) Field experience in appropriate educational setting working directly with administrator. A total of planned program of study. Placement by department assignment. Some on-campus classes in conjunction with 583 or 585. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F, Su

582 Educational Leadership and District-Level (3) Role of central administrative team; relationships, behaviors, concepts and competencies for developing and maintaining effective school organization, and 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 as effective educational leader. Simulation materials and field-based activities. Culminating course with internships at end of planned course of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F, Su

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/Nc 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/Nc 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/Nc 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/Nc only. E

605 Advanced Seminar in Administrative Theory (3) Interdisciplinary seminar. Readings selected by faculty for research and scholarly value from early to current classified works and periodical literature in administrative and organizational theory. 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 and committee. Maximum 12 hrs. S/Nc only. E

614 Statistical Methods for School Administrators (3) Descriptive and inferential statistical methods, parametric and non-parametric statistical techniques used 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 Political and Educational Environments (3) Political theories and practices as they apply to operation of public school systems and higher educational institutions. Interdisciplinary discussions of community power structures, special interest groups, based on literature and research in education, sociology, and political science. Field inquiry. Prereq: 529, 616 or equivalent or consent of instructor. F

644 Educational Finance and Business Management (3) Contemporary financial and budgetary policies and their influence upon education, nation and citizens. Superintendent 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 rights, collective negotiations, human relations, staff development, and staff evaluation. Prereq: 546 or consent of instructor. F, Su

655 State-Federal Relations in Education (3) Interrelationships between federal, state, and local responsibilities and organization for education by analysis of traditional, legal, fiscal and functional aspects of educational partnership. Funding partnerships: discussion of grant proposal development processes. Prereq: 546 or consent of instructor. F, Sp

656 Legal Foundations of Public Education (3) School law; constitutional foundations as they relate to public education at state and local levels. F, Su

658 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 develop values 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 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

593 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, policy analysis skills and critical analysis and evaluation of philosophical principles underlying American education. Continuous 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 DEGREES

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 Life Sciences program. 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 work, a pattern of coursework 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 will prepare students to participate in the wide variety of opportunities presented by the use of living cells and their components for the production of useful materials. This will be achieved at the M.S. level by a prescribed course of study of the biology and 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, bioprocess engineering, bioproduction, 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 580; 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; athology; plant, physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

511 Advanced Cellular Biology (3) Cell structures and functions of molecular and supramolecular level. Membrane structure, function, and biogenesis; cellular communication; receptors and membrane flow; growth regulation and oncogenes; plant cell structure and function; connective and modify; mitosis and meiosis; blood and immune cells.

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

CONCENTRATIONS

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


Minimum course requirements for management--Three courses from the following: 511, 521, 522, 531, 541, 542, 551, 571, 581, 593, 595.

Business Administration 510, 599. Selection must be approved by the Management Department. MBA advisor. For forest industries management--511; Forestry 580, 585. For environmental management--581 plus two approved courses from the following: Ecology and Evolutionary Biology 520, 555; Environmental Engineering 510, 555, 556; Chemical Engineering 581; Economics 677, 678; Agricultural Economics 570; Sociology 560, 565; Law 666, 867; Geography 577. For manufacturing management--511, 542.

Management Science 526, and an Industrial Engineering/Management Science course approved by the designated faculty. Industrial Engineering 524 or Management Science 541 are recommended.

Additional courses may be accepted 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 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 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

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, dynamics, 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.

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

541 Management Information Systems (3) Systems planning and control function. Application of models to real-world systems.

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

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

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

581 Environmental Management (3) Managerial 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/N/C or letter grade.

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

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

610 Advanced Topics in Life Sciences (1-3) Topics vary. May be repeated. Maximum 6 hrs.

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

612 Seminar in Strategic Management (3) Review and analysis of important books and monographs in strategic management. Understanding of thought and emergence of distinct paradigms.

Management Science

(College of Business Administration)

MAJORS

DEGREES

Management Science............................. M.S., Ph.D.

M. M. Srinivasan, Chairperson

Committee Members:

Bowers, Melissa R., Management; Bozdogan, Hamparsum, Statistics; Edirisinghe, Hanaka F., Management; Fowler, Oscar S., Management; Gilbert, Kenneth C., Management; Leitnaker, Mary G., Statistics; Noon, Charles E., Management; Ramaekers, Bruce Anthony, International Studies; Soni, Pranav R., Geography; Srinivasan, M. M., Management.

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, health, 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

Hours

Core Requirements

Management Science 531, 532, 533, 534, and 691 or 692

Statistics 563

Electives 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 coursework 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, through directed 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, 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 mathematics, statistics and computer science, a high degree of mathematical maturity to enhance a potential career in management, research, or teaching.

Admission Requirements

The doctoral program requires three 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 565, 566, and 567, by passing a written qualifying examination. Mastery of 12 to 14 semester hours in mathematics coursework must be demonstrated by passing a written qualifying examination. Topics normally include numerical analysis, either Mathematics 471, 472, 453, and 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty will consider waiving the mathematics or statistics qualifying examinations.

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

Total

40

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 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 doctoral 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.

GRADUATE COURSES

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

502 Registration for Use of Facilities (5-15) 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

526 Systems Modeling and Simulation (3) (Same as Industrial Engineering 526.)

531 Mathematical Programming (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis, linear fractional, piecewise-linear, separable and integer programming, transportation linear programs. Prereq: Fundamentals of matrix algebra. (Same as Industrial Engineering 525.)

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

533 Computational Mathematical Programming (3) Computational aspects of mathematical programming models, in particular for large systems. Prereq: 531 and proficiency in computer language.

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


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

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

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

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

(College of Business Administration)

MAJOR

DEGREES

Business Administration.................. MBA, Ph.D.

David W. Schumann, Head

Professors:

Barnaby, D. J., Ph.D. ............... Purdue
Cadotte, E. R., Ph.D. .............. Ohio State
Davis, F. W., Jr., Ph.D. .......... Michigan State
Dier, G. N., DBA ..................... Indiana
Frey, J. L. (Emeritus), Ph.D. ...... Florida
Hendrix, F. L. (Emeritus), Ph.D. .... Ohio State
Ph.D. .................................. North Carolina
Langley, C. J. (Dove Prof.), Jr., Ph.D., Penn State
Mentzer, J. T. (McNair Professor of Excellence), Ph.D. .......... Michigan State
Mundy, R. A. (Taylor Prof.), Ph.D. .... Penn State
Schumann, D. W., Ph.D. .......... Missouri
Woodruff, R. B. (Rockefeller Professor of Management), Ph.D. ...... Indiana

Associate Professors:

Dabholkar, P. A. (Liaison), Ph.D. .......... Georgia State
Foggin, J. H. (Liaison), DBA .......... Indiana
Gardial, S. F., Ph.D. ................. Houston
Holcomb, M. C., Ph.D. .............. Tennessee
Reizenstein, R. C., Ph.D. .......... Cornell
Rentz, J. O., Ph.D. .................. Georgia

Assistant Professor:

Moon, M. A., Ph.D. .................. North Carolina

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Logistics and Transportation, Marketing.

