Art and Music Education

(College of Education)

MAJORS

Music Education
Music Education

DEGREES

M.S.

Charles H. Ball, Head

Professors:

Ball, Charles H., Ph.D. Peabody
Hull, H. N., Ed.D. Peabody
Humphreys, A. W. (Emeritus), Ed.D. Illinois
Jones, J. H. (Emeritus), Ed.D. Columbia
Julian, W. J., Ph.D. Northwestern
Moore, M. C., Ph.D. Michigan
Robertson, J. W. (Emeritus), Ed.D. Columbia
Tippis, A. W., Ph.D. Michigan

Associate Professors:

Gill, H. L. (Emeritus), B.S. Milwaukee State Teachers
McDaniel, Walter H. (Emeritus), M.S. Tennessee
Mintz, J. O., Ed.D. Columbia
Sparks, J. R., M.S. Tennessee
Watkins, J. Paul, M.S. Tennessee

Assistant Professor:

Root, Patricia, M.A. Washington State

The Department of Art and Music Education offers graduate programs leading to the Master of Science with a major in Art Education or Music Education. Although degree requirements are sufficiently flexible to allow programs to be tailored to the specific needs of the individual, all emphasize a balance between creative work in the arts discipline, advanced teaching techniques, and a study of the philosophical and historical foundations of the field.

For additional information, contact the head of the Department of Art and Music Education, Room 211-A Music Building: (615) 974-3331.

Art Education

The department offers two tracks for the Master of Science degree in Art Education. Track 1 is for students who are already certified to teach in the discipline or those who are seeking the M.S. degree without certification. Track 2 is designed for students seeking initial licensure. Thesis and non-thesis options are available for both tracks.

Track 1 - The thesis option requirements are: Art Education 510, 520, and 593; 6 hours of 500-level elective courses in art history; 6 hours of 400 or 500-level elective courses in studio art; Curriculum and Instruction 580; 6 hours of 500-level elective courses in education; and 6 hours of Art Education 500 for a total of 36 semester hours. The non-thesis option requires the completion of 36 hours of coursework in art education (including practical), and education, including 6 hours of 590 Special Topics culminating in an exhibition. The exhibition of original works of art produced under the direction of Art and Education faculty and accompanied by a written analytical and critical essay. This essay must include a philosophical statement, an explanation of process and media for each work presented, and a compositional analysis of each work.

Track 2 - The non-thesis option requirements are: Art Education 510, 520, 530, 540, and 593; Education 574, 575, 591, and 3 additional hours of Education electives at the 500 level for a total of 36 hours. The thesis option requires 6 additional hours of Thesis 500 for a total of 42 hours.

For both tracks, a comprehensive written examination is required. An oral exam is given after the thesis.

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

520 Studies in Art Education (3) Current practices and procedures in art education: unit planning, sequencing, organization, and teaching methods. Prereq: Consent of instructor.

530 Developing Art Curriculum and Teaching Strategies (3) Curriculum development and teaching strategies. K-12, demonstrations of instructional methods using micro and simulated teaching situations, analysis of programs, classroom management skills and student evaluation procedures.

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

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

593 Independent Study in Art Education (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

Music Education

The Master of Science requires Music Education 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 6 hours of music or music education electives at the 500 level.

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

For students participating in the professional internship program and seeking initial certification, the Master's degree may be awarded upon the successful completion of the 24 hours earned in the internship year and an additional 12 hours consisting of six additional hours in graduate-level Music courses and Music Education 510 and 520. For the thesis option, 6 additional hours of Thesis 500 are required for a total of 42 hours.

Graduate papers may be required. Diagnostic tests in theory, music history, music education, and applied music will be required. A final written and oral examination will be required.

GRADUATE COURSES

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

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

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

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

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

540 Advanced Choral Literature and Conducting (3) Reading, conducting, and interpreting vocal scores suitable for school, college, church, and community groups. Prereq: Consent of instructor.

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

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

560 Psychology of Music Teaching (3) Research on 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.

570 Studies in Elementary and Middle School Music (3) Current trends and research in teaching of music in elementary and middle school. Prereq: 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.

Astronomy

See Physics and Astronomy

Audiology and Speech Pathology

(College of Liberal Arts)

MAJORS

DEGREES

Audiology
Speech and Hearing Science
Speech Pathology

M.A.
Ph.D.
M.A.

51
56
51
THE MASTER'S PROGRAM

A major is offered in Audiology or in Speech Pathology. A minor is offered in each of the two areas upon approval by the department.

The intent of each major program is to provide the student with scholarly and professional skills necessary for functioning as an independent professional clinician in any clinical environment.

Students majoring in either of the two areas are expected to complete the academic requirements for clinical certification from the American Speech-Language-Hearing Association, including the required number of clock hours of clinical practicum (minimum 200 hours as a graduate student, 375 total). An exception to this rule must be approved by the appropriate departmental committee. Enrollment in clinical practicum courses is required for all clinical practice experiences. If the undergraduate preparation does not include sufficient coursework in speech pathology, audiology, psychology, and related fields, the student may be required to make up such deficiencies.

Students may elect either the thesis or the non-thesis option. Students in both programs are required to take 511. The Master's program with the thesis will include a minimum of 30 semester hours of approved graduate credit, including 6 hours of 500 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least two-thirds of these total courses must be at the 500 or 600 level, including no more than 6 hours of thesis and no more than 6 hours of practicum. Students in the non-thesis option program must present a total of 36 semester hours of approved graduate credit and pass a final written examination. A minimum of 24 hours must be at the 500 or 600 level, no more than 6 of which may be practicum. The decision as to choice of the thesis or non-thesis program is normally made upon completion of 511 and a conference with the student's advisor.

THE DOCTORAL PROGRAM

The Ph.D. program in Speech and Hearing Science seeks to develop individuals for research or college teaching careers in the communication areas of speech and language pathology, audiology, speech science, or hearing science. This degree program is research oriented, with primary emphasis upon developing the scientific and cognitive skills which allow individuals to identify and independently study important questions concerning the human act of communication. Students will be expected to demonstrate their knowledge in the areas of:

1. Basic speech, hearing, and language processes;
2. Speech, hearing, and language disorders;
3. Related disciplines providing insight into human communication processes;
4. Technical skills in instrumentation and experimental design which enable the student to investigate problems pertaining to speech and hearing processes.

The program will normally consist of three or more calendar years of graduate study beyond the Master's degree with the first year being devoted primarily to formal coursework and the last year to full-time research culminating in the doctoral dissertation.

The total program is a minimum of 60 semester hours, including a minimum of:
- 24 semester hours in dissertation (500).
- 6 semester hours in a research tool.
- 6 semester hours in a cognate area outside the department.
- 24 semester hours in 600-level coursework within the department, of which:
  a. a minimum of 6 semester hours in the topic of major interest;
  b. a minimum of 6 semester hours in topics(s) of related interest;
  c. 2 semester hours in 611; and
  d. 3 semester hours in supervised teaching experience.
5. A comprehensive examination to demonstrate scholarly knowledge of audiology, speech and language pathology, and speech and hearing science; and advanced knowledge of the specifics of the area of concentration.

6. A final oral examination.

ACADEMIC COMMON MARKET

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

GRADE COURSES

404 Auditory Disorders (1-3) Diagnostic procedures for children and adults with speech and language problems including observation and practice with diagnostic tests. Prereq: Communication Disorders, Speech Science, and Clinical Practice in Speech-Language Pathology or consent of instructor.
533 Stuttering (3) Advanced clinical treatment. Prereq: 304 or consent of instructor.
433 Clinical Practice in Speech-Language Pathology I (1-4) Prereq: 302, 331 or consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval. (Same as Special Education 433.)
434 Clinical Practice in Speech-Language Pathology II (1-4) Prereq: 433 and consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval. (Same as Special Education 434.)
440 Voice Disorders (3) Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 304, 306, or consent of instructor. (Same as Special Education 440.)
538 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4) May be repeated. Maximum 6 hrs. Students with another major less than 21 hrs must have prior departmental approval.

539 Motor Speech Disorders (3) Neuromotor organization for speech production; types of motor speech disorders and associated neuromotor symptomatology; grading and management of motor speech disorders. Prereq: 506.


545 Sound Measurement Techniques and Hearing Conservation (3) Techniques of measurement and analysis of sound: hearing conservation in schools and industry. Prereq: Consent of instructor.

546 Advanced Audiology (3) Theory and practice of advanced pure tone and speech audiology; instrumented and interpreted of audiometric findings with differential diagnosis. Prereq: 473.

547 Special Problems in Audiology (1-3) Prereq: 473 or equivalent. Consent of instructor. May be repeated. Maximum 6 hrs.

548 Special Study in Audiology (1-3) Significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.

550 Seminar in Audiology (1-3) Theoretical and applied considerations of procedures used to identify lesions in auditory mechanism: behavioral assessment, acoustic immittance and electrolyrophysiological techniques. Prereq: 473, 507 and 548.

552 Seminar in Speech Pathology (2-3) Current significant research in speech pathology. Topics vary. Prereq: 9 hrs in speech pathology. May be repeated with consent of department. Maximum 9 hrs.


555 Special Problems in Speech-Language Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

556 Independent Study in Speech-Language Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

557 Management and Supervision for Speech-Language-Hearing Professionals (3) Management systems, accountability, personnel appraisal and clinical supervision for audiologists and speech language pathologists interested in private practice, supervisory or administrative positions.

561 Tutorial in Child Language Pathology (2) Interactions with various staff members of Pediatric Language Programs; selected topics. Prereq: 461 or consent of instructor. May be repeated. Maximum 6 hrs.

574 Pediatric Audiology (3) Theoretical and practical considerations in evaluation and treatment of hearing loss in infants and children. Audiological intervention in case management of hearing impaired child: amplification, educational alternatives, and state and federal guidelines.

579 Psycholinguistic Concepts in Speech Pathology (3) Psycholinguistic concepts and information theory applying the normal acquisition of language and certain disorders of language. Prereq: Consent of instructor.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Advanced Aural Rehabilitation (3) Procedures; assessment and counseling for communicative function of hearing impaired. Prereq: 494.


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

601 Experimental Phonetics (3) Acoustical and perceptual analyses of speech production and overall oral communication. Prereq: 517 or consent of instructor.

602 Psychoacoustics (2) Auditory perception and reception of nonspeech and speech stimuli. Prereq: 517.

603 Language Science (3) Seminar of theories and paradigms of language production and use of language: phonology, syntax, semantics and pragmatics. Prereq: Graduate standing and consent of instructor.


608 Advanced Clinical Concepts and Models in Hearing Science (3) Seminar of clinical and theoretical concepts of clinical manifestations in pathological condition of ear. Electrical, mechanical, and mathematic models of normal and abnormal auditory mechanism function. Prereq: Consent of instructor.

609 Seminar in Speech Science (2) Experimental areas: speech physiology, acoustic analysis, recognition, perception and intelligibility of speech, communication theory, and psychoacoustic measurement of speech and language. Topics vary. Prereq: 601 or consent of instructor. May be repeated. Maximum 6 hrs.

610 Seminar in Hearing Science (2) Advanced study of perception of nonspeech acoustic signal, detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 602 or consent of instructor. May be repeated. Maximum 6 hrs.

611 Experimental Design in Speech and Hearing (2) Analysis of experimental design in theses and related journals. Generation of experimental designs. Prereq: Consent of instructor.

619 Advanced Technology in Speech and Hearing (2) Applications of recent technological advances, computers, to speech and hearing research. Prereq: Consent of instructor.

650 Advanced Seminar in Audiology (2) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

652 Advanced Seminar in Speech and Language (2) Topics vary: aberrations of voice, articulation, speaking superstructure, communication disorders, language, and language symbolization. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

655 Practicum in College Teaching (1-3) Supervised experience in college teaching. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/JNC only.

656 Directed Research (1-4) Participation in ongoing or non-dissertation research. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

657 Directed Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

658 Directed Study in Audiology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

659 Directed Study in Speech Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

660 Directed Study in Hearing Science (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

---

**Aviation Systems (UT Space Institute)**

**MAJOR**

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>Aviation Systems</th>
<th>M.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. D. Kimberlin, Program Chair</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Professors:**

| Collins, F. G., Ph.D. | California Mason, A. A., Ph.D. | Tennessee Roberds, R. M., Ph.D. | AFT Wu, M. Ph.D. | Cal Tech Young, R. L. (Emeritus), Ph.D. | Northwestern |

**Associate Professors:**

| Kimberlin, R. D., M.S. | Tennessee Watts, C. F., M.S. | Arizona |

**Assistant Professor:**

| Solies, U. P., Ph.D. | Tennessee |

The University of Tennessee Space Institute offers a program leading to the Master of Science degree with a major in Aviation Systems. The Aviation Systems program is designed for those who possess a Bachelor's degree in engineering or science and wish to study under a "system philosophy" toward careers in research and development or administration in areas pertinent to aviation. Current emphases include flight testing, aircraft design, aviation meteorology, air traffic control, and airport management. To qualify for admission to this program, the applicant must possess a Bachelor's degree in engineering or science from an accredited institution, show evidence of ability to pursue and benefit from the program, and fulfill The University of Tennessee Graduate School admission procedures and grade-point standards. It is expected that the student will have a basic knowledge of computer utilization and statistics; an understanding of aerodynamic fundamentals, aircraft propulsion, and performance; and some understanding of economics. Both thesis and non-thesis programs are available. The thesis program involves a minimum of 30 semester hours credit while the non-thesis program involves a minimum of 33 semester hours credit.

**THESIS OPTION**

The thesis program involves satisfactory completion of the following requirements:

**Research and Development Specialization**

1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering (engineering management).
3. Six hours of electives from the major field, mathematics or engineering.
4. Six hours of Aviation Systems 500 demonstrating the ability to conduct and report on an independent investigation.
Administration Specialization
1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Three hours in industrial engineering (engineering management).
3. Three hours in economics or finance.
4. Six hours of electives selected from the major field, mathematics or engineering.
5. Six hours of Aviation Systems 500 demonstrating the ability to conduct and report on an independent investigation.

NON-THESIS OPTION
The non-thesis program will be permitted in special circumstances and involves satisfactory completion of the following requirements:

Research and Development Specialization
1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering (engineering management).
3. Twelve hours of electives in the major field, mathematics or engineering.
4. Three hours of an assigned project under Aviation Systems 510.
5. A comprehensive final written examination on all coursework submitted for the degree and defense of the project course paper.

Administration Specialization
1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Three hours in industrial engineering (engineering management).
3. Three hours in economics or finance.
4. Twelve hours of electives in the major field, mathematics or engineering.
5. Three hours of an assigned project under Aviation Systems 510.
6. A comprehensive final written examination on all coursework submitted for the degree and defense of the project course paper.

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 Aviation Systems is available to residents of the states of Arkansas, Kentucky, Mississippi, South Carolina, or West Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
501 Aviation Systems: An Overview (3) aviation systems, present and future. Socioeconomic base, aerospace and propulsion technology, meteorology, air traffic control, airport community interface, and technological developments pertinent to present status and future development of air transportation.
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.
504 Airports and the Community (3) Structure of airports and their communities. Technology and economics of cargo, baggage, ticket and passenger handling. Airport management, economics and logistics. Interfaces with community, plans, programs and development for collecting and distributing passengers and freight from various types of airports. Types airport developments and their projections. Prereq: 501.
505 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation. Aviation: Historical and legislative development of aviation regulatory agencies, organizational structure, administrative and enforcement procedures. Prereq: 501.
506 Aircraft Design (3) Design process, compromise of conflicting requirements, economical, industrial, and legal aspects. Definition of mission requirements, synthesis and optimization techniques, safety and reliability, systems integration, standards and regulations, teamwork and decision-making process.
510 Special Topics in Aviation Systems (3) Current problems. Prereq: Consent of instructor. May be repeated with consent.

Biochemistry

(College of Liberal Arts)

MAJOR DEGREES
Biochemistry .................................. M.S., Ph.D.
Wesley D. Wicks, Head

Professors:
Churchich, Jorge E., Ph.D. .......... Sheffield
Huang, Leaf, Ph.D. ................. Michigan State
Joshi, J. G., Ph.D. .................. Poona
Monty, Kenneth J., Ph.D. .......... Rochester
Salo, T. P. (Emeritus), Ph.D. .... Michigan
Wicks, Wesley D., Ph.D. .......... Harvard

Associate Professor:
Koontz, John W., Ph.D. .......... Kentucky

Assistant Professors:
Feinberg, R. H. (Emeritus), Ph.D. .... California
Howell, Elizabeth E., Ph.D. .......... Lehigh
Roberts, Daniel M., Ph.D. ....... California (Davis)
Serpursu, Engin H., Ph.D. .......... Taisei

Adjunct Faculty:
Farkas, W., Ph.D. .................. Duke
Georgiou, S., Ph.D. ................. Manchester
Kenne1, S., Ph.D. .................... California (San Diego)

THE MASTER'S PROGRAM

1. At least one year each of Introductory Organic Chemistry with laboratory** and approved physical chemistry.
2. A minimum of 8 semester hours of approved biology courses beyond the introductory level and including the subject areas of genetics and physiology.
3. Biochemistry 511-12 and 515-16.
4. At least 6 hours of advanced seminar courses from the following: 601, 603, 604, 605, 606.
5. Six hours of Master's research and a thesis.
6. A final examination that covers both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

1. Introductory Organic Chemistry**, Introductory Physics**, Differential and Integral Calculus**, approved physical chemistry, and at least 12 hours of biology beyond the introductory level and including the subject areas of genetics and physiology.
2. Biochemistry 511-12 and 515-16.
3. At least 3 hours of approved graduate courses in chemistry, physics, or other physical science; for example, Chemistry 550, 551, 552, Physics 521, 522, 551. No survey courses will be accepted.
4. At least 6 hours of topics offered in 521 and 621.
5. Participation in 601 and 603 during the entire period of residence.
6. Comprehensive examination, taken before the end of the third year of study.
7. A dissertation reporting the results of original and significant research carried out during the term of candidacy.

*Though completion of these courses or their equivalent is required, they may not be taken for graduate credit.

Petitioning for Master's Degree
Students who have passed the comprehensive examination in the Ph.D. program and have completed at least 30 hours of approved coursework for graduate credit, at least two-thirds of which must be at or above the 500 level, may petition the department for award of a Master's degree. The additional requirements for such a degree are:
1. The preparation of a research manuscript suitable for submission for publication in a major scientific journal and oral defense of that manuscript before an examining committee of three faculty members appointed by the head of the department, at least two of whom shall be members of the department; or
2. Publication of at least one full-length paper in a major biochemical journal as senior author.

GRADUATE COURSES

410 Cellular and Comparative Biochemistry (4) Electrical behavior; chemistry and structure of proteins; enzyme behavior and biological function; catalysis and energy capture; synthetic metabolism; nucleic acid function, protein synthesis and biochemical genetics; regulation of biochemical processes. Prereq: Chem 350-60 and Biology 110-20. 3 hrs and 1 discussion. F,Sp
419 Cellular and Comparative Biochemistry Lab (2) Experiments with enzymes, nucleic acids, and mem-

471-81 Biophysical Chemistry (3, 3) Physicochemical principles with applications to biological systems. 471—Thermodynamics; chemical equilibrium; solution chemistry; transport; electrochemistry; kinetics; enzyme-catalyzed reactions. 481—Elementary quantum chemistry; interactions of light with biological molecules; optical and magnetic spectroscopy; light scattering; case studies of selected macromolecules. Prereq: Calculus, Organic Chemistry, General Biology or consent of instructor. (Same as Chemistry 471-81), F, Sp.

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


511 Advanced Concepts in Protein Structure, Protein Function and Intermediary Metabolism (4) Protein structure and dynamics; regulation of enzyme activity; intermediary metabolism; membrane structure and function. Original literature and review articles; contemporary experimental approaches. Prereq: 410, 420 or consent of instructor. 3 hrs. and 1 discussion. F

512 Advanced Molecular Biology (4) Replication, repair, transcription, translation and control mechanisms. Prior knowledge of fundamentals of gene expression. Prereq: 511 or Life Sciences 511. 3 lectures and discussion. (Same as Life Sciences 512) Sp.

515 Experimental Techniques I (3) Modern experimental methodology and instrumentation in lab. Primarily for departmental graduate students. Prereq: Consent of instructor.

516 Experimental Techniques II (3) Laboratory rotations. Student works in laboratory of faculty member on clearly defined project for one semester. Primarily for departmental graduate students. Prereq: 515. Sp.

521 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated. Maximum 9 hrs.

525 Graduate Research Participation (3-12) Tutorial laboratory experience. May be repeated. Maximum 12 hrs. E

561 Environmental Toxicology (3) Basic concepts in toxicology; molecular toxicology and detoxification; reproductive toxicology; mutagenesis, teratogenesis, carcinogenesis, pathologic changes and environmental impact. Prereq: 410, Chemistry 350-60-69 or consent of instructor. (Same as Ecology 561) F.

562 Techniques in Environmental Toxicology (1) Experimental techniques for assessment of presence, toxicity and impacts of pollutants in global ecosystem. Laboratory exercises on analytical, biochemical, and bioassay methods in toxicological studies. Prereq: 419 or (quantitative analysis), 561 and Chemistry 350-60-69. (Same as Ecology 562) Sp.

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


604 Current Topics in Environmental Toxicology (1) Critical reviews of research problems and methods in environmental toxicology, behavioral toxicology, biochemical and ecological effects, biostatistics and epidemiology. Presentations by students, faculty and guest lecturers from academia and industry. May be repeated with consent of department. Maximum 4 hrs. (Same as Ecology 604) S/NC only. F, Sp.


521 Advanced Topics (1-3) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry. Prereq: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.

### Biomedical Sciences

**MAJOR**

<table>
<thead>
<tr>
<th>Biomedical Sciences</th>
<th>M.S., Ph.D.</th>
</tr>
</thead>
</table>

**Professors:**

- Raymond A. Popp, Director

**Research Professors:**

- Olins, Donald E., Ph.D. Rockefeller
- Olins, Ada L., Ph.D. New York

**Research Associate Professor:**

- Ch'ang, Lan-Yang, Ph.D. Vanderbilt

**Shared Faculty:**

- Not all faculty listed are necessarily available in teaching and/or research roles in each academic year.