Minimum course requirements for logistics and transportation—501, 506, 507, and one course from the following: 504, 505, 506, 593, and 599. For marketing—12 hours from among the following courses: 601, 602, 603, 604, 605, 606.

Ph.D. Concentration: Logistics and Transportation, Marketing.

Minimum course requirements for logistics and transportation—12 hours to include 601, 602, 603, 604, 605, 606. For marketing—12 hours from among the following courses: 601, 602, 603, 604, 605, 606.

Marketing

GRADUATE COURSES

502 Registration for Use of Facilities (3-15) Required for the student not otherwise enrolled 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 Buyer Behavior—Analysis for Marketing (3) Consumer behavior concepts and processes developed and applied to market analysis and design, and control of marketing programs. Psychological 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 market opportunity in markets, framework for finding markets and analyzing them for opportunity, application of market opportunity analysis 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 conceptual and analytical skills from each component area of marketing to formulate cohesive, well-organized marketing programs. 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. E

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

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

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

513 Independent Study (3-6) Directed research and study. Prereq: Consent of instructor. May be repeated.

514 Special Topics Seminar in Logistics and Transportation Strategy (3-6) Designed to study specific current problem areas in logistics and transportation. Topic announced prior to offering. Prereq: Consent of instructor. May be repeated.

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

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

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

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

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

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

Logistics and Transportation

GRADUATE COURSES

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise enrolled 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 customers in logistics and transportation marketplace.

506 Logistics Systems Management (3) Development of strategy for management of logistics systems. Logistic level integration of logistics operations with marketing, production, and other decision areas. Practical applications through case approach and simulation game.

507 International Logistics and Transportation (3) Logistics strategy in the multi-national firm: materials management, international sources and distribution, and import/exporting. Issues: international carrier management, and operations and comparative international transport systems analyses.

508 Executive-in-Residence Seminar in Logistics and Transportation Strategy (3) Capstone, integrative case course in logistics and transportation strategy. Participation in Executive-In-Residence program that provides student interaction with top-level logistics and transportation executives.

509 Independent Study (3-6) Directed research and study. Prereq: Consent of instructor. May be repeated.

529 Special Topics in Logistics and Transportation (3-6) Designed to study specific current problem areas in logistics and transportation. Topic announced prior to offering. Prereq: Consent of instructor. May be repeated.

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

601 Seminar in Logistics and Transportation Research (3) Analysis of contemporary models and methodologies in logistics and transportation research, topical coverage at discretion of instructor.

602 Seminar in Evolution of Logistics Thought (3) Traces evolution of logistics and transportation thought: dynamic development of principles and tools developed as organizational missions and environmental change. Economic and policy issues peculiar to transportation and other service organizations.

603 Research Methodology in Logistics and Transportation (3) Various research methods used in logistics and transportation. History and development of body of knowledge, review of literature, and discussion of contemporary research issues. Development of student's dissertation research proposal.

Materials Science and Engineering

(College of Engineering)

MAJORS

DEGREES

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

Joseph E. Spruiell, Head

Professors:

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

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

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

THE MASTER'S PROGRAM

Thesis Option

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

1. A major consisting of 12 to 18 semester hours of graduate courses in metallurgical engineering or polymer engineering. The polymer engineering major must include 540, 541, 543, 546, 549, 550 and 572 unless similar material has been covered in prior coursework.

2. Additional courses amounting to 6 to 12 semester hours total in any approved engineering, chemistry, physics, or other related fields.


All resident students are required to register for and participate in the graduate seminar in metallurgical engineering or polymer engineering, as appropriate, during each semester in which it is offered. Credits for the seminar do not count towards satisfying the coursework requirements.

Non-Thesis Option

Under certain conditions, a candidate may apply for a non-thesis option. To be eligible, the candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience or research publications would be examples of such evidence. A departmental faculty meeting will consider each application individually. Upon acceptance, a supervisory committee of three will be appointed, at least two being from the Department of Materials Science and Engineering. The requirements for completion of the non-thesis option are as follows:

1. A total of at least 33 hours in graduate courses in metallurgical engineering, polymer engineering, or related fields.

2. Satisfactory completion of a critical examination to be conducted by the faculty committee and covering the review paper and other areas of metallurgical or polymer engineering.

THE DOCTORAL PROGRAM

Students applying for entrance into the doctoral program must display concrete evidence of ability to perform and report independent research to the satisfaction of the department. The doctoral thesis may be offered as such evidence. Department requirements consist of the satisfactory completion of:

1. Graduate courses in materials science and engineering amounting to approximately 24 semester hours, subject to approval by the faculty committee.

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, and 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.

GRADUATE COURSES

405 Structural Characterization of Materials (4) X-ray diffraction and fluorescence; scanning electron microscopy; microanalytical techniques.

421 Mechanical Behavior of Materials II (3) Description of stress and strain; linear elastic constitutive equations; isotropic and anisotropic moduli in various materials; yield criteria; brittle fracture; energy-plastic strain, constitutive equations, forming operations and limit criteria. Prereq: Mechanical Behavior of Materials.


426 Materials Joining (3) Processes for joining metals, polymers, ceramics, and composites; 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 ceramic matrix composites; chemical and physical behavior; fabrication of composites; microstructural characterization; physical and mechanical properties of ceramic matrix composites; processing and properties. Prereq: Materials Science and Engineering.

470 Environmental Degradation of Materials and Mechanisms, measurement techniques and control of environmental degradation processes in metals, polymers, ceramics, and composites; materials selection and design considerations. Prereq: Introduction to Materials Science and Engineering. Recommended for chemical engineering, mechanical engineering and science and engineering majors.

472 Fundamental Principles of Composite Materials (3) Establishment of physical principles basic to design, manufacture and application of fiber reinforced polymer, metal, and ceramic composites. Prereq: 302 or equivalent.

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

475 Fracture- Safe Design (3) (Same as Engineering Science and Mechanics 432.)

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. 

503 Graduate Seminar in Metallurgical Engineering (1-2) Admission to graduate program may be repeated. S/NC only. E

504 Graduate Seminar in Polymer Engineering (1-2) Admission to graduate program may be repeated. S/NC only. E

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

522 Defects in Crystals (3) Analytical and experimental analysis of deformed 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, leading to plastic deformation; 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 Metallic Thermodynamics (3) Applications of chemical thermodynamics to metallic problems: refining, oxidation, surface treatments, alloy systems. Prereq: 570 or equivalent.

525-26 Welding Metallurgy (3,3) Welding processes; physical metallurgy of welding; phase transformations; heat flow, residual stresses; theories of welding defects, cracking and porosity formation; applications to process utilization.

526 Ceramic Matrix Composites: Material and Mechanisms (3) Same as Engineering Science 526.

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

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

531 Advanced Corrosion (3) Analysis of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to corrosion; 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 beds, multiphase systems. Basic concepts in rheology; applications in polymer processing: screw extruder operation, injection molding. (Same as Chemical Engineering 541.)

542 Further Topics in Polymer Processing (3) Description and analysis of selected polymer processing operations. Prereq: 541.


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

546 Mechanical Properties of Solid Polymers (3) Types of mechanical behavior: Hookean and rubber elasticity; plastic deformation: fracture, linear and fiber, creep and stress relaxation; glass transition; dynamic mechanical behavior and testing; loss tangent; experimental methods. Introduction to mechanical properties of polymeric composites.

549-50 Laboratory Methods in Polymer Engineering (1,2) Basic experimental techniques and instrumentation, associated with characterization, x-ray and light scattering, calorimetry, rheometry, mechanical properties of solid polymers; polymer processing operations. Coreq: 540 or consent of instructor. 549-549SNC only.

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

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


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 determination of structure; powder and single crystal x-ray techniques; introduction to crystal structure determination; characterization of orientation; application to inorganic, metallic and polymer structures.

574 Formability of Materials (3) Modeling and analysis of plastic deformation with application to powder processing and secondary forming operations: cold forming and noncrystalline materials; flow localization, instability, predictive testing. Prereq: Consent of instructor.

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


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

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

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

641 Advanced Rheology and Viscoelasticity Theory (3) Continuum mechanics, formulation of viscoelastic theories for describing deformations 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 of structure development to analysis of polymer processing operations. Prereq: 541. (Same as Chemical Engineering 642.)

643 Phase Transformations in Polymers (3) Glass transition and glassy state; annealing of polymeric glasses; crystallization of polymers; nucleation, growth and morphology; secondary nucleation theory; solidification of composites; crystallization under stress. Prereq: 543.

671 Quantitative Microscopy (3) Principal acoustic, optical, x-ray, neutron, electron 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 special 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 (College of Arts and Sciences)

MAJOR

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

John B. Conway, Head

Professors:
Alexiades, V., Ph.D. ......................... Delaware
Allikakos, N., Ph.D. ......................... Brown
Anderson, D. R., Ph.D. ...................... Chicago
Baker, G. A., Ph.D. ......................... Cornell
Bakid, John S. (Emeritus), Ph.D. .......... Iowa
Carruth, J. H. (Emeritus), Ph.D. .......... Louisiana State
Clark, C. E., Ph.D. ............................ Florida State
Conway, J. B., Ph.D. ......................... Louisiana State
Daverman, Robert J., Ph.D. ............... Wisconsin
Dobbs, D. E., Ph.D. ......................... Cornell
Dyadak, J., Ph.D. ............................. Warren
Frensdon, Henry, Ph.D. .................... Illinois
Gross, L. J., Ph.D. ........................... Florida State
Hallam, I. G., Ph.D. .......................... Missouri
Hinton, D. B., Ph.D. ......................... Tennessee
Hush, L. S., Ph.D. ............................ Florida State
Johannson, K., Ph.D. ....................... Bielefeld
Jordan, G. Samuel, Ph.D. ................. Wisconsin
Karakashian, O., Ph.D. ..................... Harvard
Kuperan, J. A. (UTSI), Ph.D. ............. MIT
Lenhart, S., Ph.D. ............................ Kentucky
McConnick, R. M., Ph.D. ................... Duke
Mathews, H. T. (Emeritus), Ph.D. ....... Tulane
Miller, D. D. (Emeritus), Ph.D. .......... Michigan
Reajt, B. S., Ph.D. ............................ Illinois
Reddy, K. C. (UTSI), Ph.D. ............... Indian IT
Rosinski, J., Ph.D. ............................ Wroclaw
Schafer, P. W., Ph.D. ....................... Maryland
Serbin, Steve, Ph.D. ......................... Cornell
Simpson, H., Ph.D. ........................... California
Son, K. (Emeritus), Ph.D. ................. Ohio State
Son, R. P., Ph.D. ............................. Oregon State
Stallman, F. W. (Emeritus), Ph.D. ....... Giessen
Stephenson, K. R., Ph.D. ................... Wisconsin
Sundberg, C., Ph.D. .......................... Wisconsin
Thistlethwaite, M. B., Ph.D. .............. Manchester
Wade, W. R., Ph.D. ........................... California (Riverside)
Wagner, C. G., Ph.D. ....................... Duke

Associate Professors:
Freire, A., Ph.D. ............................ Princeton
Kimbrell, K. (UTSI), Ph.D. ............... Ohio State
Kot, Mark, Ph.D. ............................ Arizona
Kuo, Y., Ph.D. ............................... Cincinnati
Murray, A., Ph.D. ............................ Pennsylvania
Plaut, Conrad, Ph.D. ....................... Maryland
Richter, Stefan (Lisbon), Ph.D. ......... Michigan
Row, W. H., Jr., Ph.D. ...................... Wisconsin
Smith, J., Ph.D. ............................... California

Assistant Professors:
Collins, Charles R., Ph.D. ................. Minnesota
Feng, Xiaohong, Ph.D. ..................... Purdue
Gavrielides, Sargis, Ph.D. ................. Moscow State
Guan, Bo, Ph.D. ............................. Massachusetts
Xiong, Jie, Ph.D. ............................ Virginia

Mathematics Department has three graduate degrees: (1) the Master of Mathematics degree, intended primarily for teachers, (2) the Master of Science degree, designed to prepare students for industrial employment and for teaching, and (3) the Doctor of Philosophy degree, designed to prepare students for industrial employment and for college and university teaching and research. Contact the department office for additional information.
least 6 hours of resident graduate credit in courses numbered above 400 and approved by both the major department and the Department of Mathematics.

For additional information, please visit the graduate website on the Department of Mathematics’ homepage at www.math.utk.edu.

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 community college teaching experience. Applicants 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 500 level. The coursework must include 504, 505, 506, 507, and 6 hours in the Department of Mathematics. At most 8 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 department offers two options for the Master of Science degree. The first option requires a thesis for which 6 hours must be earned along with 24 additional hours of work in acceptable courses numbered above 400. Of the additional hours, 6 may be in an area outside the department and 15 must be in courses in mathematics numbered above 500.

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

Concentration in Applied Mathematics

For this concentration, available under the thesis or the non-thesis option, the student must complete the following:
2. One hour of Seminar in Applied Mathematics 519 or Seminar in Mathematical Ecology 589.

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 mathematical ecology concentration. A student intending to work in mathematical ecology may either be required to complete the interdisciplinary mathematical ecology concentration. A student may elect to switch from one to the other provided the constraints of the latter option have not been violated. A student's status after electing such transfer is determined by the complete history of the student's earlier examinations from the standard program and the interdisciplinary mathematical 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 a student's seventh year.
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 in advance by the Department of Mathematics. The sequence must be taken at an institution of comparable quality to the University of Tennessee, Knoxville. A student may not count both Real Analysis and Applied Linear Analysis.

Requirements 1-4 must be completed no later than 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, but 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 UT graduate program in mathematics no longer than one year may take written examinations at one time during that year without having that sitting for the examinations or any incurred failure(s) count toward the limits imposed above.
d. 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 siting for the examination and any failure(s) are not counted toward the limits in condition c.

Mathematical Ecology Concentration

The student must pass written examinations in three subjects:
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 must 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 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 I. 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 subject use. A student desiring to use a course in Group IV, other than the one designated as the written examination subject in I. 2, must obtain the permission of the department of mathematics.

**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 class. Prereq: Calculus I and Introduction to Abstract Mathematics, or consent of instructor.