**506 Current Topics in Biomedical Membrane Research (1) Prereq: 410 or equivalent. May be repeated. Maximum 9 hrs. (Same as Microbiology 606) S/NC only. F, Sp.**

**621 Advanced Topics (1-3) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry. Prereq: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.**

The University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, located within the Biology Division of Oak Ridge National Laboratory, offers programs leading to the Master of Science and the Doctor of Philosophy. The National Laboratory is a well-known center of basic research. The school utilizes the staff and facilities of this laboratory and thus brings directly into the mainstream of full-time graduate study in the life sciences the talent and experience of that staff, as well as the most advanced research methods and technology.

The program of study, which incorporates a high faculty-to-student ratio, is based on intensive graduate courses supplemented by tutorial instruction, participation in a wide variety of seminars, and a heavy emphasis on communication, research training, and independent study. The program encourages students to pursue graduate study to the limits of their abilities.

Each student's curriculum is planned to meet individual needs, with the aim of giving: (1) strength in the basic sciences; (2) perception of the biomedical sciences as a whole; and (3) experience and training in a chosen specialty.

The concentration areas available for Master's thesis and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, genetics, cellular, developmental and mammalian biology, and neurobiology. Also included are such subjects as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation and environmental biology, virology, developmental biology, experimental pathology, microbial and mammalian genetics, and problems of aging.

**ADMISSION REQUIREMENTS**

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply. Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need preparation in biology, calculus, physics, and organic and physical chemistry. A course in physical chemistry is offered by the school in order to meet the last requirement. It is recommended that deficiencies in preparation, as identified in the admission process, be eliminated prior to entrance.

Requests for application forms, information on admission, financial support, and housing should be sent to Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Division, ORNL, Box 2009, Oak Ridge, Tennessee 37851-8077.

**THE DOCTORAL PROGRAM**

1. Satisfactory (B grade or better) completion of the following core courses or their equivalent: Biochemistry (511); Biophysical Biochemistry (514); Genetics (515); Molecular Genetics (517); Cell Biology (519-19); Computer Science (525); and Statistics for Biologists (574).
2. Three semesters of Biomedical Sciences Laboratory (531-33-33).
3. Participation in at least one of the student's professional laboratories; however, a limited number of students from other institutions may be accepted if qualified and as space is available. The requirements for the degree are:

1. Graduate credit or a proficiency in the following core courses: Biochemistry (511); Biophysical Biochemistry (514); Cell Biology (518-19); plus any three of the following courses: Genetics (515); Molecular Genetics (517); Statistics for Biologists (574); or Computing for the Life Sciences (525). Additional credits may be obtained (6 to 15 hours) with electives.
2. Thirty hours of approved graduate courses including 6 hours for thesis.
3. For admission to candidacy: Completion of any required prerequisite courses and one semester of graduate coursework with a B average. Admission to candidacy forms must be filed at least one full semester prior to receipt of degree.
4. A Master's committee of three approved faculty members upon admission to candidacy.
5. A thesis reporting results of original and significant scientific research. A student's background and area of specialization.
6. Passing a final oral examination.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required. May not be used toward degree requirements. May be repeated. S/NC only. E
507 Physical Chemistry (3) Thermo-dynamics; phase equilibria; chemical equilibria; electrochemical potential and surface forces; electrolyte solutions; kinetics; conductance; viscosity; diffusion.
511 Biochemistry (3) Chemistry of carbohydrates, lipids, proteins, and coenzymes; enzyme kinetics; intermediary metabolism; and photosynthesis; biosynthesis of amino acids, lipids, and macromolecules. Coreq: 507.
514 Biophysical Biochemistry (3) Chemistry of cell membranes, cell growth, and membrane proteins; energy level and excited states of large molecules; optical and instrumental adaptations to system perturbations; properties of macromolecules in solutions; molecular solution; molecular conformations; inter- and intramolecular forces; principles of microscopy. Prereq: 511.
515 Genetics (3) Mendelian genetics, mitosis and meiosis; transmission genetics; mapping and linkage; genetics of phage, bacteria, and eucaryotes; mapping; linkage; mutation; cytogenetics; chromosome structure and replication.
517 Molecular Genetics (2) Molecular biology of genetic processes. Three distinguished outside lecturers present current research on mechanisms of gene regulation; protein synthesis; suppression of nonsense mutation; mutagenesis; gene defects and hereditary diseases. Prereq: 511, 514, and 515.
518 Cell Biology I (3) Structure and composition of major nuclei and cytoplasmic organelles of eucaryotic cells. Pertinent instruments and techniques: meiosis and mitosis; cell cycle; chromosome structure; nuclear RNA metabolism; nucleoli and ribosome biogenesis; survey of specialized cells. Structure of genetic transcription and translation in bacteria. Coreq: 511.
519 Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of mitochondria, chloroplasts, peroxisomes and other organelles as related to metabolism and regulation; transport phenomena; cell cycle; cell products; interaction of cells; function of tissues and organs. Prereq: 511, 518.
525 Computing for the Life Sciences (3) Interactive computing; Mini- and micro-computing environments. Basic, Fortran, and Pascal languages; application of statistics, graphics, text manipulation, and computer communications.
531-33-33 Biomedical Sciences Laboratory (3,3,3) Approaches and technologies in various areas of modern biology. Students spend a semester in each of three laboratories conducting research in different areas of biomedical science. Required of all first-year students.
543-46-49 Graduate Research Participation (3,6,9) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated.
551-52-53 Special Topics in Biomedical Sciences (3,3,3,3) Either tutorials or formal lectures. Potential topics: X-ray diffraction and crystallography; electronic spectroscopy; crystal structure; protein chemistry; physiology or anatomy; physiological chemistry or pathobiological chemistry; mammalian genetics coverage.
574 Statistics for Biologists (2) Application and interpretation of statistical methods in data analysis. Random variation; normal; binomial, and Poisson distribution; statistical presentation of data, estimation of means and variance; confidence intervals; tests of significance for comparing samples; analysis of variance; contingency tables; Chi-square; analysis of covariance; linear regression. Prereq: Statistics 201 or consent of instructor.
600 Doctoral Research and Dissertation (3-15) P/NP only. E
624 Chemistry and Metabolism of Lipids (2) Nomenclature, chromatographic isolation; chemistry, physical properties, and enzymology and lipids. Hormonal action of prostaglandins and roles of lipids in membranes, enzymatic expression, and nervous tissue. Lipid biochemistry of mammals. Comparative aspects, lipid pathways in bacteria, and fatty acid metabolism. Prereq: 511.
628 Molecular Genetics of Carcinogenesis (2) DNA and RNA tumor viruses, oncogenes, growth factors, and their potential role in induction of cancers.
641 Techniques in Cell Biology (3) Basic concepts of cell biology techniques, their application to specific research problems, kind of data yield, and techniques in data interpretation. Laboratory demonstrations may be arranged where appropriate. Prereq: 511, 514, 518, 519.
551-52-53 Advanced Topics in Biomedical Sciences (3,3,3) Current and future research developments; protein synthesis, protein chemistry and enzyme mechanisms; cryobiology, and special topics. Either as tutorial or literature survey requiring substantial student preparation. May be repeated.
560 Mammalian Genetics (3) Known genetic variants affecting each organism system of experimental mammals, especially laboratory mice. Inheritance of phenotypical and biochemical traits in rodents and other laboratory rodents. Prereq: 515.

Botany (College of Liberal Arts)

MAJOR

DEGREES

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

Karen W. Hughes, Head

Professors:
Caponetti, J. D., Ph.D. ........................................ Harvard
Giebsch, E. E., Ph.D. ........................................ Duke
Evans, A. M., Ph.D. ........................................... Michigan
Hemond, W. R. (Distinguished Prof.) ........................................ Pennsylvania
Ph.D. ........................................ Vanderbilt
Hickog, L. G., Ph.D. ........................................ Massachusetts
Hotton, R. W., Ph.D. ........................................ Michigan
Hughes, K. W., Ph.D. ........................................ Utah
Jones, L. W., Ph.D. ........................................ Texas
McCormick, J. F., Ph.D. ........................................ Emory
Mullin, B., Ph.D. ........................................ NC State
Norris, F. H. (Emeritus). Ph.D. ........................................ Ohio State
Petersen, R. H. (Distinguished Prof.) ........................................... Columbia
Ph.D. ........................................... Schilling, E. E., Ph.D. ........................................ Indiana
Sharp, A. J. (Emeritus). (Distinguished Prof.), Ph.D. ........................................ Ohio State
Ph.D. ........................................... Smith, W. O., Ph.D. ........................................ Duke
Waine, P. L. (Distinguished Prof.), Ph.D. ........................................ Texas
Ph.D. ........................................... Associate Professors:
Amundsen, C. C., Ph.D. ........................................ Colorado
Heilmann, A. S., Ph.D. ........................................ Ohio State
Schwarz, O. J., Ph.D. ........................................ NC State
Smith, D. K., Ph.D. ........................................ Tennessee
Wolford, B. E. (Curator), Ph.D. ........................................ Tennessee
The Department of Botany offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, bryology, cytology, cytogenetics, ecology, genetics, ichthyology, morphology, mycology, phytobiology, physiology, pteridology, and taxonomy. Educational service is required of each graduate degree candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses. For further information, contact the Department Head or the Graduate Coordinator.

ADMISSION REQUIREMENTS

The Botany Department requires scores from the general and subject biology portions of the Graduate Record Examination, at least three letters of recommendation or standard recommendation forms from academic or professional persons, a statement describing reasons for interest in graduate education in botany, and the following academic requirements:

1. Bachelor's degree: a B.A. or B.S. from an accredited college or university with a cumulative grade-point average of 2.5 or better (on a 4.0 scale), with evidence of ability to do work of graduate quality.
2. General botany or general biology: 8 semester hours.
3. Advanced botany or closely allied biological sciences: 12 semester hours.
4. Physical sciences: general inorganic chemistry: 8 semester hours; organic chemistry: Physics highly recommended. 5. College mathematics: 6 semester hours including 1 term of calculus.

Evidence of a broad undergraduate background, an ability to do work of graduate quality, and an interest in the study of plant science are considered to be much more important than the particular courses taken as an undergraduate. Accordingly, students lacking specific prerequisites courses but otherwise qualified may be admitted to graduate studies in botany. In such cases, the deficiencies should be removed as soon as possible, typically during the first year of the student's graduate program. The determination of deficiencies and the manner in which they will be removed will be decided upon by the student's pre-term committee during the first meeting with the student.

THE MASTER'S PROGRAM

The program for the Master of Science is patterned to fit the needs of students who desire a comprehensive course of study than the Ph.D. program. However, the applicant must be a less extensive course of study than the Ph.D. patterned to fit the needs of students who desire a less extensive course of study than the Ph.D. program. However, the applicant must be a less extensive course of study than the Ph.D.

THE DOCTORAL PROGRAM

The Doctor of Philosophy program is patterned to provide training that involves extensive independent research within the student's area of concentration. Although there is no formal program of coursework, the student's committee may require specific courses for the completion of the degree. Most students spend from three to five years working on their Ph.D.

Requirements for successful completion of the Ph.D. program as follows:

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehension examination.
3. Presentation of one or more cognate areas outside of the department totaling 6 hours of graduate credit with at least a B average.
4. Satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 302 or German 302.
5. Satisfactory completion of 6 hours at the 600 level (excluding dissertation).
7. Presentation of a departmental seminar near the end of the doctoral program.

Note: The listed requirements for the M.S. and Ph.D. degrees should be interpreted as minimal requirements. Specific stipulations or requirements such as additional foreign languages or an additional oral comprehensive examination may be required by the student's faculty committee.

GRADE DISTRIBUTION

The thesis program is the normal route taken by botany students for the M.S. In general, the student's pro-tem committee will determine the thesis and non-thesis options. The thesis option includes thesis and non-thesis options. It is important that the entering student promptly identify a major professor and a suitable research project. (It may be either a terminal degree or an approximate step to studying for a Ph.D. degree).

1. Satisfactory preparation of a written formulation and an oral defense to the student's committee of a research proposal suitable for a thesis. This must be completed before enrollment in Botany 500.
2. Successful completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.
3. Satisfactory completion of two hours at the 600 level.
5. Presentation of a 30 minute departmental seminar.
6. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.

Non-Thesis Option

1. Satisfactory completion of 34 semester hours of approved graduate courses of which 30 semester hours must be in botany including Botany 503. At least two-thirds of the hours must be at the 500 level or higher.
2. Satisfactory completion of two hours at the 600 level.
3. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.
4. Satisfactory performance on a final written examination on all work offered for the degree. The student's committee may also require that an oral examination follow the written examination.

THE DOCTORAL PROGRAM

The Doctor of Philosophy program is patterned to provide training that involves extensive independent research within the student's area of concentration. Although there is no formal program of coursework, the student's committee may require specific courses for the completion of the degree. Most students spend from three to five years working on their Ph.D.

Requirements for successful completion of the Ph.D. program as follows:

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive examination.
3. Presentation of one or more cognate areas outside of the department totaling 6 hours of graduate credit with at least a B average.
4. Satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 302 or German 302.
5. Satisfactory completion of 6 hours at the 600 level (excluding dissertation).
7. Presentation of a departmental seminar near the end of the doctoral program.

Note: The listed requirements for the M.S. and Ph.D. degrees should be interpreted as minimal requirements. Specific stipulations or requirements such as additional foreign languages or an additional oral comprehensive examination may be required by the student's faculty committee.

GRADUATE COURSES

401-02 Field Studies in Botany (3,3) Field experience and taxonomy of special plant groups. Topics vary: bryology, lichenology, cryptogamic botany, algae, plant morphology, aquatic vascular plants, synthronology, woody plants, and botanical photography. May be repeated under different topic. Maximum 9 hrs.


412 Plant Anatomy (3) Cells, tissues and organs; development in vegetative and reproductive structures of vascular plants—seed plants. Prereq: 110-20 or Biology 110-20.

426 Paleobotany and Palynology (3) Good (Geology 426.)

431 Plant Ecology (3) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in ecosystems. Weekly field trips or laboratory periods, and at least two weekend field trips. Prereq: 330 or equivalent. Su

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organs: media preparation and maintenance of cultures. Prereq: 110-20 or Biology 110-20. Credit/No Credit. Prereq: 310-20, 321, 412; Botany 310 or 319; Oriental Horticulture 330; and Plant and Soil Science 331.

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

501 Mycology (4) Intensive study of fungi, all major classes, lecture laboratory and field information. Occasional field trips. Prereq: 310. 3 hrs and 1 lab. F,A

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 Non-Thesis Research (2) Library, field, or laboratory research under supervision of staff member. Not for thesis candidates. May be repeated. Maximum 4 hrs. E

506 Phyiology (4) Comparative study of major algal phyla, both freshwater and marine: morphological, developmental, ecological, taxonomic and phylogenetic aspects. Field and laboratory studies, identification, classification, experimentation. Prereq: 310 or consent of instructor. 3 hrs and 1 lab. F,A

507 Biological Illustration (3) Principles and applications of photography (black and white and color). Prereq: 200. 3 hrs. E

509 Morphology and Evolution of Basidiomycetes (4) Structure and function of somatic and sexual life cycles as applied to evolution in group. Cultures and specimens in laboratory. Prereq: 310 or equivalent.

512 Taxonomy of Grasses and Grass-like Plants (3) Collection, identification, classification of grasses, sedges and rushes, phylogeny of the grass subfamilies and tribes. Prereq: 330 or consent of instructor. F,A

516 Biosoystematics (3) Major experimental methods in systematic and application to specific types of systematic problems. Cytotaxonomy, numerical taxonomy, chemotaxonomy and cladistics.


530 Advanced Taxonomy of Flowering Plants (3) Evolution and classification of families of angiosperms, local flora. Prereq: 330 or equivalent, 2 hrs and 1 lab. F,A
531-32 Special Problems in Botany (1-4, 1-4) May be repeated for credit total of 12 hrs. F,A

536 Plant Communities and Plant Geography (4) Plants in communities and their classification and ordination; geographic distribution of communities— their climates and soils relationships. Prereq: 431. (Same as Geography 536.)

537 Natural Resource Management and Environmental Assessment in Developing Nations (3) (Same as Ecology 537 and Planning 553.)

544 Seminar in Botany (1) Readings and discussions of current literature and selected topics in botanical research. May be repeated. Maximum 8 hrs. S/N/C only.


555 Seminar in Quantitative Studies (3) (Same as Geology 555 and Zoology 555.)

565 Phytoplankton Ecology (3) Interaction between environment and phytoplankton. Nutrient uptake, primary production, competition, ecological theory applied to phytoplankton communities, and physiological adaptations by populations to environment. Prereq: 310 or consent of instructor.

573 Population Biology (3) (Same as Zoology and Ecology 573.)

578 Plant Cell Biology (4) Plant cellular organization, structure and function; interaction of cellular components and correlation of their structures and functions. Principles and application of analytical and experimental laboratory procedures in cell biology research. Prereq: Biology 220 or equivalent. Recommended prereq: Biochemistry 410-19, 3 hrs and 1 lab. F,A

580 Bryophytes and Pteridophytes (4) Taxonomy, phylogeny, ecology and developmental morphology; field studies and current research. Prereq: 310-20 or consent of instructor. 2 hrs and 2 labs. F,A

581 Cytogenetics (3) Chromosome structure and behavior during mitotic and meiotic divisions in relation to structural changes, genetic controls, hybridization, speciation, and polyploidy. Laboratory emphasis on normal and aberrant meiotic systems and somatic chromosomes from plants and animals. Prereq: 310 and at least 6 additional hrs in biological sciences. (Same as Forestry 581.) S,A

582 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various research methods, lab exchange relative to fermentation, spectrophotometry, polarography, zonal and ultracentrifugation, gas chromatography, automatic analysis, microscopy, culture methods, and detection of radioisotopes. Prereq: Chemistry 350, 360; Physics 121, 122. May be repeated. Maximum 5 hrs. S/N/C only.

583 The Field Research Problem (3) Conceptualization, planning, and implementing field research. Criteria for choosing instruments, sampling methods, and locations for study of populations, communities, and ecosystem. Field practice. Development and critique of formal research proposal like those required by granting and contracting agencies. Prereq: 431, or 535 or 573.

585 Methods and Instrumentation in Field Investigation (1) Appropriate methods and instrumentation. Topics vary. May be repeated with consent of instructor. Maximum 5 hrs. S/N/C only.

590 Developmental Plant Morphology (3) Developmental morphology of plants from vegetative to reproductive organogenesis, and of organ determination and differentiation. Prereq: 310, 320 or 412 and 321 or 521 or consent of instructor. 2 hrs and 1 lab. F,A

600 Doctoral Research and Dissertation (3-15) P,N,P only. E

606-07 Advanced Topics in Botanical Sciences (1-3, 1-3) Experimental botanical science: nomenclature, morphology and systematic of vascular plants, cryptogams, fungi, cytology and cell biology, genetics, plant physiology, palynology and ecology. May be repeated. Maximum 12 hrs.

632 Ecosystems of the World (2) Characterization of world and regional ecosystems; special characteristics of ecosystems fund. F,A

637 Applied Ecology (3) (Same as Ecology 637.)

662 Seminar in the History of Botany (2) History of botanical exploration and advances from early civilizations to modern period. May be repeated. Maximum 4 hrs.

### Broadcasting

**College of Communications**

**MAJOR DEGREES**

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

Norman R. Swan, Head

**Professors:**

Holt, Darrel W. (Emeritus), Ph.D. Football, Northwestern

Howard, Herbert H., Ph.D. Ohio State

Swan, Norman R., Ph.D. Missouri State

**Associate Professors:**

Moore, B. A., Ph.D. Ohio State

Ziegler, Dhyana, Ph.D. Southern Illinois State

**Adjunct Professor:**

Buhrman, Joseph, Ph.D. Indiana State

**Assistant Professor:**

Netson, Lindsey, B. A. Tennessee State

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

### GRADUATE COURSES

**410 Television News (3)** Writing, reporting, performing, and producing news for television. Experience as reporter/producers for television news program. Electronic news gathering equipment and techniques, video editing. Prereq: 310, 1-4 yrs. F,A

**420 Radio-TV Sales and Promotion (3)** Problems and practices of television, radio, and cable sales and promotion. Case studies in sales, sales management, pricing, rate cards, use of rating, and sales presentation. Effective station promotion techniques. Prereq: 320. F

**430 Producing for Television (3)** Principles of studio and field production. Both technical and creative. Writing, producing, shooting, and editing video stories and programs. 3-4 cameras, recorders, and editing system. Prereq: 320. E


**490 Radio & Television Management (3)** Business policies and practices of broadcast operations, departmental function, cost and income analysis, leadership styles and techniques, mid-level management. Capstone course to be taken in student's last semester. Prereq: 275, 310, 320, 330. E

**560 Radio & Television Law and Regulations (3)** Legal problems faced by broadcast managers. Philosophy of regulatory policy formation. Efforts at self-regulation. Sociopolitical restraints, effects of laws and regulations, and public pressure on stations, networks, cable and new technologies. Unique situation of broadcasting among mass media in terms of regulations. Prereq: Consent of instructor or admission to program. F

**570 Radio & Television Research (3)** Various techniques used by stations and consultants in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq: Communications 512 or 612, or consent of instructor. Sp

**580 Seminar in Radio & Television (3)** Salient issues in broadcasting. Topics vary. International broadcasting, cable television, new technologies, corporate television, educational and public broadcasting, broadcasting and society. Prereq: Consent of instructor or admission to program. F


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

**598 Internship (3)** Full-time (30-40 hrs per week) work experience in news, production, or sales and management with non-university professional organization. Educational experience beyond that available at university. Final term paper. Non-retroactive credit for previous work experience. Prereq: Senior or graduate standing, completion of at least 15 hrs of broadcasting courses, GPA 3.0 or better, and consent of department head.