401 Combinatorics (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts and problems in mathematics. Does not satisfy 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 equations modeling biological systems. May not be counted toward graduate degree. Prereq: Calculus II or Biocalculus.

407 Probability (3) Axiomatic probability, multivariate distributions, conditional probability and expectations, random walks, Markov chains and Poisson processes. Prereq: Calculus II or Biocalculus.


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

422 Probability I (3) Axiomatic probability, multivariate distributions, conditional probability, independence, moments, limit theorems, and the concentration of measure. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.

423 Probability II (3) Elements of stochastic processes: Random walk, Markov chains and Poisson processes. Other topics as selected by instructor. Prereq: 422.

424 Calculus III (3) Derivation of standard mathematical distributions: mean and variance, central limit theorems, point and interval estimation. Basic sampling distributions, Neyman-Pearson theorem; likelihood ratio and other parametric and non-parametric tests; sufficient statistics, probability theory I or consent of instructor.


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

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

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

447 Honors: Advanced Calculus I (3, 3) Honors version of 445-46. 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, integral domains, factorization, linear transformations. Prereq: Matrix Algebra I and Introduction to Abstract Mathematics, or consent of instructor.

457 Honors: Abstract Algebra I, II (3, 3) Honors version of 455-56. Prereq: Matrix Algebra I and Introduction to Abstract Mathematics, or consent of instructor.

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

461 Topology (3) Topological concepts, homotopy, connectedness, compactness, continuous functions, homeomorphisms, continua and topological invariants. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.

462 Numerical Analysis (3) Computation, instabilities, and rounding. Interpolation and approximation by polynomials, 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.)

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

473 Mathematical Statistics (3) Modeling, analysis, and computation applied to scientific/technical/industrial problems. Prereq: Differential Equations I and either Computer Literacy for Mathematicians or Numerical Algorithms, 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 mentor to supervise independent work. May be repeated. Minimum 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. Minimum 9 hrs.

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

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

504 Discrete Mathematics for Teachers (3) Mathematical logic and methods of argument, sets, functions and relations, combinatorics. Normally first graduate course for students seeking M.M. degree. 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.

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; integral domains 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.

507 Probability and Statistics for Teachers (3) Probability models. Discrete random variables. Binomial, hypergeometric, and Poisson distributions. Continuous random variables and their distributions. Sampling theory. 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 for 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. Minimum 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.

511-12 Methods in Applied Mathematics (3, 3) Fundamental and technical approaches and applications in fluid mechanics and continuous models of physical, engineering and biological systems; difference equations, networks and graphs, control systems; solutions of partial differential equations; asymptotic and perturbation methods; weak convergence of differential and delay-differential equations, and other topics. Coreq: 510. Prereq or coreq: 445 or 446 and 453.


515-16 Analytical Applied Mathematics (3, 3) Analysis of advanced techniques in modern context for applied problems. Nonlinear difference and differential equations, scaling, perturbation theory, variational approaches, transform theory, wave phenomena and conservation laws, stability and bifurcation, distribution theory. Prereq: 446 or 448, 453, and either 511-12 or both 431 and 435.

517-18 Mathematical Methods in Physics (3, 3) Same as Physics 571-72.

519 Seminar in Applied Mathematics (1-3) May be repeated. Minimum 12 hrs.

521-22 Enumerative Combinatorics (3, 3) Steeve methods, recursion, generating functions, and permutation groups applied to enumerated structures and incidence algebras and combinatorics of partially ordered sets.

523-24 Probability (3, 3) Pertinent facts from measure theory, definition of abstract probability spaces; random variables, independence; random variables and laws of large numbers; general theory of distribution of random vectors and their dependence; weak and strong convergence, weak compactness and Levy's continuity theorem in Euclidean spaces; infinitely divisible distributions and characteristic functions of infinitely divisible distributions, martingales, Doob's martingale convergence theorems, martingales, and optional stopping theorems. Prereq: 445-46. Recommended prereq: 425.

525-26 Statistics (3, 3) Pertinent facts from probability theory; formulation of statistical models; sufficiency, Fisher-Neyman factorization theorem, exponential families, Bayesian models; methods of estimation and hypothesis testing; maximum likelihood, minimax unbiased and minimum variance unbiased estimation, asymptotic efficiency and optimality; the confidence procedures and hypothesis testing; optimal tests and confidence intervals, the Neyman-Pearson lemma; large sample properties; weak convergence and independence; random variables and their applications to statistical decision theory. Prereq: 445-46. Recommended prereq: 426.

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


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

537-38 Mathematical Principles of Continuum Mechanics (3,3) Conservation principles, equations of motion and fluid for fluids and elastic solids, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory. Prereq: 431, 435, 446 or 448, or consent of instructor.

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


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

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

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


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

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


567-68 Differential Geometry (3,3) Classical differential geometry in two and higher dimensions; curves and surfaces in Euclidean space. Gauss-Bonnet theorem, hyperbolic geometry, Manifolds and Riemannian metrics; connections, geodesics, Jacobi fields, sectional curvature. Differential forms and moving frames. Prereq: 445-46 or consent of instructor.

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


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

577 Optimization (3) Major topics in optimization with problems developed from real-world applications including constrained and unconstrained optimization with analysis of major algorithms and utilization of appropriate software. Prereq: Numerical Algorithms, 453, 445-46.

578 Numerical Methods for Partial Differential Equations (3) Numerical approximation of solutions of partial differential equations, including conservation laws and hyperbolic, parabolic, and elliptic problems. Derivation, physical meaning, and implementation of schemes. Prereq: 435 or 512 or 615, 435 or consent of instructor.

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

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

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

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

585 Optimal Control Theory (3) Deterministic optimal control. Examples including calculus of variations, optimal trajectories, and engineering control problems. Introduction to stochastic control. Prereq: 445-46 or consent of instructor.

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

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

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

600 Doctoral Research and Dissertation (1-3) May be repeated with consent of department. Maximum 12 hrs.

607-68 Advanced Differential Geometry (3,3) Selected topics from Riemannian geometry and analysis on manifolds: Lie groups, Lie algebra, geometry, spectrum of Laplacian, Hodge Theory, variational problems, curvature and topology of manifolds. Prereq: 567-68 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

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


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

681-82 Advanced Mathematical Ecology (3,3) Selected topics from theoretical and applied mathematical ecology: population, community, ecosystem dynamics and applied topics such as demography, ecotoxicology, epidemiology, environmental change, and resource management. Prereq: 583. May be repeated. (Same as Ecology and Evolutionary Biology 681-682.)
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. Changes from these programs to another requires departmental approval. Each applicant is advised as to any prerequisite courses 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 performance; gas dynamics; flight and aerospace mechanics; aeroacoustics; and structures and stress analysis.

In Engineering Science, program concentrations include solid mechanics, fluid mechanics, computational mechanics, mechanics of composite materials, biomedical 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 or whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering or can best be met by interdisciplinary study in engineering. The program's course offerings and changes in these offerings 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 undergraduate curricula in mechanical or aerospace engineering and to qualified graduates of other curricula who satisfy the necessary prerequisites. A program application is required in addition to the Graduate School application. Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their undergraduate studies. 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 and Engineering Science; however, at least one member of the student's graduate advisory committee must be on the faculty of the Department of Mechanical and Aerospace Engineering and Engineering Science.