### Business Administration

**College of Business Administration**

**MAJOR DEGREES**

**Business Administration** M.B.A., J.D.-M.B.A.

The College of Business Administration offers two college-wide programs, the MBA and the Ph.D. with a major in Business Administration. A dual degree program is available within the college and leading to the J.D.-M.B.A.

To obtain application materials, write or call: Associate Dean for Academic Affairs, Suite 527, Stokely Management Center, College of Business Administration, The University of Tennessee, Knoxville, TN 37996-0550, Telephone: (615) 974-5033

**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 basis. The Ph.D. in Business Administration is available to residents of West Virginia or Virginia; the MBA is available to residents of Arkansas, Louisiana, West Virginia, or Virginia.

**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 degree program for full-time students and the next two semester’s coursework as established by the degree program for part-time students.

**THE MBA PROGRAM**

The MBA program is designed for students with undergraduate degrees in the social and natural sciences, the humanities, and professional fields such as engineering, business, agriculture, and architecture. For full-time students, the MBA program is a two-year, lock-step program with students beginning in the fall of each year and graduating in the spring, two years hence. During the summer between the first and second year, students must complete an internship with a company using those skills acquired during the first year of the MBA program.

The complete MBA program with a concentration in management or new venture analysis and entrepreneurship is offered for part-time evening students. The part-time program has the same admissions requirements, curriculum, and core courses as established by the degree program, which is not required of part-time students, and faculty as the full-time program. Part-time students enter in the fall semester and take approximately 4 years to complete the program. Part-time students are required to successfully complete six hours of graduate credit per semester.

The program consists of 14 MBA core courses and 5 concentration/elective courses. Each course is 3 semester hours of graduate credit with the exceptions of Business Administration 501 and 503, which are one semester hour of graduate credit each.

**Admission Requirements**

Applications are accepted for fall semester only. The application deadlines for fall semester are March 1 for international students and April 1 for others. Applications by U.S. citizens and permanent residents received after April 1 will be considered as space allows.

To be considered for admission, the applicant’s file must be complete. A completed file includes the Graduate School Application, transcripts of prior college work, the MBA program application, two completed applicant recommendation forms, and the Graduate Management Admission Test (GMAT) score report. The first items should reach The Graduate School Application before the MBA application deadline to allow for processing. Additional information is required by The Graduate School for international students.

For admission to the MBA program, consultation is given to (1) applicant’s academic record with particular attention to the last two years of undergraduate work and previous graduate studies, (2) scores on the GMAT and the Test of English as a Foreign Language (TOEFL) for those whose native language is not English, (3) work experience and other activities that demonstrate potential for leadership, and (4) recommendations from professors and work supervisors. The admission decision is based on all factors which make up the total application; therefore, there is no automatic cut-off for either grade point averages or GMAT scores.

**Prerequisites**

College-level mathematics through at least one course in college-level calculus, taken within the past 5 years, with a grade of B or better, is the only prerequisite requirement for entry into the program. Students whose undergraduate training does not include calculus should arrange to take it at UT Knoxville or at another accredited institution prior to the fall semester of entry into the program. Those electing the management science or statistics concentration must have completed two years of college-level calculus.

**MBA Program**

The following courses are required in each student’s program. For full-time students, the sequence of core courses is:

- **First semester:** Business Administration 501, Accounting 501, Management 504, Economics 501
- **Second semester:** Business Administration 503, Accounting 503, Management/Logistics 505, Finance 501, Marketing 501
- **Third semester:** Economics 503, Business Administration 506.
- **Fourth semester:** Business Law 501, Business Administration 509.

The same courses, but in a different sequence, comprise the core for part-time students.

**Concentration and Electives**

A concentration area may be indicated on the MBA Program Application or this declaration may be deferred until after matriculation. In any event, selection must be made no later than completion of 18 hours of MBA program coursework. In some cases selection of an area early in the program is encouraged to facilitate proper course sequencing. Requests for changes in concentration area must be submitted for approval to the Office of Graduate Business Programs.

Among the 5 courses in the concentration/electives block, at least 3 but not more than 4 must be in one of the following concentration areas. For specific courses required in concentration areas, see the appropriate field of instruction.

- Controllership
- Economics
- Finance
- Forest Industries Management
- Management Science
- Marketing
- New Venture Analysis and Entrepreneurship
- Statistics
- Logistics and Transportation

The remaining elective courses (1 to 2) must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the college. Courses outside the College of Business Administration as well as those listed in the Graduate Course Catalog numbered below 500 may be included in this block only with written prior permission via formal petition to the Office of Graduate Business Programs.

**Transfer Credits**

Graduate level courses taken at other institutions accredited by the American Assembly of Collegiate Schools of Business that otherwise conform to University policy may be credited toward MBA degree requirements within the following limits:

- **MBA Core:** 6 hours
- **Concentration Area:** 3 hours (provided at least 6 hours of work at this institution are included in the concentration area).
- **Elective Area:** 3 hours.

The maximum number of hours that may be transferred is 8 semester hours. Transfer credit will be considered upon formal petition to the Associate Dean for Graduate Business Programs.

**Other Requirements**

The Application for Admission to Candidacy must be approved by two faculty members and the department head in the student’s area of concentration and the Associate Dean for Academic Affairs in the College of Business Administration. It should be submitted to the Graduate Office at least one full semester prior to the date the degree is conferred. (Admission to candidacy in the fall semester permits graduation in the following spring semester.)

To qualify for the degree, the student must achieve a B average (3.0) or above in MBA core courses required in his/her program, a B average or higher in courses comprising the concentration area, and a B average or higher in the overall program. The student must demonstrate competency in these areas in a comprehensive exam administered in the capstone course, Business Administration 509.

**BUSINESS ADMINISTRATION CONCENTRATION**

For complete listing of MBA program requirements see above.

- **MBA Concentration:** New Venture Analysis and Entrepreneurship

The concentration is comprised of three specifically designed courses which are interdisciplinary in nature. This concentration strives to build a strong academic foundation for both entrepreneurial and intrapreneurial activities. The new venture analysis and entrepreneurship concentration is offered to both the full- and part-time student in recognition of the growing trend in American business today towards new product/venture development. The new venture analysis/entrepreneurship concentration courses may be combined with two elective courses in another area (management or marketing) to achieve a dual concentration.

Minimum course requirements are Finance 551, Management 551, and Marketing 550. These course descriptions are listed under their fields of instruction.

**PRE-MBA PROGRAM**

The College offers a joint BA/MBA program with the College of Liberal Arts. Students in this program take their first three years of coursework in Liberal Arts, and their last two years in the College of Business Administration. Within their first three years, students fulfill all general education requirements for the BA degree, both upper and lower division along with a minor offered by one of the Liberal Arts departments. They may use one Economics course only to fulfill distribution requirements, and they are required to take a year of calculus as the only prerequisite to the MBA.

Admission requirements are higher than those normally expected of MBA applicants. Desired qualifications include a minimum 3.4 GPA and a GMAT score of 600 or higher. Students interested in the program are counseled initially in the Liberal Arts Advising.
Center regarding admission standards and Liberal Arts requirements. At the end of their second year, they have a conference with the Associate Dean for Academic Affairs and are advised of their prospects for formal admission. Students who are likely candidates are advised to take the LSAT at their convenience. Test in October of the third year, and to submit their applications to the Associate Dean for Academic Affairs. The admission decision is made by January of the third year.

Upon admission, students begin MBA coursework in the fourth year and are awarded a BA degree at the end of that year. Students take 3 hours of graduate coursework during their senior year under the senior privilege rule, which requires them to notify the Associate Dean for Academic Affairs. The establishment of the dual program recognizes the increasingly complex body of knowledge necessary to the creative conduct of business and business-related law practice, the complementary nature of many aspects of the graduate programs of the College of Law and the College of Business Administration, and the intellectual benefits inherent in the concurrent study of both business and business-related law. Students are encouraged to take courses in the dual program leading to the conferral of both the J.D. and MBA degrees independently.

DUAL J.D.-MBA PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual program leading to the Doctor of Jurisprudence and the Master of Business Administration. The dual program saves the student an average of one semester over the time that would be required to earn both degrees independently.

The establishment of the dual program recognizes the increasingly complex body of knowledge necessary to the creative conduct of business and business-related law practice, the complementary nature of many aspects of the graduate programs of the College of Law and the College of Business Administration, and the intellectual benefits inherent in the concurrent study of both business and business-related law. Students are encouraged to take courses in the dual program leading to the conferral of both the J.D. and MBA degrees independently.

Admission Requirements

Applicants for the J.D.-MBA program must make separate application to, and be competitively ranked by, both the College of Law for the J.D., The Graduate School and College of Business Administration for the MBA degree, and by the Dual Program Committee.

Students who have been accepted by both colleges may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both colleges. Such approval will be considered only if space is available, provided that dual program studies begin prior to entry into the last 28 semester hours of J.D. coursework and prior to entry into the second year of the MBA program. Students interested in entering the dual degree program should submit a letter of application to the Dual Program Committee.

Upon receipt of the application, the Dual Program Committee will determine eligibility and assign students to advisors who will be responsible for course approval and supervision of the student's progress through the dual program.

Curriculum

A dual program candidate must satisfy the graduation requirements of each college. Students withdrawing from the dual program before completion of both degrees will not receive credit toward graduation from either college in their time in the program. The College of Business Administration will award up to 12 semester hours of credit toward the MBA for approved courses offered in the College of Law, 3 hours of which will replace Business Law 501, an MBA core requirement. The approval of courses is the responsibility of the Dual Program Committee and the student's assigned advisor.

Students may begin their studies in either the J.D. or the MBA program, but may not enroll in MBA coursework while completing the first year of the J.D. coursework or in approved courses offered in the College of Law while completing the first year of the business curriculum. During the first year in the J.D. program, students register through the College of Law. For any term in which students take MBA courses, they are also taking law courses, they must register through the Graduate School. The Graduate School registration form must be approved by the Associate Dean for Academic Affairs

Awarding of Grades

Grades for graduate business courses accepted by the College of Law and grades for law courses accepted by the College of Business Administration in approved coursework 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 in which 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 law course in which the student has earned a 2.3 grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

Approved Dual Credit

MBA courses to be counted toward the J.D. program must include Accounting 501, 503 or a more advanced graduate accounting course and 6 semester hours approved by the College of Law. Law courses to be counted toward the MBA must be selected from those approved by the Associate Dean for Academic Affairs.

DOCTORAL PROGRAM

The primary objective of the Ph.D. in Business Administration is to prepare a select number of qualified students for careers in university-level teaching and research and for responsible positions in business and government.

Admission Requirements

Students seeking the Ph.D. degree must be recommended for acceptance by the College of Business Administration to The Graduate School. Actual admission is based on the applicant's overall standing compared with other applicants and weight is given to a number of vacancies in each department. The Graduate School requires the Graduate School Application, transcripts from all previous college work, and additional information from international students. The College requires the Ph.D. application, scores from the GMAT, and four written recommendations. All materials should be received by the College of Business Administration not later than March 1. Late applications are considered only if space is available.

Under exceptional circumstances, a student may be considered for acceptance into the Ph.D. program without having a Master's degree. An applicant in this situation should have an outstanding undergraduate background and should represent a deep and sincere commitment to the pursuit of a career in research and instruction.

Program of Study

The Ph.D. normally requires at least three years of intensive study and research beyond the Master's degree. Typically, the first two years of a student's program consist of coursework, writing, and research. The third year usually focuses on completion of the dissertation research and writing. It is emphasized that the Ph.D. program of study is structured for full-time students only. Upon acceptance of a student by a particular department, the student is expected to remain in residence until the dissertation has been completed and all requirements are met for completion of the Ph.D.

Since the program focuses on the development of competent scholars, heavy emphasis is placed on both teaching and research skills. As part of the doctoral program, each student is required to serve as a teaching assistant to an undergraduate business class or as a research assistant to a senior faculty member. Typically, the College of Business Administration offers financial support for doctoral students during their tenure in the program. The Ph.D. program is highly flexible, offering a wide array of concentrations and cognates. Moreover, heavy emphasis is placed on individualized instruction and close student-faculty interaction. In addition, the program takes the form of regularly scheduled classes, doctoral seminars, and independent study and research. Students are also encouraged to attend lectures and discussions by visiting scholars throughout the year.

There are five concentrations offered in the Ph.D. program: Accounting, Finance, Management (Operations Management and Strategic Management), Marketing, Logistics and Transportation. More detailed information concerning these specific areas is available by writing directly to each department chairperson and by referring to the appropriate fields of instruction.

Degree Requirements

Doctoral students must file a program of study that has been approved by their temporary doctoral advisory committee and the
Associate Dean for Academic Affairs by the end of the first semester of coursework after entry into the program. This committee is nominated by the department chairperson in a student’s intended area of concentration, subject to the Graduate Council’s policies and procedures. Following are specific degree requirements:

1. Students must complete at least three years of full-time coursework beyond the baccalaureate degree, with two years of residence on the Knoxville campus.

2. Students must complete appropriate courses at the graduate level, or other approved concentrations of coursework, in the following areas:

- Accounting
- Behavioral Science
- Business Policy
- Calculus
- Computer Science
- Economics
- Finance
- Legal Environment
- Management
- Marketing
- Statistics

All work in the above areas is subject to approval by the temporary doctoral advisory committee and the Dean for Academic Affairs. Specific majors may have prerequisites not listed above.

- 3. Basic Core: Economics 510 (or approved substitute) is required, except that Management 567 (or equivalent) may be substituted with prior approval.

- 4. Research Tools: A minimum of 9 semester hours of graduate research methods must be completed. At least 6 semester hours in statistics courses beyond Statistics 531 are required. The remaining 3 semester hours may be completed in additional statistics courses (not to include Statistics 531) or in other areas such as research methodology, management science, computer science, econometrics, and psychometrics.

- 5. Concentrations: The concentration is the focal point of the Ph.D. program. Students are expected to master the literature and research techniques in the concentration area and to do quality research as evidenced by the preparation of an acceptable dissertation. A minimum of 12 semester hours of coursework is required, including at least one term of doctoral seminars. Graduate work taken in the concentration at other institutions is considered by the temporary doctoral advisory committee in approving the specific coursework required. Available concentrations are: accounting, finance, management (operations management and strategic management), marketing, and logistics/transportation. See the appropriate fields of instruction for specific course requirements.

- 6. A minimum of 9 semester hours of graduate coursework is required in an area outside, but complementary to, the concentration. The student may choose the cognate from one of the following: one of the five concentration business areas listed above, economics, statistics, or a related area in another school or college of the University.

Comprehensive Examinations

Comprehensive written examinations over the concentration and cognate areas are required of each person seeking candidacy for the Ph.D. The concentration area examination is administered in two sessions of approximately four hours each and the cognate area examination in one session of approximately four hours. Written examinations may be supplemented with oral examinations. For a doctoral student having a cognate area in the College of Law, the results of only an oral examination may be deemed acceptable. Scheduling of comprehensive examinations is coordinated through the Office of Graduate Business Programs. Comprehensive examinations are generally offered during the fall and spring terms. Comprehensive examinations must be taken within five years of matriculation.

When either the concentration or cognate area examination is passed, the remaining examination must be passed within the next 13 months.

Doctoral Committee

A doctoral student is advised to give serious attention early in the program to the composition of his/her doctoral committee. In accordance with Graduate School policy, the student and the Associate Dean for Academic Affairs jointly select a doctoral committee. The student's doctoral committee is composed of at least five members, excluding the chair, each of whom must be appointed by the Graduate Council and must have a full-time appointment to the University at the time of appointment. The minimum size of the doctoral committee is six members, with at least four members from the University.

Admission to Candidacy

Students may apply for admission to candidacy for the Ph.D. after maintaining at least a “B” average in coursework, successful completion of comprehensive examinations, and acceptance of a research proposal for the dissertation by the student’s doctoral committee. Admission to candidacy must be approved by the Graduate Council to direct doctoral research. When the doctoral committee has been formed, the temporary doctoral advisory committee ceases to exist.

Application for admission to candidacy must include a listing of all courses taken in each of the fields required for the degree (business functional areas, basic disciplines, concentration and cognate areas). Graduate courses accepted from other institutions must be included. Under “Other Requirements,” the date of acceptance of the research proposal by the doctoral committee should be indicated. The application must be approved by the student’s doctoral committee and the Associate Dean for Academic Affairs before submission to The Graduate School.

Dissertation

Minimum of 24 semester hours: The student must complete a dissertation embodying the results of original research demonstrating the ability to do scholarly writing. The dissertation is supervised by the candidate’s doctoral committee, which must certify its completion and acceptability after oral defense of the candidate's research effort.

The dissertation normally must be completed within three years of the student’s advancement to candidacy.

GRADUATE COURSES

501-63 Integrative Management I, II (1,1) Introductory integrative managerial policy and strategy for MBA's only. Use of tools of analysis, data, information, design, and remediation to identify, solve, and correct problems in and of organizations.

506 Management Information Systems (3) Analysis of organizational information needs, decision support systems, data base designs, data base software, computer utilization in data display, modeling, and strategies.

509 Managerial Policy and Strategy (3) Strategy and policy that affect character and success of total enter-
prise. Capstone course integrating all functional areas in formulation and implementation of strategy that enables organization to reach objectives. Prereq: MBA core.

510 Economics, Marketing and Management of Service Organizations (3) Unique cost, pricing, marketing and management issues created by the inability of service organizations to inventory output for later resale. Modification of traditional business concepts for organizations that manage service capacity rather than producing inventory.

599 Executive-In-Residence (3) Interaction with corporate executives from wide spectrum of business disciplines and discussion of domestic and international strategic planning as applied in major corporations. Prereq: MBA core and consent of instructor.

Chemical Engineering

(4) Degree Requirements

MAJOR DEGREES

Chemical Engineering .......................... M.S., Ph.D.

John W. Prados, Head

Professors:

- Bogue, Donald C. (Adjunct), Ph.D. .................. Delaware
- Byers, Charles H. (Adjunct), Ph.D. ............... California
- Clark, Edward S., Ph.D. .............................. California
- Counsel, Robert M., Ph.D. ............................ Tennessee
- Crawford, Lloyd W. (UTSI), Ph.D. ............... Cincinnati
- Cuberlin, Oran L. (Emeritus), Ph.D. ............... Texas
- Donaldson, Terry L. (Adjunct), Ph.D. ............. Pennsylvania
- Doss, James W. (Adjunct), Ph.D. ................. Tennessee
- Fellers, John F., Ph.D. ............................... Akron
- Fraizer, George C., Jr. (Condra Prof.) .......... Johns Hopkins
- Holmes, John M. (Emeritus), Ph.D. .............. Tennessee
- Hsu, Hsien-Wen, Ph.D. ............................. Wisconsin
- Moore, Charles F., Ph.D. ........................... Louisiana State
- Perona, Joseph J., PE, Ph.D. ....................... Northwestern
- Phelps, Tommy J. (Adjunct), Ph.D. ............... Wisconsin
- Prados, John W. (University Prof.), PE, Ph.D. ... Tennessee
- Scott, Charles D. (Adjunct), Ph.D. ............... Tennessee
- Thomas, Carl O., Ph.D. .............................. Tennessee
- Watson, Jack S., Ph.D. .............................. Tennessee

Associate Professors:

- Basaran, Osman A. (Adjunct), Ph.D. ............. Minnesota
- Biernkowski, Paul R., Ph.D. ....................... Purdue
- Bruns, Duane D., Ph.D. .............................. Houston
- Cochran, Henry D. (Adjunct), Ph.D. .......... MIT
- Davison, Brian H. (Adjunct), Ph.D. ......... Cal Tech
- Downs, James E. (Adjunct), Ph.D. .......... Tennnessee
- Hansen, Marion G., Ph.D. ....................... Wisconsin
- Scott, Timothy C. (Adjunct), Ph.D. .......... Wisconsin
- Sheath, Atul C. (UTSI), Ph.D. ............... Northwestern
- Vogel, Ernest F. (Adjunct), Ph.D. .......... Texas
- Wang, Tso-Wei, Ph.D. .............................. MIT
- Weber, Frederick E., Ph.D. ....................... Minnesota

Graduate programs lead to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering with concentrations in chemical engineering, chemical bioengineering, advanced control systems, and polymer science and engineering.
THE MASTER'S PROGRAM

The standard Master's program includes a thesis and leads to the Master of Science. Minimum departmental requirements are as follows:

1. A total of at least 21 hours in graduate coursework in chemical engineering and related areas excluding thesis. The minimum requirements are 15 hours in chemical engineering; 3 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 3 optional hours from either one of these two categories.

2. A Master's thesis; ChE 500, totaling 9 hours.

3. Active participation in graduate seminars in the department. Resident students must register for ChE 501 every semester it is offered.

4. A final oral examination covering the thesis, related fields and graduate coursework.

Under certain conditions, a candidate may apply for a non-thesis program. To be eligible, a 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. The departmental faculty will consider each application individually. Upon acceptance, the requirements for completion of the non-thesis option are as follows:

1. A total of at least 33 hours in graduate courses in chemical engineering and related areas. The minimum requirements are 18 hours in chemical engineering; 6 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 9 optional hours from either one of these two categories.

2. Completion of a critical review of the literature and other sources in an area related to chemical engineering (ChE 580).

3. A written comprehensive examination over the major field and an oral examination covering the review paper and related areas.

THE DOCTORAL PROGRAM

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

Department requirements consist of the satisfactory completion of:

1. Graduate courses in chemical engineering, amounting to approximately 24 semester hours, at least 9 of which must be in 600 series courses.

2. Supporting courses in related scientific and engineering fields amounting to approximately 24 semester hours, subject to approval by the student's faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.

3. The comprehensive examination, consisting of a written part and oral part. The written part covers thermodynamics, reactor analysis, and transport phenomena and separations.

4. Active participation in graduate seminars conducted by the department. Resident students must register for ChE 501 every semester offered.

GRADUATE COURSES

401 Chemical Engineering Data Analysis (3) Experimental data; identification of system extremes; statistical properties of output relation of various processes; statistical process control; optimization techniques.