THE MASTER'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 (a) graduate students with significant professional work experience and (b) graduate co-op students with the opportunity to focus their programs in special areas through either greater coursework 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>14 30 14</td>
</tr>
<tr>
<td>Coursework</td>
<td>24 30 24</td>
</tr>
<tr>
<td>Courses in department (500 level or above) (minimum)</td>
<td>12 18 12</td>
</tr>
<tr>
<td>Mathematics (400 level or above)</td>
<td>6  6  6</td>
</tr>
<tr>
<td>Engineering courses below 500 (maximum)</td>
<td>3  3  3</td>
</tr>
<tr>
<td>Thesis credit</td>
<td>6 n/a n/a</td>
</tr>
<tr>
<td>Problems credit (590)</td>
<td>n/a n/a 6</td>
</tr>
<tr>
<td>Total</td>
<td>30 30 30</td>
</tr>
</tbody>
</table>

All three program options require participation in the departmental graduate seminars program, and passing a final examination on all work submitted for the degree. Option I final examination will cover all coursework. Option II final examination will cover all the selected engineering problems. The thesis option, Option I, requires submission and defense of a written thesis that demonstrates the ability to conduct and report an independent investigation. The problems option, Option III, requires a formal report to be written for each selected engineering problem.

In Engineering Science, two M.S. options are offered: Option I requires a thesis, while Option II does not. The Option II is restricted to those students who have had significant engineering professional work experience. In Option I, a minimum of 30 semester hours including the thesis is required. In Option II, a minimum of 30 hours is required. Credit requirements for these two options are summarized below.

<table>
<thead>
<tr>
<th>Course Areas</th>
<th>Hours Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option I</td>
<td>14 30 14</td>
</tr>
<tr>
<td>Coursework</td>
<td>24 30 24</td>
</tr>
</tbody>
</table>
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 Admissions Specialist in the Office of Graduate Admissions and Records.

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 the 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 a master's program 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 UTSI campuses.

GRADUATE COURSES

422 Aerodynamics (3) Theory and design of aero- dynamic bodies for desired characteristics. Potential flow theory, viscous effects, compressibility effects, transonic, subsonic, and supersonic flight. Prereq: 370. F

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

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

425 Propulsion (3) Principles of propulsion devices: turbojet, ramjet, rocket engines. Prereq: 351. F

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

429 Aerospace System Design (4) Synthesis and design of complete aerospace system, economic and technical aspects. Participation in team design effort, formal presentations and design report. Prereq: 425, 426. Sp

449 Aerospace Engineering Laboratory (3) Design, conducting, and reporting results of experimental studies. Test standards and specifications, data collection and analysis, data and formation of conclusions. Prereq: 345, 351. 3 labs. F

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

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

513 Experimental Methods in Fluid Mechanics (3) Experimental techniques for measuring and evaluating representative experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, water table experiments, supersonic flow experiments, boundary layer measurements, laser-optical measurements. Prereq: 423 or Mechanical Engineering 531.

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

521-22 Aerodynamics of Compressible Fluids (3,3) One-dimensional and external flow, waves; scale model wind tunnel; boundary layer theory; slender body theory; similarity rules; method of characteristics. Prereq: 422 for 521; 521 for 522.

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

527-28 Aerospace Ground Test Facilities (3,3) Atmospheric modeling and simulation of aerospace vehicles; test methods; test facilities; propulsion test facilities or arc-operated rockets; ground test facilities for environment and space vehicle test facilities. Prereq: 512 and 513; Mechanical Engineering 513 and 522.

529 Rarefied Gas Dynamics (3) Binary elastic collisions; kinetic theory; flow regimes; Boltzmann and model equations; vector equation; gas-surface interactions; fundamental subsonic flight data. Prereq: 512. Mechanics 522.

531 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics; thermodynamic and thermophysical properties of gases; plasma, engineering applications and applications. Prereq: 422 and Mathematics 471.


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

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


554 Aerospace Vehicle Stability and Control (3) Static and dynamic longitudinal directional and lateral stability and control. Coupled motions. Motion with fixed and free flight control surfaces. Automatic control systems. Prereq: 423, 551.

556 Vertical or Short Take Off and Landing Aircraft (3) Performance, stability, control of rotorcraft, tilt wing, vectored lift and jet vertical take off aircraft. Vertical and transition flight modes. High lift airfoil. Automatic control, simulation, test facilities, and flight testing. Prereq: 555.


561 Fundamentals of Aeroacoustics (3) Generation, propagation, and absorption of sound in static and moving media. Prereq: Consent of instructor.

564 Spacecraft Attitude Dynamics and Control (3) Rotational attitude dynamics of space vehicles, GYRO-

434 Engineering Mechanics (3) Concepts of mechanics; statics; dynamics of particles and rigid bodies, with applications; kinematics and dynamics of rigid bodies. Prereq: 526.

434 Engineering Acoustics (3) Concepts of acoustics, noise generation and transmission, measurement, material properties and design, and materials and procedures for noise abatement. Prereq: Senior standing or consent of instructor.

442 Fluid Mechanics II (3) Fluids and waves, fluid dynamics, fluid flow, fluid mechanics, fluid behavior, fluid control, fluid modeling, fluid simulation, fluid stability, fluid turbulence, fluid mechanics and heat transfer. Prereq: 540 or consent of instructor.

528 Ceramic Matrix Composites: Mechanical and Fracture Mechanics of Ceramic Matrix Composites (3) Ceramic matrix composites; stress-strain relations; mechanical behavior; fatigue and fracture; mechanical properties; fatigue and fracture; mechanical behavior of composites. Prereq: Consent of instructor.

529 Fatigue of Engineering Materials (3) Fatigue life prediction, crack initiation, crack propagation. Variable amplitude loading, multiaxial loading, environmental fatigue, creep fatigue, metallographic and microstructural variables, fractography, non-metals. Prereq: Consent of instructor.

536 Advanced Engineering Acoustics (3) Introduction to theory and application of acoustic analysis; vibration of continuous systems, plane and cylindrical waves, transmission phenomena, radiation and scattering, Resonators, filters, absorption mechanisms, microphones, airborne noise, sonar transducers, Prereq: 550 or graduate vibrations course.

539 Continuum Mechanics (3) Cartesian tensors, transformation laws, basic continuum mechanics concepts, strains, stress, strain, deformation, constitutive equations. Conservation laws for mass, momentum, energy, Applications in solids and fluid mechanics.

542 Experimental Mechanics of Composite Materials (3) Stress-strain relationships for orthotropic and transversely isotropic materials; composite lamina and laminate; stress and strain transformation; laminate plate theory; fiber, matrix, fiber-matrix interface, and composite mechanical properties (tensile, compressive, shear, pressure, stress, strain, stiffness, strength, stress field, stress intensity factor, notch sensitivity, strain energy release rate, composite fracture toughness; failure criteria.