403 Introduction to Optimization (3) Principles and applications of optimization techniques; constrained and unconstrained optimization; linear programming, dynamic programming, and geometric programming. Prereq: Math 421.


485 Hydrocarbon Processing (3) Chemical and physical properties of selected petroleum and those processes utilized in conversion of raw material into various fuels and selected chemical feedstocks. Prereq: Mass Transfer and Separation Processes. Organic Chemistry.

486 Coal Processing to Liquid Fuels (3) Characterization of various coals with respect to current gasification and liquefaction technologies; modeling of conversion processes and estimation of product yields and associated water, oxygen, and energy requirements; catalytic hydrogasification and reactor design consideration; economic assessments. Prereq: 485.

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

501 Graduate Seminar (1) Prereq: Admission to graduate program. May be repeated. S/NC only.

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

505 Engineering Analysis (3) Formulation and solution of problems in chemical engineering and materials areas, ordinary and partial differential equations; types of ODE, PDE and solution techniques; transform methods; conformal mapping; variational methods; introduction to numerical methods. (Same as Materials Science Engineering 505.)

506 Approximate Methods in Chemical Engineering (3) Chemical engineering problems requiring approximate solution; introduction to some approximate methods. Prereq: 505.

507 Application of Numerical Linear Algebra in Systems and Control Engineering (3) Fundamental concepts of linear algebra to problems in systems and control areas. Overview of physical interpretations of relevant concepts; least square problems, LU, OR, and SVD decompositions of matrix, eigenvalue problems and similarity transformations in solving difference and differential equations. Numerical computational aspects of various algorithms. Application of linear algebra concepts in optimization problems to linear programming. Computer projects. Prereq: Graduate standing or consent of instructor. (Same as Electrical and Computer Engineering 507 and Mechanical Engineering 507.)


531 Advanced Chemical Engineering Thermodynamics (3) Phase equilibrium in ideal and nonideal solutions; composition relationship between phases, solution behavior and application to macromolecules; introduction to microscopic approach to thermodynamics.


541 Fluid Mechanics and Polymer Processing (3) (Same as Materials Science and Engineering 541.)

542 Diffusive and Stagewise Mass Transfer Operations (3) Analysis of mass transfer processes, coupled mass balance, process design, reactor design, mass transfer, applications of packed towers and agitated vessels, membrane separations. Equilibrium stage concepts applied to mass transfer operation, emphasizing nonequilibrium and multicomponent systems.

551 Chemical Reaction Analysis (3) Rate models for heterogeneous reactions, properties of porous catalyst, catalyst deactivation, fluid-fluid and fluid-solid reactors.

561 Process Modeling and Simulation (3) Theories and models of structures and art of simulation. Development from basic principles. Model development from plant list. Uses computer simulation to study the effect of optimization and control. Prereq: Consent of instructor.

575 Applied Microbiology and Bioengineering (3) Crossdisciplinary course combining basic concepts in microbiology, biochemistry, biotechnology, and biochemical and environmental engineering. Commercial processes, biodegradations/wastewater treatment, analysis of basic bioreactor systems, biosensors, and immobilization methods. Fundamental laboratory techniques during 6-week laboratory period. (Same as Environmental Engineering 575 and Microbiology 575.)

576 Principles of Chemical Separations (3) Fundamental aspects of chemical and biochemical separations methods with emphasis on separations as unified field; several chemical separation techniques with application examples from both chemical and biochemical fields; development of predictive mathematical models.


581 Industrial Waste Minimization (3) Principles and practical aspects of industrial waste minimization. Regulatory environment, waste minimization strategies, economic criteria, process safety, case study: analysis of alternative waste minimization management technologies. Prereq: Graduate standing in engineering or consent of instructor.

585 Process System Reliability and Safety (3) (Same as Nuclear Engineering 585.)

588 Measurement Science I (3) (Same as Nuclear Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 588, Engineering Science and Mechanics 588, Mechanical Engineering 588, and Aerospace Engineering 588.)
589 Measurement Science II (3) (Same as Nuclear Engineering 589, Electrical and Computer Engineering 589, Engineering Science and Mechanics 589, Mechanical Engineering 589, and Aerospace Engineering 589)

590 Special Topics in Chemical Engineering (3) May be repeated. Maximum 6 hrs.

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

625 Venture Analysis (3) One or more chemical engineering processes or products selected as basis for proposed new business venture. Case study with attention to markets, manufacturing needs, cost estimation, and management and financial planning. To support decision on management or by potential investors. Prereq: 525 or equivalent.

631 Advanced Topics in Statistical Thermodynamics and Molecular Dynamics (3) Statistical thermodynamics, molecular based computer simulations, Monte Carlo and molecular dynamic calculations; applications to supercritical fluids, macromolecules and biological systems. Prereq: 531


642 Advanced Topics in Polymer Processing (3) (Same as Materials Science and Engineering 642.)


661 Advanced Topics in Process Dynamics and Control (3) May be repeated. Maximum 6 hrs.

675 Microbial Systems Analysis (3) Identification and analysis of complex microbial systems using perturbation-response methods. Structuring of important mechanistic processes, interactions, and regulation at several systems levels (reactor or macro, ecological, cellular/physiological and molecular). Experimental methods for data gathering, signal resolution and processing, mathematical analysis, model development (deterministic, stochastic, phenomenological), and utility and limitations of approach. Prereq: 575 or consent of instructor. (Same as Environmental Engineering 675.)

691 Advanced Topics in Chemical Engineering (3) May be repeated. Maximum 6 hrs.

Chemistry

(College of Liberal Arts)

MAJOR DEGREES

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

Gleb Mamantov, Head

Professors:

Baker, D. C., Ph.D. ........................................ Ohio State
Bloor, J. E., Ph.D. .......................................... Manchester
Bull, William E., Ph.D. ................................. Illinois
Chambers, J. O., Ph.D. ................................... Kansas
Compton, R. N., Ph.D. .................................... Tennessee
Dean, J. A. (Emeritus), Ph.D. .......................... Michigan
Eastham, J. F., Ph.D. ..................................... California
Fletcher, W. H. (Emeritus), Ph.D. ...................... Minnesota
Grimm, F. A., Ph.D. ....................................... Cornell
Guiochon, G. (Distinguished Scientist), Ph.D. ....... Ecole Polytechnique and Paris VI
Kabalka, G. W., Ph.D. .................................... Purdue
Kleinerfein, D. C., Ph.D. .................................. Princeton
Lietzke, M. H. (Emeritus), Ph.D. ....................... Wisconsin
Magro, A. (Emeritus), Ph.D. ............................. Temple
Magid, R. M., Ph.D. ....................................... Yale
Mamantov, Gleb (Distinguished Prof.), Ph.D. ...... Louisiana State

Pagni, R. M., Ph.D. ....................................... Wisconsin
Peterson, J. R., Ph.D. ..................................... California
Schweitzer, George K. (Distinguished Prof.), Ph.D. Illinois
Smith, W. T. (Emeritus), Ph.D. ......................... Ohio State
VanHook, W. A., Ph.D. .................................. Johns Hopkins
Wehry, E. L., Ph.D. ....................................... Purdue
Williams, T. F. (Distinguished Prof.), Ph.D. ........... London

Associate Professors:

Adcock, J. L., Ph.D. ....................................... Texas
Alexandratos, D., Ph.D. .................................. California
Barnes, C. E., Ph.D. ....................................... Stanford
Bartmess, J. E., Ph.D. .................................... Northwestern
Cook, K. D., Ph.D. ........................................ Wisconsin
Kovac, J. D., Ph.D. ........................................ Yale
Lane, C. A., Ph.D. .......................................... California
Schell, F. M., Ph.D. ....................................... Indiana
Sepanlak, M. J., Ph.D. .................................... Iowa State
Woods, C., Ph.D. ......................................... NC State

Feigler, C. S., Ph.D. ...................................... Colorado
Shibata, J. H., Ph.D. ...................................... Washington

Assistant Professors:

THE MASTER'S PROGRAM

The department offers concentrations in six areas for the M.S.: analytical chemistry, environmental chemistry, inorganic chemistry, organic chemistry, polymer chemistry, and physical chemistry. The requirements for the M.S. in Chemistry consist of the satisfactory completion of:

1. Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 500.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
3. Prescribed remedial courses based on performance on entrance examinations.
4. Sufficient graduate coursework in chemistry (at the 400 level or above) and/or a related field to make an overall total of 30 hours, including one of the following sequences: 510-11-12, 530-31-32, 550-51-52, 53-54, 570-71-72-73, and 590-94-95.
5. A final oral examination.

THE DOCTORAL PROGRAM

The department offers concentrations in eight areas for the Ph.D.: analytical chemistry, chemical physics (in cooperation with the Department of Physics), environmental chemistry, inorganic chemistry, organic chemistry, physical chemistry, polymer chemistry, and theoretical chemistry.

The requirements for the Ph.D. in Chemistry (except for the chemical physics concentration) consist of the satisfactory completion of:

1. Research and a dissertation to give at least 24 hours of graduate credit in Chemistry 600. Registration must be continuous from the beginning of research.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.
3. Prescribed remedial courses based on performance on entrance examinations.
4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 600.
5. Demonstration of a reading knowledge of French, German, Russian, or an alternative approved by the Chemistry faculty.
6. Eighteen additional hours in courses at the 500 level or above including at least one course above 601 and one of the following sequences: 510-11-12, 530-31-32, 550-51-52, 53-54, 570-71-72-73, and 590-94-95.
7. A final oral examination.

THE Ph.D. program in chemical physics in chemical physics is conducted jointly with the Department of Physics. Requirements depend on the choice of the major department. Chemistry departmental requirements include passing the above degree requirements in chemistry with concentration in physical chemistry plus 6 additional hours in physics at the 500 level or above. Three of the additional physics hours can be used to satisfy the 18 hours requirement in item 6.

GRADUATE COURSES

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 230. Prereq or coreq: 380 or 381.

431 Radioactivity and Its Application (2) Radioactive materials in tracer and therapeutic applications. Radioactivity in decay, detection, apparatus, and techniques, tracer procedures, safety precautions in agriculture, biology, medicine, nutrition. Not for credit by chemistry or physics majors or minors. Prereq: Mathematics 120 or equivalent and 1 or general chemistry. Sp


471-81 Biophysical Chemistry (3,3) (Same as Biochemistry 471-81.)

473-83 Physical Chemistry (3,3) Students may not receive credit for both 473 and 473 nor for both 481 and 483-83: Properties of phases, thermodynamics, electrochemistry, and spectroscopy.

475-83 Physical Chemistry (3,3) Properties of substances; structure and properties of matter; solid state; quantum mechanics; and applications to solid state, surface science, and spectroscopy. Prereq: General chemistry, physical chemistry, and quantum mechanics.

479-89 Physical Chemistry Laboratory (2,2) Emphasis on current trends. Prereq: 471-81 or 473-83. Prereq or coreq: 481-83. Sp

484 Advanced Physical Chemistry (3) Dynamic chemical and quantum mechanistic, quantum mechanics of atomic and molecular systems, crystal structure and solid state. Prereq: 481 or 483.
571 Advanced Quantum Chemistry and Spectroscopy (3) Prereq: 570 or consent of instructor. Sp.

572 Thermodynamics and Statistical Mechanics (3) Microscopic and macroscopic description of equilibrium systems. Basic principles of thermodynamics and statistical mechanics, and application to selected chemical systems. Prereq: 1 yr of physical chemistry. F.

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory. Prereq: 1 yr of physical chemistry. Sp.

580 Fundamental Topics in Physical Chemistry (3) Quantum chemistry, spectroscopy, chemical kinetics, transport properties, thermodynamics, and statistical thermodynamics. Prereq: 1 yr of physical chemistry. F.

590 Polymer Chemistry (3) Fundamentals of polymer synthesis and characterization through application of organic and physical chemical principles. Prereq: 1 yr each of organic and physical chemistry. Sp.


595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solution and bulk properties, rubber elasticity, kinetics of polymerization, polymer thermodynamics. Prereq: 590. F.

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

601 Chemistry Research Proposal (2) Preparation and oral defense of original written research proposal based on thorough survey of chemical literature. Prereq: Consent of department head. S/NC only. E

610 Selected Topics in Analytical Chemistry (3) Topics of current significance. Prereq: 510-11-12 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Selected Topics in Inorganic Chemistry (3) Topics of current significance. Prereq: 530-31-32 or consent of instructor. May be repeated. Maximum 12 hrs.

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 550-51-52 or consent of instructor. May be repeated. Maximum 12 hrs.


670 Selected Topics in Physical Chemistry (3) Topics of current significance. Prereq: 570-72-73 or consent of instructor. May be repeated. Maximum 12 hrs.

690 Selected Topics in Polymer Chemistry (3) Topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

---

**Child and Family Studies**

(College of Human Ecology)

**MAJORS**

**DEGREES**

Child and Family Studies .................................. M.S.

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

---

**Connie Steele, Head**
500-level research methods, 3 hours of 500-level statistics, 6 hours of CFS courses in the area of specialization, 6 hours of thesis credit and an oral comprehensive examination. Non-thesis students are required to take the following: 3 hours of 500-level research methods, 3 hours of 500-level statistics, 6 hours of CFS courses in an area of specialization, 6 hours of thesis credit and an oral comprehensive examination. Non-thesis students are required to take the following: 3 hours of 500-level research methods, 3 hours of 500-level statistics; CFS 564, 565; 9 hours of CFS courses in the area of specialization; and a written comprehensive examination.

Students seeking the M.S. in Child and Family Studies are required to file a plan of study with the department head after 15 hours of graduate credit have been completed.

THE PH.D. CONCENTRATION

The doctoral program in Human Ecology prepares scholars in the concentration areas of child development and of family studies. The strength of the doctoral program is based on three major components: the integration of child development and family studies within the context of human ecology and related areas, concentration in child development or family studies, and an emphasis on becoming proficient practitioners of professional research. A doctoral program that is concurrently specialized and integrative in nature reflects the complexity of the disciplinary subject matter. It provides a broader context to formulate theoretical questions, and broadens the empirical literature for addressing those questions.

Requirements include:
1. Minimum 10 credits in child and family studies, required foundation courses: 510, 560, 570, 571.
2. Minimum 12 credits in 500- and 600-level courses in child development or family studies, with at least 3 credits in 600-level courses (in addition to the required courses described in #1);
3. Minimum 6 credits in a cognate area;
4. Minimum 9 credits in graduate-level statistics; at least 3 of these credits in a more specialized area than a sequence of survey courses;
5. Minimum 3 credits of specialized research methods;
6. Pre-doctoral research project approved by student’s committee;
7. College Professional Seminar, Human Ecology 610;
8. Minimum 8 credits of electives;

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not only use 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 Survey of Theory and Research in Child Development (3) Theoretical models and research literature; course development (conception through adolescence); application to research and education. Preq: 9 hrs of either upper division undergraduate or graduate social science or consent of instructor. F
512 Survey of Research in Early Childhood Education (3) Current curriculum issues in early childhood education. Preq: 510 or equivalent or consent of instructor. Sp
520 Development and Evaluation of Curriculum in Early Childhood Education (3) Designing, implementing, and evaluating physical and human resources in educational environments. Development of skills in environmental organization; interpretation of research and education. Preq: 510 or equivalent or consent of instructor. Sp
521 Organizational Management in Early Childhood Education (3) Designing, implementing, and evaluating physical and human resources in educational environments. Development of skills in environmental organization; interpretation of research and education. Preq: 510 or equivalent or consent of instructor. Sp
530 Families of Handicapped Children (3) Developmental nature of families’ experiences in caring for handicapped children, especially during infancy and early childhood. Preq: 510 or consent of instructor.
533 Peer Relations (3) Significance of peer context in socialization. Development of social skills and consequences of peer relationships. Preq: 510 or equivalent or consent of instructor.
540 Parent-Child Relations (3) Influence of parents on children, influence of children on parents, reciprocal interaction between parents and children, applications of systems models, child abuse, and impact of divorce on children. Preq: 550 or equivalent or consent of instructor. F
550 Survey of Theory & Research in Family Studies (3) Research issues and literature in family studies, use of family conceptual frameworks, development of theoretical models and application to research and family life programs. F
556 Marital Dyad (3) Communication, power, sexuality, marital stability, and marital satisfaction. Preq: 550 or equivalent or consent of instructor. F
564 Practicum in Human Development or Family Studies (1-3) School and community programs. Education for human development or family studies, Committee approved and supervised. Preq: Consent of instructor. S/NC only. E
566 Approaches to Family Intervention and Counseling (3) Various theoretical approaches for family intervention and counseling. Social, personal, strategic, experiential, and educational programming. Preq: 510 or equivalent or consent of instructor. S/NC only. E
568 Parenting (3) Family processes including times of stress, vulnerabilities and coping mechanisms of families. Preq: 550 or equivalent. Sp
571 Research Seminar (1) Presentation and critique of research projects. Preq: Departmental major or consent of instructor. May be repeated. S/NC only. E
572 Ethical Implications of Research in Family Studies (1-3) Research and its role in decision making about family issues. Preq: 550, 571, 3 hrs graduate statistics, or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E
573 Directed Study in Human Development or Family Studies (1-3) Individual learning experiences in specific topics in child development and early childhood education or family studies. Preq: 6 graduate hrs or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E
574 Advanced Research in Human Development or Family Studies (1-3) Advanced, in-depth individualized learning experiences in specific topics in child development, early childhood education, or family studies. May be repeated with different topics. Maximum 6 hrs. E
590 Assessment of Development and Learning in Young Children (3) Theory, empirical research and practices related to measurement of development and learning in young children. F
590 Doctoral Research and Dissertation (3-15) P/NP only. E
591 Advanced Special Topics in Human Development or Family Studies (3-15) Study of research and theory related to any area of specialization. Preq: 12 graduate hrs in major or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E
600 Advanced Directed Study in Human Development or Family Studies (3-15) Advanced, in-depth individualized learning experiences in specific topics in child development, early childhood education, or family studies. May be repeated with different topics. Maximum 6 hrs. E
631 Adolescent Development in Families (3) Normative and nonnormative adolescent development: physical, cognitive, moral, social, familial, sexual, and personal identity. Preq: 510 or equivalent or consent of instructor. F
632 Advanced Study in Family Interaction (3) Human communication and conflict management within family context. Theoretical perspectives for familial processes, assessment, decision making, and coping. Preq: 550 or equivalent or consent of instructor. Sp
633 Survey Design and Analysis (3) (Same as Sociology 633.)
691 Assessment of Family Behavior (3) Analysis of methods and measures used in family science research. Preq: 550, 571, 3 hrs graduate statistics, or consent of instructor. S/NC only. Sp.

Civil Engineering

MAJORS

Civil Engineering

DEGREES

Civil Engineering

M.S., Ph.D.

Environmental Engineering

M.S.

Gregory D. Reed, Head

Professors:

Burdette, E. G. (Fred N. Peebles Prof.), PE, Ph.D.

Civil Engineering

(College of Engineering)
problems is required. The special problem will culminate in a written report which must be approved by the student's major professor.

**Environmental Engineering**

For a Master of Science with a major in Environmental Engineering, normally a Bachelor's degree in a field of engineering is required. For a student who does not have an engineering background, the following minimum prerequisite courses will be required: Basic Engineering or Computer Science 101; Basic Engineering 121, 131; Engineering Science and Mechanics 231, 321; Civil Engineering 360, 365, 380; Mathematics 141, 142, 231, 241; Chemistry 120, 130. In general, these must be completed with a B average before courses for graduate credit can be taken.

The Department of Civil Engineering offers both thesis and non-thesis options for work toward the Master of Science degree in Environmental Engineering.

**Thesis Option:** The student must present a minimum of 24 semester hours of approved graduate courses. The major shall include 6 semester hours of thesis and a minimum of 12 semester hours of approved environmental engineering courses. A minor may be selected but is not necessarily required.

**Non-Thesis Option:** The student must present a minimum of 33 semester hours of approved graduate courses. The major shall include a minimum of 10 semester hours of approved environmental engineering coursework. A minor may be selected but is not necessarily required.

Either option must be approved by the student's major professor. A student's program must include a minimum of 9 semester hours of advanced engineering design courses selected from a list provided by the student's committee.

Normally, the graduate program of study will be adjusted by the head of the department and the student's committee to suit the individual academic objectives.

**THE DOCTORAL PROGRAM**

A graduate program leading to the Doctor of Philosophy is offered in Civil Engineering. Specific departmental requirements for the Ph.D. degree include the following:

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 24 semester hours in 600 Doctoral Research and Dissertation will be required.
2. A minimum of 24 semester hours of graduate courses in civil engineering, exclusive of thesis or dissertation credit, at least 8 hours of which must be 600-level courses.
3. 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 such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 9 semester hours of mathematics will be required beyond the civil engineering graduate requirements.
4. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research effort.
5. Upon completion of at least one-half of all coursework, each student must pass a comprehensive examination.

6. After completion of the dissertation, prior to graduation, each student must pass a comprehensive examination administered by a faculty committee.

**ACADEMIC COMMON MARKET**

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

---

**Civil Engineering**

**GRADUATE COURSES**

406 Legal and Ethical Aspects of Engineering (2)

410 Land Surveying (3) Procedures of locating proper-

451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; appli-

472 Steel Design (3) Design of plate girders and com-

473 Reinforced Concrete Design (3) Reinforced con-

474 Reinforced Concrete Design (3) Reinforced con-

475 Traffic Engineering (3) Characteristics of driver,

476 Analysis of Framed Structures (3) Maximum stress due to moving loads; use of influence lines, lateral

477 Geology (3) Principles of Geology (3) Same as Geo-

479 Water Resources Project Design (3) Coherent de-

485 Principles of Geophysics (3) Same as Geo-

490 Water Resources Project Design (3) Coherent de-

494 Urban Drainage Engineering (3) Design and man-

---

The Department of Civil Engineering offers degrees leading to the Master of Science and Doctor of Philosophy with a major in Civil Engineering concentrating in construction engineering, environmental engineering, geotechnical/materials engineering, public works engineering, structural engineering, and transportation engineering; to the Master of Science in Environmental Engineering with concentrations in water quality, water resources, air quality, mixed waste management, and waste management.

The MASTER'S PROGRAM

The Master of Science programs in Civil Engineering and Environmental Engineering are offered to graduates of recognized under-

graduate curricula. Departmental requirements provide that for a major in Civil Engineering, the Bachelor's degree must be in civil engineering, or certain undergraduate prerequisite courses must be taken before admission to candidacy for the Master of Science in Civil Engineering.

Civil Engineering

The Department of Civil Engineering offers two options for the Master of Science with a major in Civil Engineering.

**Thesis Option:** A minimum of 30 semester hours, including 6 hours of thesis, is required.

**Non-Thesis Option:** A minimum of 33 semester hours, including a 3-hour special course, is required.
507 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

506 Seminar (1) Reports on current research in civil engineering at UTK. Prereq: Graduate standing.

510 Urban Systems: Engineering and Management (3) Various urban systems usually under responsibility of city manager and/or city engineer: streets, lighting, water, sewerage, refuse collection. Personnel management, finance, planning and public relations. Prereq: Graduate standing. E

521 Pavement Design (3) Empirical and theoretical based methods of pavement design and analysis, strengthening; existing pavements, pavement distress and economical design alternatives. Prereq: 321 and 330.

530 Shear Strength and Earth Slope Stability (3) Shear strength of fine graded soil from perspective of ideal, simple clay. Drained and undrained shear strength and stress-strain behavior of real soils. Laboratory testing. Stability of natural and cut slopes and embankments. Prereq: 335.

531 Soil Stabilization (3) Mechanical stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils with admixtures, waterproofing and modifying of soils and additives. 2 hrs and 1 lab.

532 Principles of Rock Mechanics (3) Properties of rock materials and masses. Analysis of stress and strain; time-dependent effects. Applications in slope stability, tunnelling, mining, and foundation engineering. Prereq: 335 or consent of instructor.

535 Advanced Foundations and Retaining Structures (3) Planning subsurface investigations; bearing capacity and settlement of shallow foundations on layer-end bearing; deep foundations and piles; foundation design with pressure-meter, lateral earth pressures and design of retaining structures and sheet pile walls. Prereq: 335.

536 Geomechanics Seminar (1) Seminar topics in materials, geotechnical engineering and geomechanics. Graduate student research contributions and practical applications presented by practicing engineers from community. Prereq: Graduate standing and consent of advisor. May not apply toward degree. May be repeated. S/NC only.


541 Construction Management II (3) Management organization of heavy and building construction projects. Prereq: 340.

543 Construction Estimating (3) Project costs, estimation of mixed labor and material costs, manhours, and manhour costs. Prereq: 340 or consent of instructor.


551 Traffic Engineering-Characteristics (3)Driver-vehicle-roadway system; traffic flow modeling; elements of transportation/highway safety. Prereq: Graduate standing.

552 Traffic Engineering-Operations (3) Signs, signals and marking; short-term operations; controllers; signal timing/hasing; one-way reversible flow; system operations; identification and correction of high-accident locations and system deficiencies. Prereq: 551 or 452.

553 Geometric Design and Layout of Roads and Communities (3) Design and layout of rural and urban roads of all classes; subdivision layout; configuration of urban roads of all classes; techniques for access control, urban design, and street intersections; and parking. Prereq: 451 or consent of instructor.

554 Urban Transportation Planning (3) Transport plans and their role in urban planning; urban transportation system management. Prereq: 352 or graduate standing.

555 Public Transit Planning (3) Characteristics of transit modes—conventional and paratransit; operational design of transit services; route planning and scheduling; cost analysis; mode choice models; performance evaluation; transient urban growth and financing. Prereq: 554 or graduate standing.

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control programs; roadway hard-surface design and crash testing. Prereq: 452 or graduate standing.

557 Transportation Planning and Operations with Micro-Computer Applications (3) Transportation system management techniques and application of micro-computers to analysis of transportation actions. Prereq: 551, 554.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationship between various transportation modes and between transportation and other community features. Use of planning process to establish existing travel patterns, system reliability and economics, and demand for proposing alternatives and evaluation. Prereq: Graduate standing. (Same as Planning 537.)

561 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, solution techniques, direct stiffness analysis of plane trusses, general members, and structures composed of general members. Prereq: 361.

562 Analysis and Design of Plate Structures (3) Plate bending and buckling theory; analysis and design of bridge and building floors and structural plate components. Prereq: 361.

563 Statical Indeterminate Structures (3) Deflections, internal forces and trusses; force methods; moment distribution and other displacement methods; secondary stresses. Prereq: 361.

564 Finite Element Structural Analysis (3) Application of finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 561.

565 Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elastoplastic behavior considered for structural and earthquake design and response of structures. Prereq: 561.

566 Structural Reliability (3) Application of probability theory and statistics to evaluating reliability of structures; development of safety factors and probability based design codes.

571 Behavior of Steel Structures (3) Behavior of structural steel members due to static and fatigue loading; relation of design stress and current specifications for design. Prereq: 471.

572 Connections for Structural Steel Frames (3) Design, analysis and behavior of connections for structural steel frames. Simple, rigid and semi-rigid connections; column bases and column splices. Prereq: 472.

573 Prestressed Concrete (3) Properties of prestressing materials; methods of posttensioning; analysis and design of simple and continuous beams and slabs. Prereq: 471.

574 Behavior of Reinforced Concrete Members (3) Mechanism and pattern of failure; selection of reinforcement for reinforced concrete beams; combined bending and axial load; shear and torsion; relation between research results and specifications for design. Prereq: 471.

575 Repair and Retrofitting of Structures (3) Techniques, methods, and materials for repair and retrofitting of deteriorated or overstressed structures, foundation underpinning, retrofitting of steel fatigue failures. Prereq: 471.

586 Measurement Science I (3) (Same as Nuclear Engineering 586, Chemical Engineering 588, Engineering Science and Mechanics 586, Electrical and Computer Engineering 588, Mechanical Engineering 588, and Aerospace Engineering 588.)

589 Measurement Science II (3) (Same as Nuclear Engineering 586, Chemical Engineering 589, Engineering Science and Mechanics 589, Electrical and Computer Engineering 589, Mechanical Engineering 589, and Aerospace Engineering 589.)

590 Special Problems in Civil Engineering (1-6) Enrollment limited to civil engineering students in non-thesis programs. May be repeated. Maximum 6 hrs. S/NC only.

595 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated. Prereq: Consent of instructor.

596 Special Readings (1-4) Readings related to current developments in field. May be repeated. 600 Doctoral Research and Dissertation (3-15) P/NP only. E

537 Numerical Models for Geologic Materials (3) Numerical models to represent the stress/strain/volume relationships for soils, rock, and concrete; nonlinear soil testing and determination of soil parameters. Prereq: 335 and 565 or Engineering Science and Mechanics 539.

539 Soil Dynamics (3) Behavior of soils and soil-structure systems under time dependent loading; wave propagation in elastic media; principles of seismic refractive techniques; effects of earthquakes and vibrating machines on soils and foundations; dynamic and cyclic soil testing and determination of soil parameters. Prereq: 335 and 565 or Engineering Science and Mechanics 431.

651 Analysis Techniques for Transportation Systems I (3) Analysis, modeling and simulation of demand, modal split and traffic assignment, employing mathematical, statistical, and computer science techniques. Static, the art and new modeling techniques. Prereq: 554 or 558.

652 Analysis Techniques for Transportation Systems II (3) Advanced topics of application of mathematical, statistical, and computer science techniques in modeling and analysis of transportation systems. Prereq: 651.

666 Advanced Structural Reliability (3) Monte Carlo methods; structural system reliability; random process; dynamic loads on structures. Prereq: 566.

671 Behavior of Steel Bridges and Buildings (3) Behavior, analysis and design of plate girder, columns, and composite beams subjected to static and dynamic loading. Prereq: 571.

674 Behavior of Reinforced Concrete Beams and Slabs (3) Strength and behavior of statically indeterminate reinforced concrete beams and slabs; limit analysis of behavior; analysis of design of reinforced concrete slabs; yield-line theory; finite element solutions, and ACI Code Method. Prereq. 574.

691 Special Topics in Civil Engineering (3) Selected advanced problems of current interest. Prereq: Consent of instructor. May be repeated.
Environmental Engineering

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.

508 Seminar (1) Reports on current research in environmental engineering at UTK. Prereq: Graduate standing.

510 Environmental Protection (3) Managing of water resources; wastewater quality, air quality, solid wastes, and hazardous materials to promote efficiency and comfort and to safeguard balances in natural ecosystems. Prereq: Consent of instructor.

520 Open Channel Hydraulics (3) Open channel flow principles, properties, and classifications; uniform and gradually varied flow theory and applications; open channel design; unsteady flow theory and analysis; discharge determination, spillway and flood flow, non-linear alignment; microcomputer applications, featuring HEC-2 model. Prereq: Civil Engineering 390.

522 Floodplain and Urban Flood Management (3) Reviews the factors and factors of floodplain and flood flow, non-linear alignment; microcomputer applications, featuring HEC-2 model. Prereq: Civil Engineering 390 or consent of instructor for non-majors.

524 Sediment Transport (3) Sediment properties and measurements; principles of dynamics of suspended and bed load sediment transport in erodible channels; erosion, transportation, and deposition of sediment by flowing water, erodible channel design; channel regime theory; common computer models. Prereq: Civil 390.


530 Stormwater Modeling (3) Systems approach to stormwater management. Hydrologic components, linear and nonlinear systems integrated into mathematical models of watershed response. Review and application of commonly used deterministic and parametric computer models. Prereq: Civil Engineering 395.

535 Ground Water Hydrology (3) Dynamics of flow and contaminant transport in porous media: hydrodynamics, dispersion, anisotropy, layered soils, unsaturated flow, and groundwater contaminant transport phenomena. Analytical and numerical solution of flow and transport equations. Prereq: Hydraulics or 485 or consent of instructor. (Same as Geological Sciences 535.)

540 Remote Sensing for Transportation and Facilities Siting (3) Principles of remote sensing; sources of data: non-revision systems; photo interpretation; analog and digital techniques for analysis of aerial and terrestrial photos, radar and thermal imagery with applications to land use, urban planning, and construction and operations. Prereq: Consent of instructor.

541 Remote Sensing Data Acquisition and Analysis (3) Active and passive sensors; automated analog and digital analysis and interpretation systems; image enhancement and classification techniques for color aerial photo and thermal imagery applications to environmental pollution and stress assessment. Prereq: Consent of instructor.

551 Physicochemical Unit Processes (3) Theory and design application in water and wastewater treatment. Prereq: Civil Engineering 380, and Civil Engineering 390.

552 Biological Treatment Theory (3) Theory and design application of biological processes connected with wastewater and solid wastes. Prereq: Civil Engineering 390. 2 hrs and 1 lab.

553 Environmental Engineering Chemistry (3) Theoretical, applied and analytical chemistry related to operation, measurement and treatment of environmental contaminants. Prereq: Chemistry 130. 2 hrs and 1 lab.

555 Solid Waste Management (3) Magnitude and characteristics of solid waste problems; collection systems, design of disposal systems: landfill, incineration, and composting, design of resource recovery systems; current and future regulations. Prereq: Senior standing.

556 Hazardous Waste Management (3) Analysis and design of operations and processes for hazardous waste disposal and processing; regulations analysis; industrial applications. Prereq: Graduate standing or consent of instructor.

570 Air Quality Management/Pollution Control (3) Introductory course on concepts of air pollution, analysis of relationships among sources, meteorology, effects; stack sampling; emission control systems. Prereq: Consent of instructor.

571 Design of Air Pollution Control Systems (3) Design and evaluation of systems used to control emissions and particle air pollutants: comprehensive design of specific devices and systems. Prereq: 570.

572 Air Quality Dispersion Modeling (3) Diffusion in atmospheric dispersion models and evaluation of meteorological and air quality data. Prereq: Consent of instructor.

573 Sampling of Air Pollutants (3) Standard sampling methods for particulate and gaseous air pollutant emissions from industrial sources, ambient air monitoring instrumentation/techniques. Prereq: Consent of instructor.

575 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 375 and Microbiology 575.)

590 Special Problems in Environmental Engineering (1-6) Enrolment limited to environmental engineering students who non-thesis program. Prereq: Graduate standing. May be repeated. Maximum 6 hrs. S/NC only.

595 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated.

596 Special Readings (1-4) Readings related to current developments in field. May be repeated.

620 Advanced Surface Water Hydraulics (3) Advanced topics in surface water hydraulics: solutions to St. Venant's equations of unsteady flow for complex channel situations; dam breach modeling. Prereq: 520.

630 Advanced Stormwater Modeling (3) Advanced topics in stormwater modeling; stormwater quality modeling; advanced applications of available stormwater computer models. Prereq: 530.

651 Industrial Waste Unit Operations and Processes (3) Theoretical and laboratory modeling of industrial waste treatment processes and operations. Prereq: 551, 552, 2 hrs and 1 lab.


653 Pollutant Fate Modeling and Risk Assessment (3) Application of scientific principles concerning movement and fate of chemicals at interfaces of air, water, and earth/soils in environment. Methods of assessing risk posed by presence of those chemicals. Prereq: 551.

675 Microbial Systems Analysis (3) (Same as Chemical Engineering 675.)

691 Special Topics in Environmental Engineering (3) Selected advanced topics of current interest. Prereq: Consent of instructor. May be repeated.

Environmental Engineering

GRADUATE COURSES

401 Greek Poetry (3) Epic, lyric, drama. Authors vary. Prereq: 261.

402 Greek Prose (3) History, philosophy, oratory. Authors vary. Prereq: 293.

405-06 Selected Readings from Greek Literature (3) For advanced students in Greek, plays, historical writings, poetry of ancient Greece in original Greek. Prereq: 401-402 or consent of instructor. May be repeated. Maximum 9 hrs. Sp

414 Cicero and Techniques of Latin Prose Composition (3) For advanced students in Latin, practice in prose composition, writings of Cicero the model. Prereq: 351-52 or consent of instructor. Sp

422 Seminar in Classical Studies (3) Field of classical studies today: recent achievements in areas of philology and archaeology; impact of decipherment of Linear B; new understandings of culture and politics of "golden age" of Pericles and Augustus; classical studies and academic profession on both high school and college levels. May be repeated. Maximum 6 hrs.

431-32 Selected Readings from Latin Literature (3,3) For advanced students in Latin, oratory, historical writings, poetry of ancient Rome in original Latin. Prereq: 251-352 or consent of instructor. May be repeated. Maximum 9 hrs.

435 Medieval Latin (3) Selected readings from Latin prose and poetry of medieval Europe. Prereq: Consent of instructor.

441 Special Topics in Classical Civilization (1-3) Art, literature, religion, and society of Greece and Rome. May be repeated with consent of department. Maximum 9 hrs.

461 Studies in Classical Archaeology (3) Variable content course offering subject matter not taught in an existing course, or concentrating on one aspect of existing survey. Prereq: According to topic. May be repeated. Maximum 9 hrs.

462 Roman Law (3) Development of Roman law through examination of cases from writing of Roman jurists, world's first legal professionals. Understanding legal institutions in relationship to Roman society. Roman property and contract law.

501 Special Topics in Greek Literature (3) Advanced study of classical Greek literature, authors selected by students and instructor. May be repeated. Maximum 9 hrs.

531 Special Topics in Latin Literature (3) Advanced study of classical or medieval Latin literature, authors selected by students and instructor. May be repeated. Maximum 9 hrs.
Communications

(MAJOR DEGREES)

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

Professors:

Ashdown, Paul G., Ph.D. ............ Bowling Green
Crook, James A., Ph.D. ............ Iowa State
Everett, George A., Ph.D. ............ Iowa
Holt, Darrel W. (Emeritus), Ph.D. .... Northwestern
Howard, Herbert H., Ph.D. ............ Ohio
Leiter, B. Kelly (Emeritus). Ph.D. .. Southern Illinois

Associate Professors:

Buchman, Joseph, Ph.D. ............. Indiana
Hoy, Mariea, Ph.D. ................. Oklahoma State

The College of Communications offers the Bachelor of Science and the Doctor of Philosophy degrees with a major in Communications. For application forms and other information about the M.S. and Ph.D. programs in Communications, write to: Assistant Dean for Graduate Studies, College of Communications, 425 Communications Building, The University of Tennessee, Knoxville, TN 37996-0347.

ADMISSION REQUIREMENTS

Applicants must meet admission requirements of The Graduate School. In addition, they must complete the Graduate Record Examination, rating forms, and application forms as required by the College of Communications. Minimum requirements for admission to full potential candidate status normally include a 3.0 (4.0 system) grade-point average in undergraduate studies and scores above the fiftieth percentile in verbal and quantitative aptitude on the Graduate Record Examination. All application materials are screened by an admissions committee authorized by the faculty of the College of Communications.

New students normally are admitted to the programs only at the beginning of fall semester. However, under special circumstances, a student may be admitted at the beginning of spring semester in a temporary non-degree status. Applications for fall admission must be received by May 1. Applications for financial aid are due by March 1.

A baccalaureate degree in communications or a related field is recommended. Admission is possible with other baccalaureate degrees. However, all applicants without the appropriate background are required to take up to 18 semester hours of prerequisite and corequisite courses as determined by the department in which the student is enrolled. Students may take a proficiency test on any prerequisite course, subject to review by the Master's or Doctoral Committee of the College of Communications. Students who have had no courses in their major area of concentration may expect to spend four or more full-time semesters in the program, including a media internship.

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 is available to residents of Louisiana (advertising) or Arkansas. The Ph.D. program in Communications is available to residents of the states of Alabama, Arkansas, Louisiana, South Carolina, Virginia, or West Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

ACADEMIC STANDARDS

A student in the College of Communications whose graduate grade-point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate credit will be placed on probation. A student on probation will be dropped from the program unless his or her cumulative graduate grade-point average is at least 3.0 at the end of the probationary period. The probationary period is defined as the next 12 semester hours of graduate coursework attempted that is specified in the student's degree program. Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Studies of the College of Communications on the recommendation of the student's faculty committee.

THE MASTER'S PROGRAM

The Master of Science with a major in Communications is intended for students who desire a career in the mass media with an emphasis on communications management and a deeper understanding of the communication process and social role of the mass media. The program follows a broad-based multi-media approach while allowing the student to concentrate in one of four fields: advertising, broadcasting, journalism or public relations. Both thesis and non-thesis options are available.

The prospective student who is interested in acquiring basic skills in one of the areas listed above is advised to enroll for a second baccalaureate rather than an advanced degree.

Degree Requirements

The M.S. program emphasizes communications management in the areas of advertising, broadcasting, journalism (publications) and public relations. For the thesis option, a minimum of 31 hours of approved graduate work is required. The non-thesis option requires 34 hours.

1. Ten hours of core courses—Communications 510, 512, 540, and 550, the first three of which must be taken during the first two semesters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College.
2. Twelve hours within one department of the college, at least 6 hours at the 500 level or above. An internship, if needed, is included.
3. Three hours for the thesis option and 9 hours for the non-thesis option of electives from a list provided by the department in area of concentration.
4. Six hours of thesis work (Communications 500) including a thesis seminar or a 3-hour project (Communications 590).

Additional hours may be required for those who do not have academic prerequisites and an internship may be required for those who do not have professional experience in the field they wish to study. A course in communications law is a prerequisite.

A student's internship experience requires approval by his/her advisor. Credit will be given through Advertisements 598, Broadcasting 598, or Journalism 598 on the basis of 3 hours of credit for the equivalent of 15 weeks of full-time professional experience. This credit is to be included in the hour requirements for the M.S. program. Previous professional experience will be evaluated by the student's committee.

Students interested in subsequent entry into a doctoral program are advised to pursue the thesis option and to take additional courses in communications theory and research, subject to advisor's approval.

After completion of the formal program of coursework and research for the thesis option, the student will pass an oral examination conducted by his/her graduate committee. The non-thesis option requires a written comprehensive examination and an oral defense of the project.

THE DOCTORAL PROGRAM

The Ph.D. with a major in Communications is intended to prepare scholars for teaching, research, administration, and service in the field of mass communications.

The program is interdisciplinary, consisting of a required core curriculum and recommended courses outside the College in the related social and behavioral sciences. The program is flexible and will accommodate a wide variety of career goals in communications. New students may be admitted to the program at any time; however, core courses must be completed in the fall semester.

The Master's degree is not required for entry into or completion of the doctoral program. Program planning, however, will permit the Master's degree to be completed if desired. Students lacking academic or professional experience in communications will be required to take prerequisite courses. In general, however, the program may be completed within three academic years of full-time study beyond the Bachelor's degree. Those holding Master's degrees should anticipate two or more years of full-time study for completion of the Ph.D.
The following are minimal requirements for admission to full potential candidate status:

1. A 3.0 (4.0 system) grade-point average in undergraduate studies, or 3.5 for graduate work if applicant holds a Master's degree.
2. Above the fiftieth percentile in verbal and quantitative aptitude on the Graduate Record Examination.
3. Endorsement by at least three former teachers or professional colleagues; and
4. A statement of applicant's goals and reasons for pursuing the doctorate. Personal interviews with members of the Ph.D. Admissions Committee are recommended and may be required. Professional experience in some field of communications is a highly desirable criterion for admission.

A minimum of 88 hours of approved graduate work is required for the Ph.D.

1. Twenty-eight hours of core courses: Communications 610, 612, 620, 640, 641; 6 hours of statistics*; and three of the following courses: Communications 622, 632, 642, 652, and 692.
2. Fifteen hours in a primary concentration (advertising, broadcasting, journalism, public relations, or telecommunications).
3. Twelve hours in a secondary concentration (outside the College of Communications).
4. Nine hours of electives*.
5. Twenty-four hours of dissertation.

*Specific courses to be taken require the approval and consent of student's advising committee.

Admission to candidacy must be attained at least two semesters prior to graduation and requires successful completion of a written comprehensive examination. Each doctoral student's progress will be reviewed annually by the Doctoral Committee of the College of Communications. Results will be reported to the student by his/her program advisor, who will convey the committee's recommendation concerning the student's remaining in the program (non-binding) and suggestions for improvement in performance.