547 Biomedical Fluid Mechanics (3) Application of fluid mechanics to blood flow, cardiovascular system, respiratory system, and other biological systems. Prereq: Mechanical and Aerospace Engineering and Engineering Science 521 or consent of instructor. (Same as Materials Science and Engineering 523.)
558 Industrial Pollution Prevention (3) (Same as Chemical Engineering 581 and Environmental Engineering 581.)

559 Measurement Science II (3) (Same as Nuclear Engineering 589 and Aviation Systems 589.)

624 Viscoelasticity (3) Viscoelastic constitutive relations; isothermal and nonisothermal analysis; propagation of waves in viscoelastic materials; stability problems; determination of viscoelastic properties. Prereq: 523 and 539 or Polymer Engineering 541.

625 Computational Plasticity and Creep (3) Theory and numerical analysis of visco-plastic and creep behavior in finite element structural models. Perfect plasticity, kinematic and isotropic hardening; Mroz, mechanical, and isotropic hardening, and two-surface models; volume plasticity models; traditional creep models and unified creep-plasticity models. Numerical algorithms, including error maps, and plane stress plasticity algorithms. Prereq: 523 or 523. Mechanical and Aerospace Engineering and Engineering Science 553.


641 Advanced Topics in Fluid Mechanics and Convective Heat Transfer (3) Convective momentum, heat and mass transfer; boundary layer analysis, stability, transition, turbulence, closure models; Navier-Stokes equations, closure procedures: time- and ensemble-averaging, large scale structures; high speed flow, reacting, nonrepeating, excitation, ionization. Applications in propulsion, lasers, aerodynamics. Prereq: Mechanical and Aerospace Engineering and Engineering Science 542. See also Aerospace Engineering.

645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic turbulence, energy spectra, Kolmogoroff's hypothesis, large and small eddy structures for turbulent flows; turbulent diffusion by continuous (scalar) and discontinuous (vector) processes, integral and local scales, plane flow, and boundary layers. Prereq: Mechanical and Aerospace Engineering and Engineering Science 542.

657 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/mechanical mechanics. For departmental thesis students only. May be repeated.

681 Advanced Topics in Engineering Mechanics (3) Advanced problems in mechanics, group or individually. Prereq: Consent of instructor. May be repeated with consent of department.

Mechanical Engineering

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

GRADUATE COURSES


455 Introduction to Design (2) Engineering economy, optimization, design for automation, reliability, product liability, and human factors. Design of mechanical engineering solid mechanics system. 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, product liability, and human factors. Design of mechanical engineering thermal-fluid system. Participation in team design effort; design report. Prereq.: 332, 344, F.

468 Machine Design II (3) Application of strength and properties of materials design rules, theories of design to failure of mechanical elements. Use of design experience. Prereq: Materials Science and Engineering 201, Engineering Science and Mechanics 521, F.

469 Machine Design (4) Design of complete machine; documentation, complete specifications, design calculations, working drawings, and cost analysis. Written and oral report. Prereq.: 455, 468, F.

471 Refrigeration and Air Conditioning (3) Vapor compression and absorption cycles; heat pump systems, psychometric processes, air washers; condensing towers; solar radiation; building heat transmission. Prereq.: 332, 344.

475 Thermal Engineering (3) Thermal systems, thermomechanics, heat exchangers, combustion and system analysis and design. Second law and economic analysis. Prereq.: 332, 344, F.

479 Thermal Engineering Design (4) Design of complete thermal-fluid system, economic, technical and optimization aspects. Participation in team design effort, final presentations and design report. Prereq.: 456, 475, F.


494-495 Selected Topics in Mechanical Engineering (1-4) Problems and topics related to developments and progress in mechanical engineering. Prereq.: Consent of instructor. E

505 Microcomputer-Based Control of Electromechanical Systems (3) Application of microcomputers to control electromechanical devices. Application and theory: digital control, signal processing, computer-aided design techniques. Prereq.: 514, 552, 553.

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


514 Phase Change Heat Transfer (3) Mechanisms and modeling of nucleate, transition and film boiling processes; critical heat flux; forced convection boiling and pool drying; heat transfer; condensation processes; heterogeneous nucleation; dropwise and filmwise condensation; flow condensation; liquid-solid phase change processes; alternative phase fronts: mathematical modeling. Prereq.: 332, 441.

521-22 Thermodynamics I and II (3,3) Macroscopic thermodynamics, including First and Second Law analyses, availability, phase and chemical equilibrium criteria, combustion, gas mixtures, and property relations, thermodynamic properties from molecular structure, spectroscopic data, kinetic theory, statistical mechanics, quantum physics, Schroedinger equation. Prereq.: 332.

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

525 Combustion and Chemically Reacting Flows I (3) Fundamentals: thermochimry, chemical kinetics and conservation equations; photomorphological approach to laminar flames; diffusion and premixed flame theory; single droplet combustion; deflagration and detonation theory; stabilization of combustion waves in laminar streams, probability density function framework. Introduction to turbulent flames. 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/or rocket motor combustors; furnaces; introduction to supersonic combustion and hypersonic flows. Prereq.: 555.

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

553 Development of Superior Products and Processes (3) Case studies of latest techniques of superior products and processes developed by industry. Case study of product or process yielding superior results developed by student. Prereq: B.S. in Engineering or consent of instructor.

561 Rocket Propulsion I (3) Rocket propulsion fundamentals; thermodynamics of propulsion; rockets and chemically reacting ideal gases, rocket nozzle design; ideal rocket performance parameters; rocket heat transfer; chemistry of propellants; liquid rocket engine systems; ground testing; introduction to solid propellant rockets. Prereq.: Consent of instructor.

562 Rocket Propulsion II (3) Solid propellant rocket performance, homogeneous and heterogeneous propellant chemistry and combustion system performance, thermal decomposition and gas phase reaction models; effect of chamber pressure and additives on solid propellant burn rates, erosion burning; analysis of two-phase solid rocket exhaust flow. Introduction to nuclear and electric propulsion; electrical resistance and electric field (ion) engine performance, magnetohydrodynamic thrusters, traveling wave thrusters, exotic propulsion systems. Prereq.: Consent of instructor.

584-85 Turbomachinery Systems I, II (3,3) Ideal cycle analysis of turbine engines, real cycle analysis, component analysis and systems integration (inlets, nozzles, combustors, compressors, turbines), flow theory, turbine engine component matching, component modeling, and rotating stall, engine control systems, structural considerations. Prereq.: First year graduate standing and consent of instructor.

586 Mechanics and Control of Robot Manipulators (3) Fundamentals of robot manipulation; kinematics and dynamics of manipulator arms, controller design for industrial robots, trajectory planning, compliant motion control and force control. Prereq: Matrix Computations, undergraduate dynamics and controls.


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

599 Special Topics in Mechanical Engineering (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

610 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer; convection; nuclear processes; high-speed laser ranging; dimensional analysis, advanced boundary layer techniques, combustion, perturbation and variational methods of analysis, heat exchange theory and design. May be repeated. Maximum 9 hrs. Prereq: 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 student uses University facilities and/or faculty time before classes begin. May not be used toward degree requirements. May be repeated. S/CN only. E


553 Computational Solid Mechanics (3) Finite element analysis techniques in structural mechanics and nonlinear elasticity, nonlinearity, two and three-dimensional formulations; isoparametric elements, numerical quadrature. Solution of equilibrium equations; finite element programs; matrix iteration techniques. Application of beams, plates, and shells. Use of representative computer programs in networked computers/workstation environment; CAD, graphics, finite elements, finite element constructions. Computer project. Prereq: 551.

559 Computational Mechanics Laboratory (1) Utilization of networked X-terminal/engineering workstation environment for conducting computational mechanics experiments. May be taken for credit with each of courses 551, 552, 553, and 557. Coreq: 551.

576 Expert Systems in Engineering (3) Same as Nuclear Engineering 576.

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


651-54 Advanced Topics in Computational Solid Mechanics (3) Fracture mechanics; singularity solutions; non-linear constitutive equations; variational methods; geometrically non-linear problems, large deflection, stability, shell structures; numerical analysis of concentration, convergence, adaptive grids. Prereq: 553.

671 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 671.)
adjust smoothly to the research programs of the department, to develop a background of research procedures and concepts, and to facilitate the selection of a research professor. Usually the student selects a research professor toward the end of the laboratory rotation period. The major professor assists in the selection of and carrying out of a suitable research program and in the naming of a thesis or dissertation committee.

THE MASTER'S PROGRAM

The program leading to the M.S. is designed to provide the student with broad basic knowledge, to permit the acquisition of technical competence in the fundamentals of research, and to encourage creative and independent thinking. Two to three calendar years are usually needed for the course of study that has the following requirements: (1) 30 hours including 6 thesis credits; (2) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F system; (3) a 3.0 GPA in courses taken in the department; (4) a complete course sequence in 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 system; (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, viruses, fungi, and protozoa. Prereq: Introduction to Microbiology. Sp

420 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, hypersensitivity, 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. May be repeated. May be repeated. S/NC only. E

575 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 575, Environmental Engineering 575, and Agricultural Engineering 5.)

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/NC 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 18 hrs. S/NC only. E

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

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

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

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

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

605 Journal Club in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC 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: 420 or consent of instructor. May be repeated. Maximum 12 hrs.

640 Topics in Virology (1-3) Prereq: 420 or consent of instructor. May be repeated. Maximum 12 hrs.

650 Topics in Microbial and Molecular Genetics (1-3) Prereq: 410 or consent of instructor. May be repeated. Maximum 12 hrs.

670 Advanced Topics in Environmental Microbiology (1-3) Prereq: 310 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

DEGREES

Music .................................................. M.M.

Dolly Davis, Acting Head

Professors:

Ball, Charles H. (Emeritus), Ph.D. ............... Peabody
Blitzes, George C., M.M. ....................... Converse
Brady, John P., Ph.D. .......................... Alabama
Carter, W. J. (Emeritus), D.M.A. ............. Eastman
Coker, J. M. ......................................... Missouri
DeVine, George F. (Emeritus), ............... Schurz
Dorn, W. (Emeritus), M.A. ....................... Columbia
Fried, Herbert W. (Emeritus), ................. Pennsylvania
Hofford, A. B. (Emeritus), M.M. ............... Northwestern
Jacobs, J. A., M.A. ............................... Texas
Julian, W.J. (Emeritus), Ph.D. .................... Northwestern
McClelland, D. K., M.A. ....................... Columbia
Machon, W. S., M.M. ............................. Wisconsin
Meachum, John J. (Emeritus), M.M. .......... Northwestern
Moore, M. C., Ph.D. ............................ Michigan
Northington, D. B., D.M.A. .................... Yale
Pederson, D. M., Ph.D. ........................... Iowa
Pamphlet, G. H. ................................. Ohio State
Starr, W. J. (Emeritus), M.M. .................... University of Maryland
Tippett, A. A., Ph.D. ............................. Michigan

Associate Professors:

Adams, Faye, M.M. ............................... Tennessee
Boling, M. E., M.M. ............................. Tennessee
Brown, Donald R., Ph.D. ....................... Indiana
Brunelle, D. E., D.M. ............................ Indiana
Carter, P. S., M.M. ............................... Colorado
Davis, D. L., D.M.A. ............................ Yale
Dubberly, T. S., D.M.A. ........................ Yale
Hough, Don, M.M. ............................... Tennessee
Leach, C. F., M.M. ............................... New Mexico
Searle, S. M., M.M. ............................... Tennessee
Spero, G. R., M.M. ............................... Indiana

Assistant Professors:

Batey, A. L., D.M.A. .......................... South Carolina
Binder, S. L., M.A. ............................... Virginia Commonwealth
Gay, Jr., L. C., Ph.D. ............................ Columbia
Hawthorne, W., Ph.D. .......................... Cincinnati
Murphy, G. A., Ph.D. ............................ Ohio State
Romines, J. J., M.M. ............................ Indiana
Schallert, G. T., D.A. .......................... Northern Colorado
Smith, B. M. ....................................... SUNY-Fredonia
Wentzel, A. N., M.M. ........................... Southern California

The Department of Music offers the Master of Music degree with concentrations in accompanying, choral conducting, composition, instrumental conducting, jazz, music education, musicology, performance (organ, piano, strings, voice, winds, and percussion), piano pedagogy and literature, sacred music, string pedagogy, and theory.

Applicants must have completed an undergraduate degree approximately equivalent in music requirements to those required in degrees conferred by UT Knoxville, appropriate
to the applicant's prospective area of concentration on the master's level.

Applicants who plan to pursue the concentration in performance or music education are required to audition before the appropriate area faculty committee. Applicants for admission to the program in composition must submit scores and tape recordings of representative works. Applicants for the concentration in jazz must audition in jazz improvisation and jazz piano proficiency and interview with members of the faculty in this area. Other applicants are required to have an interview with members of the faculty of the prospective area of concentration.

All applicants are required to take the Diagnostic Examinations in music theory, ear-training, and music history/literature. These examinations are given by the Department of Music at the beginning of each semester.

THE MASTER'S PROGRAM

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

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

Concentration in Music Education

The concentration in music education is designed for persons who hold a Bachelor's degree in Music or Music Education and certification to teach music in the public schools. Students seeking initial certification should consult the requirements for the Master of Science degree in the College of Education. The program requires 510 and 520; 9 hours of music education electives at the 500 level; 6 hours of Thesis 500; 6 hours of 500-level courses in music theory or history; 2 hours of applied music at either the 400 or 500 level; 2 hours of music ensemble at the 500 level; and 3 hours of electives at the 500 level.

A three-credit research problem and three extra hours 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.