A candidate without prior teaching experience must register for courses 521, Tutorial in Communications Teaching. Planned course offerings in the College of Communications for a full calendar year are published in the Dean's Office. More information is available from the Dean's Office, 302 Communications Building, 974-3031. See also courses listed under Advertising, Broadcasting, and Journalism.

GRADUATE COURSES

400 Mass Communications Law and Ethics (3) Legal issues directly affecting the mass media: libel, privacy, free press-fair trial, judicial controls, governmental regulation. Business aspects of mass media in America. Prereq: Writing for Mass Communication or consent of instructor. E

500 Thesis (1-10) P/NP only. E

502 Registration for Use of Facilities (3-15) Required for use of campus facilities. Prereq: Consent of instructor. P/NP only. E

510 Orientation to Master's Studies (1) Degree and thesis requirements. Committee formation and program planning. Overview of research methods and information sources. Prereq: Consent of instructor or admission to program. S/NC only. F

512 Fundamentals of Media Research (3) Applications of communications research techniques for management. Gathering and analysis of data for assessing media studies, marketing and message impacts. Prereq: Consent of instructor or admission to program. S

521 Tutorial in Communications Teaching (1) Experiential training as instructor under guidance of faculty member. Prereq: Consent of instructor. S/NC only. E

540 Theory for Media Management (3) Selected research hypotheses and theories in literature of mass communications, managerial decision-making. Prereq: Consent of instructor or admission to program. F

550 Seminar in Media Economics and New Technology (3) Electronic and print media ownership, financial structure and market forces. Prereq: Consent of instructor. S/NC only. F

593 Seminar in Mass Communications Issues (3) Contemporary topics in communications. Consent of instructor. Maximum 6 hrs. E

597 Independent Study (3) Reading, research or projects on special topics in communication. Individual basis, under faculty direction, with consent. May be repeated. Maximum 6 hrs. E

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

610 Orientation to Doctoral Research (1) Degree and dissertation requirements. Committee formation and program planning. Overview of research methods and information sources. Prereq: Consent of instructor or admission to program. S/NC only. F

612 Fundamentals of Communications Research (3) Universal research process from defining ideas and problems to research implementation. Causal inference and relative strengths of various research designs. Fundamentals and specific applications of most common data-gathering and measurement techniques in communications research: experimental, survey, content analysis, historical and qualitative. Prereq: Consent of instructor or admission to program. S

620 Seminar in Mass Communications Education (3) Role and scope of mass communications teaching unit, historical perspectives of curricular trends. Teaching methods and instructional objectives; classroom testing and measurement; design of professional curricula, research and extension; program evaluation; grants and contracts in research. Prereq: Consent of instructor or admission to program. S

622 Quantitative Research (3) Techniques for evaluation of research design and measurement. Survey, content and experimental techniques. Assessment of reliability and validity, data analysis, hypothesis testing, and inference strategies. Prereq: 612. F

632 Mass Communications History and Historiography (3) Origins and development of mass media in America. Critical evaluation of literature. Prereq: Consent of instructor or admission to program. S/NC only. F

640 Mass Communications Theory I (3) Selected research hypotheses, and theories in literature of mass communication theory. Prereq: Consent of instructor or admission to program. F

641 Mass Communications Theory II (3) Selected topics in theory: Critical evaluation of extant theory, derivation of hypotheses, and advanced theory construction. Prereq: 640. S

642 Qualitative Research (3) Theory and application of qualitative research methods to social science and communications research. Theoretical considerations underlying symbolic interactionism as translated into research strategies. Prereq: Consent of instructor or admission to program. F

652 Mass Communications Law and Legal Research (3) Legislation and regulations under which mass media operate. Prereq: Consent of instructor or admission to program. S

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

670 Comparative and Experimental Medicine (3) Electronic and print media ownership, financial structure and market forces. Prereq: Consent of instructor. S/NC only. F

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

700 Comparative and Experimental Medicine (3) Electronic and print media ownership, financial structure and market forces. Prereq: Consent of instructor. S/NC only. F

Comparative and Experimental Medicine (Office of the Vice Chancellor for Academic Affairs)

MAJOR DEGREES

Comparative and Experimental Medicine - M.S., Ph.D.
L. N. D. Potgieter, Director

Joint Graduate Coordinating Committee:
Fuhr, J. E., Ph.D., Medical Biology
Lawler, J. E., Ph.D., Psychology
Lazio, C., M.D., Medical Biology
Potgieter, L. N. D., Ph.D., Veterinary Teaching Hospital
Sims, M. H., Ph.D., Veterinary Teaching Hospital

The Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a jointly-administered graduate program intended to prepare students for teaching and/or research careers in the health sciences. This program emphasizes the comparative approach to the study of pathology, immunopathology, hematology, infectious diseases, aberrant metabolism, oncology, and genetic disorders. The Ph.D. program is open to approved graduate students seeking training in this area and is especially useful for individuals with professional degrees. For the student with undergraduate biological science background, the Comparative and Experimental Medicine program provides an unusual opportunity to study disease processes common in humans and animals from a multidisciplinary perspective. The scope of this intercollegiate program, which pools faculty resources from both veterinary and human medicine, is broadened by faculty members representing animal science and numerous areas of the life sciences. The interdisciplinary training environment includes such diverse support as facilities and personnel at the Veterinary Teaching Hospital, the Oak Ridge National Laboratory, Knoxville Zoological Park, Hemophilia Clinic, Developmental and Genetic Center, Aberrant Metabolism Laboratory, Hematology and Oncology services, and departments of life sciences.

For specific course listings, see Veterinary Medicine and Medical Biology under Fields of Instruction.

ADMISSION REQUIREMENTS

General Requirements
Admission requirements of The Graduate School of UT Knoxville apply. In addition, all applicants must furnish three letters of recommendation from individuals who are familiar with their scholastic or professional records.

Requirements for Admission to the Master of Science Degree Program
Applicants must have a baccalaureate degree with coursework in chemistry through organic, mathematics through calculus, physics, and basic biology. More advanced study in biology such as biochemistry, mammalian
anatomy, histology, cell biology, or other appropriate biomedical courses from a recognized university is recommended.

Applicants for admission to the Master of Science degree program whose background include no formal training in the biomedical field beyond the baccalaureate degree will be required to score at least 1,000 on the quantitative and verbal portions of the Graduate Record Examination.

Requirements for Admission to the Doctor of Philosophy Program

Applicants will generally be expected to have a Master's degree in one of the biomedical sciences or a professional degree in one of the medical sciences, (e.g., M.D., D.D.S., D.V.M.).

An individual having a baccalaureate degree with a strong background in the physical and biological sciences may be admitted upon presenting evidence of exemplary performance on the Graduate Record Examination.

Exceptional veterinary students at UT Knoxville may be enrolled in the Comparative and Experimental Medicine graduate program but will be listed officially as veterinary students. Such students may take advantage of enlisting in graduate courses during summers and as elective courses in the veterinary program.

For additional information, write to the Office of Research and Graduate Programs, P.O. Box 1071, Knoxville, TN 37901-1071.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. and Ph.D. programs in Comparative and Experimental Medicine are available to residents of the state of Kentucky. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

Computer Science

(College of Liberal Arts)

MAJOR DEGREES

Computer Science .................................. M.S., Ph.D.

Jesse H. Poore, Head

Professors:

Ali, Moonis (UTSI), Ph.D. .................................. Allighri
Dongarra, Jack, Ph.D. .................................. New Mexico
Gonzalez, R. C. (ECE), Ph.D. .......................... Florida
Poore, J. H., Ph.D. .................................. Georgia Tech
Sherman, Gordon R., Ph.D. ........................... Purdue
Thomason, Michael G., Ph.D. .......................... Duke

Associate Professors:

Case, Jeffrey D., Ph.D. .................................. Illinois
Langston, Michael A., Ph.D. .......................... Texas A&M
Leuze, Michael, Ph.D. .................................. Purdue
MacLennan, Bruce J., Ph.D. .......................... Purdue
Whitehead, Bruce (UTSI), Ph.D. ....................... Michigan

Assistant Professors:

Blair, J. R. S., Ph.D. ................................. Pittsburgh
Booth, Heather A., Ph.D. ............................... Princeton
Lee, Seung-Chul (UTSI), Ph.D. ........................ Florida
Mutchler, David, Ph.D. ................................ Duke
Straight, David W., Ph.D. .............................. Texas
Vander Zanden, Bradley, Ph.D. ........................ Cornell
Vose, M. D., Ph.D. .................................. Texas

Instructor:

Mayo, J. W., M.S. .................................. Tennessee

THE MASTER'S PROGRAM

One year of college mathematics beyond algebra and trigonometry is required for admission. For the master's degree, 30 semester hours of graduate credit are required, 24 of which must be 500 level or above. 511, which cannot be counted toward the 30 semester hours, is required for students who need a stronger background in software; one course in programming in a modern recursive, high-level language is the prerequisite to 511. Graduate courses outside the department are allowed but must be approved by the Graduate Committee before enrollment.

Thesis Option

The student must reach agreement on a thesis topic with a faculty advisor and must take 6 hours of 500 Thesis. Six hours of 500 Thesis may count in the 24-hour requirement at the 500 level or above.

Non-Thesis Option

The student must take coursework in an area to prepare for the non-thesis Master's examination. The student's advisor must verify that an acceptable set of courses has been taken before the student may schedule the examination. Information concerning the examination is available in the department office.

Master's Minor in Computer Science

The graduate minor consists of 511 or its equivalent plus an additional 6 hours of computer science graduate level courses at or above the 400 level.

THE DOCTORAL PROGRAM

A student seeking admission to the Ph.D. program is expected to meet the following requirements:

1. The student should have three letters of recommendation sent directly to the department head from individuals capable of assessing the student's potential for advanced work in computer science (for example, college teachers or employers for whom the student has worked after earning a Bachelor's degree). The department reserves the right to contact these individuals or other knowledgeable people if additional information is deemed necessary or desirable.

2. The student is expected to have taken the GRE verbal and quantitative general test within the past three years and to have these scores sent to The Graduate School.

3. The student should satisfy the same background requirements as for the Master's program. See the departmental brochure for details.

Original research reported in a dissertation of high quality is emphasized. The minimum hour requirements are 24 hours of course 600 (Doctoral Research and Dissertation) and 24 hours of graduate courses beyond the equivalent of a Master's degree (beyond 30 graduate credit hours) graded A-F. The 24 hours of courses must include at least six semester hours of 600-level courses taken in computer science at UT Knoxville. The student's advisor and committee will establish the specific course requirements. The comprehensive examination consists of a departmental written examination and a subsequent oral examination conducted by the student's committee.

GRADUATE COURSES

401 Applications of Computer Graphics (3) Commercial software, techniques, hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

402 Applications of Artificial Intelligence (3) Commercial software, techniques, hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

403 Applications of Microcomputers (3) Microcomputers, DOS, commercial software and hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

404 Applications of Database Systems (3) Commercial software, techniques, hardware. Prereq: 100 or 101 or 102. Not for credit for computer science majors. 3 hr lab required.

421 Introduction to Artificial Intelligence (3) Basic techniques of heuristic search, gaming, and theorem proving. Prereq: 320. 3 hr required.

422 Expert Systems (3) Production rule model and its extension into many-valued and fuzzy logics. Deriving explanations, examples of expert system tools and building expert systems. Other methodologies--frames, scripts, decision expressions. Prereq: 421. 3 hr lab required.

423 Natural Language Processing (3) Phase-structured and slot grammars, error-correcting interfaces and semantics. Applications in database and expert systems. Prereq: 381 and 421.

424 Robotics Software (3) Software for robotic control. Prereq: Computer Organization, Data Structures, and Calculus. 3 hr lab required.

425 Functional Languages (3) Functional, applicative and object-oriented languages. LISP and SMALLTALK, used for research applications. Prereq: 111, 112 and Mathematics 222. 3 hr lab required.

432 Computer Graphics (3) Interactive computer graphics. Transformations, perspectives, shading, vector generation. Graphics hardware, tablets and chips, with goal of understanding techniques for designing computer systems for graphics capability. Prereq: Computer Organization and Data Structures. 3 hr lab required.

433 Computer Systems Architecture (3) Parallel processing, memory, I/O, pipelines, specialized architectures. Prereq: 331 and 360.

434 Networks and Communications (3) IPO open systems interconnect, interconnection model, protocols, study of several existing wide area networks, local area networks. Prereq: Systems Programming.

435 Microcomputer Systems (3) Disk operating systems, peripherals, local area networks and communication protocols. Introduction to microcomputer systems. Prereq: Systems Programming. 3 hr lab required.

436 Computer Systems Hardware Design (3) Computer systems hardware: bus structures, I/O devices, interrupt support hardware, direct memory access logic, timing budgets, and system considerations. Lab: construction, testing, and debugging of either or both of prototyped subsystem; system based on commercially available microcomputer component devices. Prereq: 435.
439 Microprogramming (3) Microprogramming concepts and techniques for control systems of large and small machines. Bit-slice architecture, sequencers. Prereq: Computer Organization and Data Structures. 3 hr lab required.

441 Science Information Systems (3) Design of scientific data banks, document repositories, information retrieval, and electronic dissemination services. Control and dissemination of scientific information at national and international level. Prereq: 340.

442 Introduction to Database Management Systems (3) Concepts and features of database management systems, hierarchical, network, and relational models; relational calculus and algebra, data definition and manipulation languages; implementation and security considerations, performance, integrity, and reliability metrics; intelligent database systems. Prereq: 340 and 311.

443 Introduction to Information Storage and Retrieval (3) Information storage and retrieval, statistical, syntactic, and logical analysis of information content, evaluation of retrieval effectiveness. Prereq: 340.


451 Pattern Recognition and Analysis (3) Elements of syntactic pattern recognition, learning algorithms, decision theory, classification rules. Prereq: 111, 112, and 311. 3 hr lab required.

452 Image Processing and Analysis (3) Methods for digitizing, storing, processing, and displaying images. Image enhancement, restoration. Prereq: 451. 3 hr lab required.

460 Human Factors in Software (3) Interface between people and machines and ease of use of software in intended environment. Prereq: 111 and 112.


462 Software Engineering (3) Exploration of software design and application process from initial requirement and specification statements to coding, testing, implementation, and maintenance. Prereq: 111 and 112.

463 Programming Languages (3) Study and comparison of programming languages and their environments: Human interfaces, formalisms, domain of applicability, object manipulation, syntax. Prereq: 111 and 112.

464 Compiler Writing (3) Techniques of compiler construction. Syntax and semantics; lexical analysis; table construction and manipulation. Prereq: 360.

465 Parallel Computation I (3) Examination of non-numeric algorithms for parallel computation, operating systems, design of parallel processors, compilers, concurrent computation. Prereq: 433.


471 Numerical Analysis (3) (Same as Mathematics 471.)

472 Numerical Algebra (3) (Same as Mathematics 472.)


482 Graph Theory and Applications (3) Planarity, network flow, critical paths. Prereq: 111, 112 and 311.

483 Information Theory (3) Theory of communication. Entropy, efficient transmission and storage at information.

494 Special Topics in Computer Science (1-3) May be repeated. Maximum 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 using such facilities. Prereq: 311. Only when faculty time before degree is completed: May not be used toward degree requirements. May be repeated. S/N/C only. E

511 Immigration to Computer Science (5) Advanced programming techniques in high-level language; control of input/output devices; file systems; machine organization and assembly language programming, data structures and analysis of algorithms. Computing laboratory. Prereq: Course in programming.

521 Artificial Intelligence (3) Heuristic search, automatic theorem proving, symbolic methods, semantic information processing, representation theory. Prereq: 511 and 513.

522 Cybernetics (3) Various functions in living systems and their actual or potential realization in computers. Prereq: Discrete Structures and 511.

523 Machine Learning (3) Algorithms whereby computers exhibit aspects of learning or inference about their environment. Supervised and unsupervised methods; data-driven pattern analysis; explicit and implicit structure. Prereq: 521.

525 Software Engineering (3) Survey of key ideas in software engineering: formal methods, tools, testing, reliability, structured design and development, metrics, management and history of the field.


535 Computer Architecture (3) Parallel processing control methods, pipelining, vector processors, functional units, memory organization and control, data flow, reduced instruction sets, symbolic processors. Prereq: 511 and 532.


541 Database Management Systems (3) Data model theory, optimization, and normalization; intelligent database systems; comparison of implementations; analysis of distributed and networked databases. Techniques for evaluation of performance, integrity, security and reliability. Prereq: 511.

544 Information Storage and Retrieval (3) Organization, storage and retrieval of bibliographic data; analysis of commercial information retrieval system; information analysis and automatic dictionary and thesaurus construction; statistical and syntactic approaches to content analysis. Prereq: 511.

551 Pattern Analysis (3) Decision-theoretic and structural pattern analysis. Deterministic and statistical decision rules, feature extraction and representation; syntactic and semantic methods, relational models. Prereq: Digital Design and probability or statistics.

552 Image Analysis (3) Techniques of computer image processing and understanding. Prereq: 551.

562 Language Design (3) Description, structure, and design philosophies of high-level languages. Names, types; control and data structures; abstraction and modularity. Design project. Prereq: 511.


571-72 Numerical Mathematics (3) (Same as Mathematics 571-72.)

573 Finite Difference Methods for Partial Differential Equations (3) (Same as Mathematics 573.)

574 Finite Element Methods (3) (Same as Mathematics 574.)

575 Matrix Theory and Techniques in Numerical Analysis (3) (Same as Mathematics 575.)

581 Design and Analysis of Algorithms (3) Analysis of algorithms and relevance of analysis to design of efficient computer algorithms. Sorting, searching, graph algorithms, pattern matching, dynamic programming, efficient approximation algorithms.


593 Independent Study (1-15) Maximum 6 hrs toward degree requirements.

594 Special Topics in Computer Science (1-3) May be repeated. Maximum 6 hrs.

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

610 Advanced Topics in Intelligent Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

630 Advanced Topics in Computer Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

640 Advanced Topics in Databases/Information Retrieval (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

650 Advanced Topics in Pattern/Image Analysis (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

660 Advanced Topics in Software Systems (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

670 Advanced Topics in Numerical Mathematics (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

680 Advanced Topics in Theory and Foundations (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

690 Advanced Topics in Computer Science (1-6) Prereq: Consent of instructor. May be repeated with consent of department.

---

**Curriculum and Instruction**

(Chair of Education)

**MAJOR DEGREES**

Curriculum and Instruction... M.S., Ed.D., Ed.D.
Education... Ph.D.

J. Estill Alexander, Acting Head

Professors:

Alexander, J. Estill, Ed.D., assistant professor, Kentucky
Allison, G. B., Ph.D., assistant professor, Oklahoma
Bellon, Jerry J., Ed.D., director of graduate studies, California
Blank, Kermit J., Ph.D., assistant professor, Ohio State
Butefish, William L., Ed.D., assistant professor, Texas Tech
Christensen, Mark A., Ph.D., assistant professor, Kansas State
Davis, A. R., Ph.D., assistant professor, Ohio State
Deiss, Donald J., Ph.D., assistant professor, Maryland
encompasses concentrations in the following areas: curriculum, elementary education, English education, foreign language education, instructional media and technology, mathematics education, reading education, science education, and social science education.

THE DOCTORAL PROGRAM

The Ed.D. program in Curriculum and Instruction may include concentration upon the following fields of educational foundations, educational research, elementary education, English education, foreign language education, mathematics education, science education, and social science education.

The Doctor of Philosophy with a major in Education includes concentrations and specializations as listed under Education.

For further information, write the Department of Curriculum and Instruction.

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 (concentration in foreign language education only) in Curriculum and Instruction is available to residents of the state of Louisiana. The Ed.S. program (concentration in reading education only) in Curriculum and Instruction is available to residents of the state of South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

404 Problems in Improvement of Instruction (1-3) Special conferences, workshops, or in-service programs. May be repeated. Maximum 6 hrs. S/NC only. E

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

422 Elementary and Middle School Teaching Methods I (6) Methods and materials for teaching science and social studies. Development of functional relationships and entities of two fields. Not open to students with recent course or background in teaching science and social studies. Prereq: Admission to teacher education. F, Sp

429 Language Arts/Reading Instruction in Elementary and Middle Schools (3) Language and language development as applied to teaching of oracy (listening-speaking) and aspects of literacy (reading process, readiness and writing). Not open to students with recent course in language and concept development. E

429 Language Arts/Reading Instruction in Elementary and Middle Schools (3) Language and language development as applied to teaching of oracy (listening-speaking) and aspects of literacy (reading process, readiness and writing). Not open to students with recent course in language and concept development. E

430 Elementary and Middle School Developmental Reading Instruction (3) Word recognition (including phonics, comprehension, evaluation, and materials. Not open to students with recent course in reading methods. Prereq: Admission to teacher education. F, Sp

430 Elementary and Middle School Developmental Reading Instruction (3) Word recognition (including phonics, comprehension, evaluation, and materials. Not open to students with recent course in reading methods. Prereq: Admission to teacher education. F, Sp

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

443 Elementary and Middle School Mathematics Instruction (3) Procedures for helping children learn mathematics. Unit planning, daily planning, grouping, general factors related to classroom management. Not open to students with recent course in teaching of elementary mathematics. Prereq: Admission to teacher education. F, Sp

443 Elementary and Middle School Mathematics Instruction (3) Procedures for helping children learn mathematics. Unit planning, daily planning, grouping, general factors related to classroom management. Not open to students with recent course in teaching of elementary mathematics. Prereq: Admission to teacher education. F, Sp

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 local elementary school. Prereq: Admission to teacher education. E

451 Education in Cultural Perspective (3) Contribution of anthropological concepts (primarily concepts of culture) to understanding education processes, problems, and thought in our society and others. F

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

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

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

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

461 Developing Reading Skills in Content Fields (3) Techniques for teaching reading and study skills in content areas of school programs. May be repeated. Maximum 6 hrs. S/NC only. E

475 Utilization of Instructional Media (3) Basic concepts of communication and instructional development for improving instruction through use of media. (Same as Library and Information Science 475) E

485 Teaching Mathematics, Grades 7-12 (3) Preparatory program of teaching plans, evaluation, materials for teaching mathematics; teaching simulation and directed observation in schools. Prereq: Admission to Teacher Education Program.