Music Education

GRADUATE COURSES

500 Thesis (1-15) P/NC only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
510 Foundations of Music Education (3) Historical, philosophical and aesthetic bases. Prereq: Consent of instructor.
520 Research in Music Education (3) Definition of research problems, data collection and analysis, and research report writing. Application of knowledge of research techniques to analysis of existing research literature in music education. Prereq: Consent of instructor.
530 Advanced Band Literature and Conducting (3) Reading, conducting, and interpreting band scores suitable for school, college, and community bands; contemporary and standard band 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.
590 Special Topics in Music Education (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
593 Special Problems in Music Education (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Music Ensemble

GRADUATE COURSES

503 Small Jazz Ensemble (1) May be repeated. Maximum 12 hrs.
504 Jazz Ensemble (1) May be repeated.
505 Studio Orchestra (1) May be repeated. Maximum 12 hrs.
506 Trombone Choir (1) May be repeated.
510 Percussion Ensemble (1) May be repeated.
511 Marimba Choir (1) May be repeated.
515 Chamber Music Ensemble (1) May be repeated. Maximum 12 hrs.
520 UT Singers (1) May be repeated.
530 Chamber Singers (1) May be repeated.
540 Opera Theatre (1) May be repeated.
550 Concert Band (1) May be repeated.
552 Campus Band (1) May be repeated.
554 Varsity Band (1) May be repeated.
556 Laboratory Band (1) May be repeated.
559 Marching Band (1) May be repeated.
570 Symphony Orchestra (1) May be repeated.
580 Concert Choir (1) May be repeated.
589 Women's Chorale (1) May be repeated.
599 Accompanying (1) May be repeated.

Music General

GRADUATE COURSES

500 Thesis (1-15) P/NC only. E
501 Graduate Recital (2) 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
511 Lecture Recital (2) E
521 Special Topics in Performance (1-3) Prereq: Consent of department head. E
540 Secondary Applied Music (1) May be taken by music majors desiring applied study on a 2nd or 3rd instrument. May be repeated for a maximum of 4 hours credit on each instrument. Admission by audition. Requires payment of Applied Music fee. E
561 Church Music Performance Project (1-2) May be repeated. Maximum 3 hrs. E

Music History

GRADUATE COURSES

410 Music History Genre (3) Topics vary. May be repeated. Maximum 6 hrs.
420 History of Opera (3) Dramatic, vocal, and orchestral elements in opera of Italian, French, and German schools, 1600-present.
430 Symphonic Literature (3) Literature for orchestra from Baroque to present, evolution of symphony.
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 areas 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, E
540 Music in the Baroque Period (3) From c.1600 to 1750, rise of opera and oratorio, sacred and secular cantatas, instrumental forms, performance practice.
550 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-romanticism.
580 Music in the Twentieth Century (3) From 1890, Debussy, to present, Stockhausen and others.
585 Topics in North American Music (3) Topics vary.
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 Instrumental

GRADUATE COURSES

490 Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of diverse styles to conductor's art; musical analysis and practice in conducting. Prereq: Music Education 320 or equivalent.
580 Band Literature (3) Band literature and origins of band. Its important expanded cultivation during past century in United States and Europe.
582 Instrumental Conducting Performance (1) Jury performance; conducting band or orchestra in public.
Music Jazz

GRADUATE COURSES

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

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

520 Seminar in Jazz (3) Topics vary.

Music Keyboard

GRADUATE COURSES

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

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

485-86 Suzuki Piano Method I (2,2) Psychology, procedures, and literature of Suzuki piano method; must be taken in sequence. Prereq: Consent of instructor.

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

531-41 Recital Project (2,2) Preparation and accomplishment of full recital for accompanying concentrations only. 531-Vocal recital, 541-Instrumental recital. Prereq: Consent of instructor.

540-50 Advanced Piano Pedagogy I (2,2) Evaluation and study of methods and materials for teaching piano at all levels. Supervised laboratory teaching. Prereq: 440, 450, or consent of instructor, 550-Introduction and principles of Kodaly, Orff, Suzuki, Dalcroze Eurythmics, and class piano teaching. Prereq: 440, 450 or consent of instructor.

560 Organ Literature Seminar (3) Topics vary. May be repeated. Maximum: 6 hrs.

Music Performance

GRADUATE COURSES

All performance courses require an audition and consent of instructor. May be repeated. Maximum: 8 hrs toward M.M. degree.

403 Flute (1-4)

405 Oboe (1-4)

410 Bassoon (1-4)

415 Clarinet (1-4)

420 Saxophone (1-4)

425 Horn (1-4)

430 Trumpet (1-4)

435 Trombone (1-4)

440 Baritone (1-4)

445 Tuba (1-4)

450 Percussion (1-4)

455 Voice (1-4)

460 Violin (1-4)

465 Viola (1-4)

470 Cello (1-4)

475 String Bass (1-4)

476 Electric Bass (1-4)

479 Guitar (1-4)

480 Piano (1-4)

485 Harpsichord (1-4)

490 Organ (1-4)

494 Composition (1-3)

495 Composition with Electronic Media (1-3)

500 Advanced Orchestration (1-3) May not be used toward applied music requirement.

503 Flute (1-4)

505 Oboe (1-4)

509 Bassoon (1-4)

510 Clarinet (1-4)

520 Saxophone (1-4)

525 Horn (1-4)

530 French Horn (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)

573 String Bass (1-4)

576 Electric Bass (1-4)

579 Guitar (1-4)

580 Piano (1-4)

585 Harpsichord (1-4)

590 Organ (1-4)

594 Composition (1-3)

595 Composition with Electronic Media (1-3)

599 Improvisation (1-4)

Music Theory

GRADUATE COURSES


450 Choral Arranging (2) Analysis of scores and writing of arrangements for choruses. Prereq: Theory IV or consent of instructor.

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

520 Analytical Techniques (3) Analytical techniques, contemporary approaches. Tonal and atonal 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 Engineering

DEGREES

GRADUATE

418-29 Song Literature I, II (2,2) 418-German songs. 419-French, Italian, Russian, Scandinavian, Czechoslovakian, British, and American art songs. Graduate credit not available for students in vocal performance.

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

510 Vocal Literature Seminar (3) Topics vary. May be repeated. Maximum: 6 hrs.

520 Music Theatre Performance Techniques (1) Improvisation, movement, and basic techniques for dramatic vocal performance. Prereq: Vocal major or consent of instructor. May be repeated for credit. Maximum: 2 hours.

530 Opera Performance (2) Prereq: Consent of instructor. May be repeated. Maximum: 4 hrs.

540 Opera Production (1-3) Prereq: Consent of instructor. May be repeated. Maximum: 6 hrs.

550-60 Advanced Vocal Pedagogy I (2,2) 550-Study of vocal production, examination of different methods. 555-Study of teaching materials, observation of studio teaching, analysis of vocal problems in selected students, and supervised teaching.

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

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

590 Advanced Choral Conducting (3) Expansions and continued refinement of conducting techniques; development of choral rehearsal skills. Prereq: Consent of instructor.

594 Project in Choral Conducting Performance (1-3) Public performance, critical document; recording project. Prereq: Consent of instructor. May be repeated.

595 Choral Conducting Seminar (3) Score reading and preparation; problems of interpretation, performance practices, and conducting techniques. Prereq: 590 or consent of instructor. May be repeated.

Nuclear Engineering

(College of Engineering)

MAJOR DEGREES

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

H. L. Dodds, Head

Professors:

Dodds, H. L., Ph.D. ..................... Tennessee

Mihalozco, J. T., Ph.D. ..................... Tennessee

Miller, L. F., Ph.D. ..................... Texas A&M

Uhrig, R. E. (Distinguished Prof.), Ph.D. ........................ Iowa

Upadhyaya, B. R., Ph.D. ................. California