486 Introduction to Instructional Computing (3) Classroom use of computers, applications for teachers, overview of computer operation and software for teachers of all grades. F, Sp

496 Teaching Science Grades 7-12 (3) Methods, materials, recent trends in science and environmental education programs for secondary schools. Prereq: Admission to teacher education. F, Sp

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or uses campus before the beginning of the semester when student seeks admission to the University. F


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

505 Elementary and Middle School Teaching Methods II (6) Content area teaching and development of students to apply methods. Prereq: 422, Coreq: 575. F

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

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

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


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

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

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

519 Educational Specialist Research and Thesis (2) May be repeated. Maximum 4 hrs. P/NP only. E

520 Techniques of Research in Education (3) Study and application.

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. Course in teaching of social studies or consent of instructor. Sp.

522 Teaching Mathematics in Elementary and Middle Schools (3) Instructional strategies for helping elementary and secondary school children learn mathematics. Examining, development and use of materials for creating active learning environments. Prereq.: 443 or equivalent or consent of instructor. F, Su.

523 Diagnosis and Correction of Children's Difficulties in Reading (2) Diagnosis and remediation of reading 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 program materials 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 designs in elementary school. Trends and issues which affect elementary and middle school instruction. Prereq.: Consent of instructor. Spring.

528 Teaching Language Arts Elementary and Middle School (3) Recent trends and current materials and methods in teaching elementary language arts (except reading). Course in language arts or consent of instructor. Sp, Su.

529 Practicum in Diagnosis and Remediation of Difficulties in Learning Mathematics (2) Assessment and remediation of children having difficulties in learning elementary mathematics. Prereq.: 525 or consent of instructor. May be repeated. Maximum 4 hrs. 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.

531 Teaching Science in Elementary and Middle Schools (3) (B) Recent trends, materials and content in teaching elementary school science. Prereq.: Course in teaching elementary school science or consent of instructor. F, Su.

532 Instructional Research: Analysis and Application (3) A learning research on instructor's childhood. Translation and application of research findings into instructional performance. Prereq.: Consent of instructor. F, Su.

533 Reading in Middle and Secondary Schools: Research and Theory (3) Analysis of components of effective middle and secondary school reading programs. Attention to research and theoretical bases. Prereq.: Course in reading education or consent of instructor. Su.

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

535 Curriculum Evaluation and Program Improvement (3) Historical background and importance of educational evaluation in relation to curriculum development. Psychometric, sociometric, and curriculum evaluation approach and application. Prereq.: Consent of instructor. F.

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

537 Diagnosis and Correction of Classroom Reading Problems (3) Procedures, methodologies and materials for diagnosing and correcting classroom reading problems. Prereq.: Course in diagnosis and correction of classroom reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp.

538 Practicum in Diagnosis of Reading Problems (2) 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. May be repeated. Maximum 4 hrs. Sp.

539 Practicum in Remediation of Reading Problems (2) Application of learning and teaching methodology in working with elementary and/or secondary school students. Prereq.: 538 or consent of instructor. Prereq.: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp.

540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and inservice programs. May be repeated. Maximum 6 hrs. S/N only. E

541 The High School Curriculum (3) Identification of problems associated with curriculum study, Tennessee curriculum framework, assessment of trends in programs of local, regional, and national significance. E

542 Development of Educational Thought (3) Historic and philosophical approach to lives and writing of influential educators: Plato, Quintilian, Comenius, Rousseau, Pestalozzi, Froebel, Dewey. Prereq.: Graduate status and consent of instructor. Sp, Su.

543 Foundations of Educational Policy (3) Relationship between theory, policy, and practice; educational policies that arise from philosophical and practical considerations relative to human nature, to educational purpose, to social structure, and to curriculum. Prereq.: Consent of instructor. F, Su.

544 Survey in Contemporary Philosophies of Education (3) Existentialism, phenomenology, philosophical anthropology, structuralism, hermeneutics and other philosophies. E

545 Educational Sociology (3) Sociological analysis of American education system. Controversial social issues that affect educational system and potential solutions offered by various programs. Open to juniors, seniors, and graduate students. F.

546 Topics in History of Education (3) may be repeated. E

547 Topics in Philosophy of Education (3) may be repeated. E

548 Topics in International Education (3) Historical, philosophical, and sociological foundations; selected nations and their cultures. May be repeated. E

550 Assessment and Correction of Language Arts Difficulties (3) Procedures and materials for diagnosing and correcting language arts difficulties; analysis of children's work. Prereq.: At least one language arts course or consent of instructor. Su.

552 Developmental Reading Pracicum (2) Diagnosing and correcting students' individual reading problems; corrective reading needs; Prereq.: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp.

557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Characteristics of students, curricu-
581 Seminar in Mathematics Education (3) Current issues influencing instruction in mathematics in elementary through college. Related teaching methodologies. Opportunities for work on special problems. Prereq: Undergraduate course in teaching of mathematics. Su

582 Teaching Enrichment Mathematics in Middle and Junior High Schools (3) Topics to enrich middle and junior high mathematics: Geometrical, laboratory, and problem solving activities. Special attention to metric system. Opportunities for individual projects. Prereq: 581. Su


585 Teaching Secondary School Social Studies (3) Strategies, projects, materials, and programs in social studies. Prereq: Undergraduate course in teaching of social studies. F,Sp

586 Teaching Probability & Statistics (3) Teaching of probability and statistics in schools, elementary through college. Probabilities and statistical experiments, demonstrations, and applications. Prereq: 581. F


588 Instructional Theory and Design (3) Relationship of curriculum to instruction; examination of instructional and related learning theories; instructional models and teaching styles. E

589 Field Experience (1-3) Application of curricular and instructional theories and materials in schools. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

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

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

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

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

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

596 Advanced Studies in Secondary Science and Environmental Education (3) Trends in science and environmental programs, materials, methods and research in middle, junior and senior high schools, and community colleges. Prereq: 596 or equivalent and consent of instructor. Sp

600 Doctoral Research and Dissertation (3-15) Preregistration required. May be repeated. Maximum 60 hrs. S/NC only. E

601 Studies in English Education (3) Issues and research in teaching of English. Su

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 learners process print. Prereq: 500-level courses in reading education or consent of instructor. May be repeated. Maximum 6 hrs. S/NC only. E

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

605 Organizing and Administering Reading Programs (3) Analyzing and synthesizing instructional, learning, and materials components into classroom, school, and system programs. Prereq: 500-level courses in reading education or consent of instructor. Su

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

608 Seminar in Philosophy of Education (3) Selected philosophical issues in education. Prereq: 2 courses in history or philosophy of education. May be repeated with consent of instructor. E

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

623 Programs for Curriculum Improvement (3) Research methodology, application to descriptive/ ethnographic studies as applied to classroom practice. Prereq: Graduate course in curriculum improvement or equivalent or consent of instructor. May be repeated. Maximum 4 hrs. E

635 Teacher Education in America (3) For students preparing to enter teacher education. Brief history, development, program analysis and evaluation, current issues, and future directions. F

640 The Dynamics of Educational Change (3) Interdisciplinary approach to change process in education. Prereq: Consent of instructor. Sp

648 Topics in Sociology of Education (3) May be repeated. Sp

650 Advanced Studies in Early Childhood Education (3) Prereq: 2 graduate courses in early childhood education and consent of instructor. Prereq: Maximum 6 hrs. S/NC only. E

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

652 Advanced Studies in Educational Anthropology and/or Sociology (3) Ethnographic methods applied to formal and non-formal educational settings. Analysis of selected research in field. Prereq: 451; 2 courses in cultural anthropology, or consent of instructor. Sp


669 Instructional Media Research (3) Identification, location, and collection of developmental and experimental research on instructional media. Application of research. Sp

671 Advanced Educational Statistics (3) Applications of parametric and non-parametric statistical inference to educational and instructional problems. Use of microcomputers in educational research. Prereq: 561. Sp,Su

672 Interpretation and Application Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction. Newer methodologies and strategies. Utilization of research to improve curriculum and instruction practice. Application of research principles in context of specific professional assignments. Prereq: Consent of instructor. Sp

675 Curriculum Evaluation: Theory and Application (3) Description trends and issues. Theoretical framework to design evaluation studies for various educational programs. Sp

676 Curriculum Theory (3) Influent curriculum theory and approaches, implications for structure and design of educational programs. Nature and function of theory, building activities. Prereq: Consent of instructor. Sp

683 Advanced Studies in Elementary School Mathematics (2) Research in elementary school mathematics. Prereq: Graduate course in mathematics education or consent of instructor. Sp

695 Educational Leadership: Theory and Practice (3) Theoretical leadership applied to variety of educational settings. 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 Readings (1-3) May be repeated. S/NC or letter grade. E

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

696 Advanced Studies in Secondary Science and Environmental Education (3) Trends in science and environmental programs, materials, methods and research in middle, junior and senior high schools, and community colleges. Prereq: 596 or equivalent and consent of instructor. Sp

Ecology (College of Liberal Arts)

MAJOR

DEGREES

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

Dewey L. Bunting, Director
J. Larry Wilson, Associate Director
Paul A. Delcourt, Associate Director

Shared Faculty:

Adams, Marshall, Ph.D., ORNL
Amundsen, C. C., Ph.D., Botany
Bartell, Steve, Ph.D., ORNL
Blaylock, B. G., Ph.D., ORNL
Boake, Christine R. B., Ph.D., Zoology
Buckner, R. E., Ph.D., Forestry, Wildlife & Fisheries
Dearden, B. L. Ph.D., Forestry, Wildlife & Fisheries
Dewey, L. W., Ph.D., Zoology
Berghardt, G. M., Ph.D., Psychology
Clebsch, E. E. C., Ph.D., Botany
Coutant, C. C., Ph.D., ORNL
DeAngelis, D. L., Ph.D., ORNL
Drake, J. W., Ph.D., Zoology
Elwood, J. W., Ph.D., Zoology
Eckert, H. J., Ph.D., Zoology
Farkas, Walter, Ph.D., Environmental Practice
Fisheries

Dewey, L. W., Ph.D., Zoology
Berghardt, G. M., Ph.D., Psychology
Clebsch, E. E. C., Ph.D., Botany
Coutant, C. C., Ph.D., ORNL
DeAngelis, D. L., Ph.D., ORNL
Drake, J. W., Ph.D., Zoology
Elwood, J. W., Ph.D., ORNL
Eckert, H. J., Ph.D., Zoology
Farkas, Walter, Ph.D., Environmental Practice
Fisheries

Dewey, L. W., Ph.D., Zoology
Berghardt, G. M., Ph.D., Psychology
Clebsch, E. E. C., Ph.D., Botany
Coutant, C. C., Ph.D., ORNL
DeAngelis, D. L., Ph.D., ORNL
Drake, J. W., Ph.D., Zoology
Elwood, J. W., Ph.D., ORNL
Eckert, H. J., Ph.D., Zoology
Farkas, Walter, Ph.D., Environmental Practice
Fisheries
Gist, C. S., Ph.D., ORAU
Gittelman, John L., Ph.D., Zoology
Goss, L. Barry, Ph.D., Science Appl.
Greenburg, Neil, Ph.D., Zoology
Gross, L. J., Ph.D., Mathematics
Hallam, Thomas G., Ph.D., Mathematics
Hardesty, Carol F., Ph.D., Geography
Hay, R. L., Ph.D., Forestry, Wildlife & Fisheries
Herbes, S. E., Ph.D., ORNL
Hildebrand, S. G., Ph.D., ORNL
Hilly, J. W., Ph.D., Entomology & Plant Pathology
Horn, Sally P., Ph.D., Geography
Houston, M., Ph.D., ORNL
Kimmel, B. L., Ph.D., ORNL
McCarthy, J. F., Ph.D., ORNL
McCormick, J. Frank, Ph.D., Botany
McCracken, G. F., Ph.D., Zoology
Mckinney, M. L., Ph.D., Geology
McLaughlin, S. B., Ph.D., ORNL
Muhammad, P. J., Ph.D., ORNL
Nodvin, Stephen C., Ph.D., CPSU
Norby, Richard, Ph.D., ORNL
O’Neil, R. V., Ph.D., ORNL
Pagni, R. M., Ph.D., Chemistry
Parker, Charles, Ph.D., ORNL
Pelton, Michael R., Ph.D., Forestry, Wildlife & Fisheries
Pimm, S. L., Ph.D., Zoology
Pliss, C. D., Ph.D., Entomology & Plant Pathology
Post, W., Ph.D., ORNL
Rehder, J. B., Ph.D., Geography
Reiche, D. E., Ph.D., ORNL
Rennie, J. C., Ph.D., Forestry, Wildlife & Fisheries
Reynolds, John H., Ph.D., Plant & Soil Science
Riechert, Susan E., Ph.D., Zoology
Sayler, Gary S., Ph.D., Microbiology
Scott, L. E., Ph.D., Forestry, Wildlife & Fisheries
Smith, W. O., Ph.D., Botany
Stacey, G., Ph.D., Microbiology
Stewart, A., Ph.D., ORNL
Stewart, D., Ph.D., Forestry, Wildlife & Fisheries
Turner, Monica G., Ph.D., ORNL
Van Hook, R. I., Ph.D., ORNL
VanWinkle, W., Ph.D., ORNL
Vaughn, G., Ph.D., Zoology
Walton, B. T., Ph.D., ORNL
Wehry, E. L., Ph.D., Chemistry
West, D. C., Ph.D., ORNL
White, David C., Ph.D., Microbiology
Wilson, J. L., Ph.D., Forestry, Wildlife & Fisheries
Witherspoon, J. P., Ph.D., ORNL

The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology for students from undergraduate programs in basic and applied biology, social sciences, mathematics, and engineering. Research opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of the Oak Ridge National Laboratory, the national Park Service, and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, TVA lakes and wild rivers provide locally a spectrum of natural habitats and consequent biological diversity that is truly unique. In addition, faculty research programs provide opportunities for student research elsewhere on this continent and abroad.

ADMISSION REQUIREMENTS

Requirements for admission to this program are: (1) admission to The Graduate School; (2) chemistry including organic, mathematics including calculus, and 3 semester hours of ecology at the upper division level (physics highly recommended); (3) departmental application and 3 rating forms; (4) the Graduate Record Examination.

Application forms for admission should be obtained from The Graduate School and the Ecology Program. Inquiries concerning the admission requirements should be addressed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37966-1610.

THE MASTER'S PROGRAM

Within the minimum requirements of The Graduate School, the program of study must include Ecology 573 and 574 or an approved equivalent and one course from an approved list of quantitative methods offerings. The list is available from the ecology office and is updated annually by the Ecology Curriculum Committee. The remainder of a student's course program is determined in consultation with the graduate committee. A listing of approved campus-wide ecology offerings is provided to each student during orientation.

A graduate minor in ecology is available on an individual basis.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. The doctoral program must include Ecology 573 and 574 or an approved equivalent and one course from an approved list of quantitative methods offerings. A student cannot enroll for dissertation hours until the research proposal has been discussed and approved by the doctoral committee. A foreign language is required.

ADVISORS

Advisors are selected from ecologists on the shared faculty of the University who have competence in the area in which the student expects to work. Entering students should consult early with the director of the program on the choice of a faculty committee. The Master's committee need not have more than three members. Doctoral committees consist of the major professor as chairperson, one additional member who should have an appointment in the same department, and at least two additional Ecology faculty from other departments.

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 Ecology is available to residents of the states of Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

500 Thesis (1-15) P/ NP only, E
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 Special Problems in Ecology (1-3) Individual investigation in ecology. May be repeated with consent of instructor. Maximum 6 hrs.
520 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. Appropriate for students in Planning and Environmental Engineering.
530 Implementation of Environmental Policy (3) Goals and problems of environmental legislation. National Environmental Policy Act; purpose, preparation, and evaluation of environmental impact statements and similar multidisciplinary studies. Pre req: 520 or 573 or course work or experience in environmental law.
537 Natural Resource Management and Environmental Assessment in Developing Nations (3) Assessment of environmental and resource development issues. Scientific basis for integrated resource management and environmental assessment in developing nations. Pre req General ecology or equivalent. (Same as Planning 553 and Botany 537)
552 Development Planning in the Third World (3) (Same as Planning 552.)
555 Environmental Planning (3) (Same as Planning 555.)
561 Environmental Toxicology (3) (Same as Biochemistry 561.)
562 Techniques in Environmental Toxicology (1) (Same as Biochemistry 562.)
573 Population Biology (3) (Same as Zoology 573 and Botany 573.)
574 Communities and Ecosystems (3) Patterns underlying principles behind short and long term community and ecosystem organization, dynamics, energetics and nutrient cycling.
600 Doctoral Research and Dissertation (3-15) P/ NP only, E
604 Current Topics in Environmental Toxicology (1) (Same as Biochemistry 604.)
610 Special Topics in Ecology (3) Seminars on advanced topics and recent developments. Pre req. Consent of instructor. May be repeated. Maximum 9 hrs.
620 Seminar in Ecology (2) May be repeated. Maximum 12 hrs.
637 Applied Ecology (3) Review of contemporary and historical issues. Analysis of scientific basis of environmental assessment and natural resource management. Analysis of careers and career planning in applied ecology. Pre req: 573-74 or equivalent or consent of instructor. (Same as Botany 637.)

Economics

(Majors of College Administration)

MAJORS

DEGREES

Economics

M.A., Ph.D.

Business Administration

MBA

Anne Mayhew, Head

Professors:

Bohm, Robert A., Ph.D. Washington (St. Louis)
Bowers, Roger L., Ph.D. Texas A&M University
Carroll, Sidney L., Ph.D.  Harvard
Chang, Hui S. Ph.D.  Vanderbilt
Cole, William E. Ph.D.  Texas
Davidson, Paul (J. Fred Holly Chair).  Texas
Feiwel, George R. (Emeritus), Ph.D.  McGill
Fox, William F., Ph.D.  Ohio State
Garrison, Charles B., Ph.D.  Kentucky
Herzog, Henry W., Ph.D.  Maryland
Jansen, Hans E. Ph.D.  Texas
Lee, Feng-Yao (Emeritus), Ph.D.  Michigan State
Mayhew, Anne, Ph.D.  Texas
Murray, M. N., Ph.D.  Syracuse
Phillips, Keith E., Ph.D.  Washington
Spiva, George A., Ph.D.  Texas

The Department of Economics offers graduate programs leading to the M.A. and Ph.D. The M.A. may be completed by either a thesis or non-thesis option, while the Ph.D. requires successful completion of a dissertation. Applicants to these programs should contact the Associate Dean for Graduate Programs, College of Business Administration.

ACADEMIC STANDARDS

A graduate student whose grade-point average falls below 3.0 will be placed on probation. A student on probation will be dropped from the program if the grade-point average falls below 3.0 at the end of the probationary period. The probationary period is defined as the next semester's courses at the 500 level or above, outside the two fields of specialization.

THE MASTER'S PROGRAM

Admission to the M.A. program is based on undergraduate academic performance and on scores from the GRE. The student may choose either the thesis or non-thesis option.

The non-thesis option requires 30 hours of coursework at the 400 level or above. Of these, at least 24 hours (at least 18 hours of which are in economics) must be at the 500 level or above. Of the minimum 18 hours in economics at the 500 level or above, 12 hours must consist of 511, 512 and 513, and 514, and the remaining 6 hours must be in one field of economics. Of the 30 hours, a maximum of 9 hours in courses approved by the department may be taken in fields other than economics. Students electing the non-thesis option are required to pass a final comprehensive examination.

THE DOCTORAL PROGRAM

Admission to the Ph.D. program is based on promise of outstanding scholarship as demonstrated by previous academic performance and by scores achieved on the general portion of the GRE. Requirements for successful completion of the program consist of the four components listed below:

1. Students are required to complete the following core requirements:
   a. Economic Theory: Microeconomic theory by comprehensive examination or by completion of 511, 512 with a B+ average or higher, and macroeconomic theory by comprehensive examination or by completion of 513, 514 with a B+ average or higher.
   c. Mathematical and Quantitative Economics: 581, 582. The 582 requirement may be waived for students completing 581, 582.
   d. Students must achieve a grade average of B+ or higher over the courses offered to fulfill requirements in subparagraphs b and c, or, as an alternative, may petition to satisfy either or both of these two core areas by some other means such as a comprehensive written examination.
   2. Students are required to demonstrate their competence by comprehensive examination in two fields of specialization with the approval of the department, at least one of which must be selected from the following: comparative systems, economic development, economic history, economics of labor and human resources, industrial organization, international economics, public finance, and regional and urban economics.
   3. Students are required to complete with a grade of C or better two elective economics courses at the 500 level or above, outside the core subject areas and outside the two fields of specialization.
   4. Students are required to complete a dissertation, including an oral defense, to give at least 24 hours of graduate credit (600).

BUSINESS ADMINISTRATION CONCENTRATION

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

MBA Concentration: Economics

Minimum course requirements are as approved by the area MBA faculty advisor.

GRADUATE COURSES

400 Special Topics (3) Topics vary. Prereq: Determined by department.

413 Macroeconomic Fluctuations (3) Analysis of historical data, methods of analyzing macro-economic fluctuations, theoretical explanations of cycles, and role of monetary and fiscal policies in aggregate econony. Prereq: Intermediate Macroeconomics or consent of instructor.

415 History of Economics (3) Methods of study of doctrinal history. Origins and evolution of major doctrines. Analytical and historiographical approach to economic thought of Keynes and his followers, principal developments of second half of 20th century. Major writing requirement. Prereq: 201 or equivalent and consent of instructor.

424 Political Economy of World Development (3) Topics vary: Latin America, Asia, Soviet Union and Eastern Europe. Analysis of major economic strategies, policies, and problems. Prereq: 201. This course includes a major writing requirement. May be repeated when topic varies. Maximum 9 hrs.


462 Economics of Resources and Environmental Policy (3) Economic analysis of environmental and allocation of resources. Benefits and costs of development of natural resources and impacts of growth on environment. Major writing requirement. Prereq: 201.

471 Public Finance: Optimal Government Functions and Expenditure Analysis (3) Problems of public consumption, external effects, public investment, social decision making. Prereq: 201.

472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual taxes and of tax systems, non-tax sources of revenue, fiscal federalism. Prereq: 201.


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

501 Managerial Economics (3) Application of economic concepts to business decision making. Analysis and forecasting of demand, cost analysis, pricing behavior, and application of optimizing techniques.

502 Registration for Use of Facilities (3-15) Required for all students. Not available for students with credit for 511. Prereq: 311 or equivalent.

503 Business Conditions Analysis (3) Macroeconomic environment of firm. Determination of level of output, employment, and prices for economy as a whole. Implications of aggregate fluctuations for individuals, role of forecasting techniques and stabilization policies.

510 Fundamentals of Microeconomics (3) Theory of consumer behavior and demand, theory of production and cost, behavior of the firm in perfectly competitive and monopolistic environments. For non-economics majors. Not available for students with credit for 511. Prereq: 311 or equivalent.

511-12 Microeconomic Theory (3,3) Theory of consumer choice and demand, theory of supply and demand, attributes of goods and implicit prices, market demand, labor supply, individual behavior under uncertainty, theory of firm, theory of production and cost, market structures, derived demand and factor pricing, introduction to welfare economics, market failure and theory of second best in exchange.

513-14 Macroeconomic Theory (3,3) Determination of national income, prices, and employment. Results using Keynesian, non-market-clearing, monetarist, and rational expectations paradigms.

515 History of Economics (3) Purpose and methods of history of economics. Background for and origins, concerns, methods, development and conclusions of classical...
Education

MAJOR

DEGREE

Education ........................................ Ph. D.

THE MASTER'S PROGRAM

The College of Education offers an extended teacher preparation program which features a professional year internship with accompanying coursework. By completing the 24 hours associated with the professional year, a student could complete a Master's degree with 12 more credits for the total of 36 semester hours. Course requirements for the M.S. program include:

Fall Semester

Internship ....................................... 4 hrs
Specialty Studies ................................ 6 hrs
Analysis of Teaching for Professional Development 2 hrs

Spring Semester

Internship ....................................... 8 hrs
Clinical Studies ................................ 4 hrs

Post Internship

Concentration Area 12 hrs
TOTAL ........................................ 36 hrs

Prior to the first semester of internship, a student must be admitted to The Graduate School. Prior to the completion of the first semester of internship, a student must be admitted to the Master's program in the College of Education in which the degree is to be pursued.

THE DOCTORAL PROGRAM

The Ph.D. program with a major in Education provides six concentrations. The departments participating in the Ph.D. program are Curriculum and Instruction; Educational Leadership; Educational and Counseling Psychology; Health, Leisure, and Safety; Human Performance and Sport Studies; Special Services Education; and Technological and Adult Education. The program requirements, concentrations and specializations are:

Requirements

Minimum Hours

Research Area .................................. 14
Foreign or Computer Language (demonstrate proficiency) 6
General Core Requirements

Courses in history of education, philosophy of education (two areas must be represented) 4
Courses in learning theory, curriculum theory, and administrative theory (three areas must be represented) 6
Trans-college seminar-three consecutive semesters (including summer) 3
Alternative Core Requirements

Courses in philosophy of science Trans-college Seminar-three consecutive semesters (including summer) 3
Seminar in area of specialization 3
Courses in learning theory/group or independent study 3

Concentrations

Primary Concentration—A minimum of 16 hours normally selected from one or two specializations within the primary concentration 16
Supporting Specialization—A minimum of 9 hours selected from a specialization in a concentration other than the primary concentration 9
Cognate

A minimum of 6 hours selected from outside the college in addition to the designated research courses 6
Dissertation .................................... 24

CONCENTRATIONS

Administrative Theory and Practice
Specializations:

1. School administration
2. Higher education administration
3. Organizational leadership and policy studies

Theories of Curriculum Development and Foundations of Education
Specializations:

1. Anthropological, historical, philosophical, and sociological bases for educational planning and curriculum
2. Principles and models for planning, developing, and evaluating educational programs
3. Research design for educational programs


**Instructional Theory and Practice**

Specializations:

1. Principles and models for instructional improvement
2. Elementary and early childhood instruction and assessment
3. Secondary/community colleges: (English, foreign language, mathematics, science, social studies education)
4. Elementary: mathematics, science, social studies education
5. Reading education
6. Instructional media and technology
7. Technological and adult education
8. Special education and rehabilitation

**Theories and Practice of Educational and Personal Adjustment**

Specializations:

1. Counselor education
2. Counseling psychology
3. Educational psychology
4. School psychology

**Foundations of Human Movement**

Specializations:

1. Exercise Science: Adapted Physical Education Exercise Physiology/Fitness
3. Socio-Cultural Foundations of Sport: History Philosophy Sociology

**Health Education**

Specializations:

1. Public health
2. Safety

**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 Education is available to residents of the states of Georgia or South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

See College of Education for additional departmental listings.

**GRADUATE COURSES**

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

575 Professional Internship in Teaching (1-4) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to postbaccalaureate students in professional year program. Prereq: Admission to Teacher Education program. May be repeated. Maximum 12 hrs. S/NC only. F,Sp

591 Clinical Studies (4) Group and individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.

601 Trans-College Seminar (1) Introduction to Ph.D. program in Education: research requirements, meaning of scholarship in academic and issues/problems in education. Minimum of two consecutive semesters preceded or followed by summer term required of all Ph.D. students. Prereq: Admission to Ph.D. program or consent of Ph.D. program coordinator. May be repeated. Maximum 3 hrs. May not be used to meet 600 requirement. S/NC only.

---

**Educational and Counseling Psychology**

*(College of Education)*

**MAJORS**

<table>
<thead>
<tr>
<th>DEGREES</th>
<th>MINORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S.</td>
<td>Guidance</td>
</tr>
<tr>
<td>M.S., Ed.D.</td>
<td>Educational Psychology</td>
</tr>
<tr>
<td>Ed.S. Education</td>
<td>and Counseling</td>
</tr>
<tr>
<td>Ph.D.</td>
<td>Education</td>
</tr>
</tbody>
</table>

**Professors:**

- Davis, K. L., Ed.D., Georgia
- DeRidder, Lawrence M. (Emeritus), Michigan
- Dickinson, Donald J., Ed.D., Oklahoma State
- Dietz, Siegfried C. (Emeritus), Ed.D., Arizona State
- Hector, M. A., Ph.D., Michigan State
- Huck, Schuyler W., Ph.D., Northwestern
- McCallum, R. S., Ph.D., Georgia
- McClain, Ed W. (Emeritus), Ph.D., Texas
- Peterson, M. P., Ph.D., Ohio State
- Poppen, William A., Ph.D., Ohio State
- Thompson, C. L., Ph.D., Ohio State
- Williams, R. L., Ph.D., Georgia

**Associate Professors:**

- George, Thomas, Ed.D., Tennessee
- Kindall, Luther M., Ed.D., Tennessee

**Professors:**

- Harris, Shanne Marie, Ph.D., Virginia Tech
- Hutchens, Teresa A., Ph.D., Georgia
- Nettles, Arie L., Ph.D., Vanderbilt

**Assistant Professors:**

The Department of Educational and Counseling Psychology offers graduate programs leading to the following:

- Master of Science with a major in Educational Psychology, concentrations in educational psychology and community counseling; Master of Science with a major in Guidance, concentrations in educational psychology, and counseling psychology; and Doctor of Education with a major in Educational Psychology, concentrations in counselor education and educational psychology. The department also participates in the college-wide Ph.D. program with a major in Education. The concentration area is theories and practice of educational and personal adjustment with specializations in counselor education, counseling psychology, educational psychology, and school psychology.

Several programs in the department are accredited. The Ed.D. counselor education concentration and the Ph.D. specialization in counselor education are accredited by the Council for Accreditation of Counseling and Related Educational Programs; counseling psychology by the American Psychological Association; and school psychology by the National Association for School Psychology. Also, the school counseling and school psychology programs have the approval of the National Council for Accreditation of Teacher Education. The community counseling and school counseling programs are accredited by the Council for Accreditation of Counseling and Related Educational Programs. The program in Educational Psychology has been recognized as a "Designated Program" by the American Association of State Psychology Boards and the Council for the National Register of Health Service Providers in Psychology.

The application deadline for admission varies by program area. February 1 is the deadline for all programs. Some programs also review applications May 1, August 1, and November 1. For information about the various programs of study, write to the departmental admissions secretary.

**THE MASTER'S PROGRAMS**

Admission requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. Hour requirements for a major in Educational Psychology, concentration in educational psychology, 36; concentration in community counseling, 60; and for a major in Guidance, 48. The programs in community counseling and in guidance each require supervised practicum and internship experiences with clients. A final examination is required of all Master's degree students.

**THE EDUCATIONAL SPECIALIST PROGRAM**

Admission requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. The program in school psychology requires a minimum of 66 hours. When students are admitted to the Ed.S. programs in educational psychology or school counseling, it is assumed that they have completed a Master's degree equivalent to the one offered at UT Knoxville. In this case, the minimum hours beyond the Master's required to complete the Ed.S. are: educational psychology, 24; school counseling, 22. The specialist programs require supervised practicum and internship experiences with students or clients, either in the public schools or in community human services agencies. A final examination is required of all specialist students.

**THE DOCTORAL PROGRAMS**

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education. For students applying to the Ph.D. program concentration located in this department, two applications are required: one for the Ph.D. in Education program and one for the department that specifies which specialization is desired (i.e. counseling psychology, counselor education, educational psychology, or school psychology). Applicants for the Ph.D. with a concentration in either counselor...
493 Independent Study (1-15) May be repeated. Maximum 15 hrs. S/NC or letter grade. E

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

502 Registration for Use of Facilities (3-5) Required for the student to register 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 (1-3) May be repeated. Maximum 12 hrs. S/NC only. E

504 Special Topics (1-3) Instructor-initiated course offered in consultation with department on topic of current interest. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

510 Psychological Theories of Human Development Applied to Education (3) Theory and research on emotional, social, and intellectual aspects of development. Prereq: Admission to program. E

511 Cognitive Development: Implications for Education (3) Theory and research on intellectual and cognitive development. Prereq: 510 or consent of instructor. E

515 Educational Applications of Behavioral Theories of Learning (3) Behavioral theories and research related to higher mental problem-solving. Prereq: 510 or consent of instructor. F

516 Educational Applications of Cognitive Learning Theories (3) Cognitive theory and research, social learning, attribution and information processing as systems approach to education. Prereq: 515 or consent of instructor. F

518 Educational Specialist Research and Thesis (1-9) May be repeated. Maximum 9 hrs. P/NP only. E

520 Statistics and Research Design: Conceptual (3) Consumer-oriented, conceptual treatment of statistics, research design, and qualitative basis of testing. E

521 Statistics and Research Design: Application (3) Data collection and analysis. Descriptive techniques, estimation, logic of hypothesis testing and selected parametric statistics. E

525 Formal Measurement in Education and Counseling (3) Essentials of theory and research related to higher mental problem-solving. Survey of standardized tests of intelligence, achievement, aptitude, vocational interest, attitudes and personality. Prereq: 520 or equivalent. F,Su

526 Informal Methods of Assessment (3) Development and use of informal, direct, diagnostic, observation, test scores and case reports in assessment and counseling of children and adults. Prereq: 525. Sp

540 Seminar in School Psychology (3) Essentials of theory and research related to higher mental problem-solving. Survey of standardized tests of intelligence, achievement, aptitude, vocational interest, attitudes and personality. Prereq: 520 or equivalent. F

541 Practicum in Psychoeducational Assessment (3) Application of assessment skills to clients in learning environments. Prereq: Admission to school psychology program or consent of instructor, and 525 or equivalent. F,Sp

542 Practicum in Psychoeducational Assessment (3) Application of assessment skills to clients in learning environments. Coreq: 541 or consent of instructor. May be repeated. Maximum 6 hrs. S/NC only. F,Sp

543 Practicum in Psychoeducational Consultation (3) Use of two or more models of consultation in educational and therapeutic settings based on theoretical, ecological, social learning and cognitive-behavioral theories. F,Sp

546 Practicum in Consultation (3) Application of counseling skills to educational settings. Coreq: 543. Sp

548 Internship in School Psychology (1-6) Supervised employment in departmentally approved school psychology internship sites. Prereq: Enrollment in school psychology program or consent of instructor. May be repeated. Maximum 12 hrs. (Same as Psychology 548). S/NC only. E

550 Development and Operation of Pupil Personnel Services (3) History, philosophy, trends, standards of preparation, certification, and role identity of counselors and other personnel service specialists. Program administration and organization. F,Su

551 Theory and Practice of Counseling (3) Philosophical bases of helping relationship; development of counselor and client self-awareness; counseling theory/techniques. F,Su

552 Career Development: Vocational Theory, Research and Practice (3) Relationship of vocational theory, career development research and societal factors to life career roles. F,Su

553 Career Development: Vocational and Educational Resources (3) Application of career and educational resources in personnel planning and program development. Sp

554 Group Dynamics and Methods (3) Theory and types of groups, descriptions of group practices, methods, dynamics, and facilitative skills, supervision of leadershipship. E

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with client instructors. Prereq: Admission to program, 431, 525, 551 and consent of instructor. May be repeated. Maximum 9 hrs. E

556 Seminar in Community Agency Counseling (1) Orientation to professional organizations, code of ethics, certification requirements, and role identity of community agency counselors. May be repeated. Maximum 2 hrs. S/NC only. E

566 Approaches to Family Intervention and Counseling (3) (Same as Child and Family Studies 566.)

570 Cross-Cultural Counseling: Theory and Research (3) Theory and research on issues and problems in counseling of clients from different cultural backgrounds in U.S. and abroad. Sp

575 Community Education (3) (Same as Family Life Education 575.)

578 Seminar in Gerontology (1) (Same as Human Ecology 585, Nursing 585, Physical Education 585, Public Health 585, Psychology 585, Social Work 585, and Sociology 585.)

593 Independent Study (1-15) Independent investigation of problems in educational and counseling psychology. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

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

602 Directed Research (1-3) Instructor- or student-initiated guided investigation of empirical and theoretical problems in educational and counseling psychology. May be repeated. Maximum 12 hrs. S/NC only. E

604 Special Topics (1-3) Instructor-initiated course offered at convenience of department on topics of interest. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

625 Advanced Study in Personality (3) Related to theory, research and conceptual analysis of studies with applications to education and counseling. Prereq: 431 or equivalent. F

635 Ethical, Legal, and Professional Issues in Psychology (3) Research, human services, teaching and public policy. Prereq: Admission to doctoral program in psychology, or consent of instructor. (Same as Psychology 635.) E

649 Advanced Internship in School Psychology (1-9) Supervised experience as school psychologist in departmentally-approved internship site for doctoral level students. Prereq: Enrollment in doctoral level school psychology program and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

558 Seminar in Educational Psychology (3) Theory and research on issues and problems in educational and counseling psychology. May be repeated. Maximum 12 hrs. S/NC only. E

560 Models of Classroom Discipline (3) Applications of major models of discipline in development of constructive atmospheres for classroom learning. F,Sp

603 Seminar in School Psychology (3) Theory and research on issues and problems in educational and counseling psychology. May be repeated. Maximum 12 hrs. S/NC only. E

625 Advanced Study in Personality (3) Related to theory, research and conceptual analysis of studies with applications to education and counseling. Prereq: 431 or equivalent. F

635 Ethical, Legal, and Professional Issues in Psychology (3) Research, human services, teaching and public policy. Prereq: Admission to doctoral program in psychology, or consent of instructor. (Same as Psychology 635.) E

649 Advanced Internship in School Psychology (1-9) Supervised experience as school psychologist in departmentally-approved internship site for doctoral level students. Prereq: Enrollment in doctoral level school psychology program and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

677 Seminar in School Psychology (3) Theory and research on issues and problems in educational and counseling psychology. May be repeated. Maximum 12 hrs. S/NC only. E

685 Seminar in Social Psychology (3) History, philosophy, trends, standards of preparation, certification, and role identity of counselors and other personnel service specialists. Program administration and organization. F,Su
560 Seminar in Counseling Education (1) Professional issues related to role and function of counselor educator. Prereq: Admission to doctoral program in counseling education. May be repeated. Maximum 2 hrs. S/NC only. F

555 Practicum in Counseling Education (3) Supervised practice and application of counseling skills with clients. Prereq: Admission to counselor education program and consent of instructor. May be repeated. Maximum 6 hrs. Sp

559 Internship in Counseling Education (1-6) Supervised employment in departmentally approved internship area of counseling. May be repeated. Maximum 12 hrs. S/NC only. E

660 Seminar in Educational Psychology (1) Major professional issues, role and scope of educational psychology as field of study and practice. Prereq: Admission to doctoral program in educational psychology. May be repeated. Maximum 2 hrs. S/NC only. F

661 Education Implications of Neuropsychology (3) Theory and assessment. Common syndromes and their behavioral and cognitive manifestations. Prereq: 516; and 541 or equivalent individual assessment course; or consent of instructor. Sp


663 Scale Construction (3) Development, pilot testing, and revision of attitude inventories, rating scales, and other paper-and-pencil techniques for assessing beliefs, personality characteristics, and opinion. Prereq: 525, and two-course sequence in statistical analysis. A

664 Cognitive Interventions with Psychoeducational Problems (3) Cognitive approaches applied to coping skills, self instruction, cognitive restructuring, symbolic and social modeling and belief systems. A

665 Analysis of Research in Instructional Technology (3) Research on human learning, design of learning environments. Analysis of teacher behavior, text development, computer software design and video presentation. A

666 Practicum in Instructional Planning (3) Development and management of course or program of instruction in educational psychology. Prereq: 665, or consent of instructor. F

669 Internship in Educational Psychology (1-6) Supervised employment in departmentally approved educational psychology internship sites. May be repeated. Maximum 12 hrs. S/NC only. E


671 Personality and Vocational Assessment (3) Use and interpretation of personality and vocational measures in assessment of clients. Prereq: 525, 552 or consent of instructor. A

672 Psychological Dysfunction (3) Classification methods, dynamics and treatment of dysfunctional individuals in counseling. Prereq: 625 and course in abnormal psychology, or consent of instructor. A

673 Advanced Theory and Practice in Group Counseling (3) Theories and supervised practice. Prereq: 554, 555, and consent of instructor. F

674 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 135 clock hrs required each semester. Prereq: Admission to counseling psychology doctoral program, 555, and consent of instructor. May be repeated. Maximum 6 hrs. E

678 Theory and Practice of Counseling Supervision (3) Theory and practice of supervision in counseling. Prereq: 655, or 674, or consent of instructor. S/NC only. E

679 Internship in Counseling Psychology (1-6) Supervised employment in departmentally approved counseling psychology internship sites. Prereq: Admission to counseling psychology doctoral program and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

693 Independent Study (1-15) Independent investigation of problems in educational and counseling psychology. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

Educational Leadership
(College of Education)

MAJORS

DEGREES

College Student Personnel .................... M.S.
Educational Administration and Supervision .................... M.S., Ed.S., Ed.D.

Education

Mary Jane Connelly, Head

Professors:

Coffield, William H. (Emeritus), Ph.D. .... Iowa
Harris, G. W., Jr., Ph.D. ......................... Michigan
McInnis, Malcolm C., Jr., Ph.D. .... Florida State
Peccolo, C. M. (Emeritus), Ph.D. .... Iowa
Petitbone, Timothy J., Ph.D. ............ New Mexico State
Roney, Robert K., Ed.D. .............. Tennessee
Stollar, Dewey H. (Emeritus), Ph.D. .... Ohio State
Trusty, Francis M. (Emeritus), Ed.D. .... Stanford
Ubben, Gerald O., Ph.D. ............. Minnesota
Vandetti, Fred P. (Emeritus), Ed.D. .... Northern Colorado

Associate Professors:

Askev, Jerry W. (Adjunct), Ph.D. .... Ohio State
Connelly, Mary Jane, Ed.D. ............ VPI
Gross, Francis M. (Adjunct), Ed.D. .... Tennessee
Hugen, Helen M., Ed.D. ............... Stanford
Mertz, Norma T., Ed.D. ............. Columbia

Assistant Professor:

Grubb, James J., M.S. ............... Indiana State

The Department of Educational Leadership offers graduate programs leading to the Master of Science with majors in Educational Administration and Supervision and in College Student Personnel (higher education), the Specialist in Education, the Doctor of Education with a major in Educational Administration and Supervision, and the Doctor of Philosophy with a major in Education. Specializations may be developed in research, major central office positions, the principalship, and in other educational and social agencies.

The Ed.D. program also offers a concentration in higher education. The instructional program combines theory and practice in an innovative demonstration of scholarly study and research. A blend of classroom instruction, individualized advising, and supervised practice and internships allows students to develop a specialization in academic administration, community-junior college administration, professional issues, role and scope of educational psychology as field of study and practice. Prereq: Admission to doctoral program in educational psychology. May be repeated. Maximum 2 hrs. S/NC only. E

For additional information, contact the department head.

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. Application deadlines are February 1, July 1, and October 1.

THE MASTER'S PROGRAM IN EDUCATIONAL ADMINISTRATION AND SUPERVISION

Thesis Option

A minimum of 33 credit hours including 6 hours of Thesis 500 is required. A major consists of a minimum of 18 hours. An internship is highly recommended but not required. A final oral examination is required with a written exam at the option of the committee.

Non-Thesis Option

A minimum of 36 credit hours is required with a minimum of 18 hours in the major. An internship is highly recommended but not required. A final written comprehensive examination is required with an oral exam at the option of the committee.

Students entering either of these options must complete the introductory core consisting of Educational Administration and Supervision 513, 515, 516, and 535 or a demonstrated computer proficiency. The courses are prerequisites to other courses in the department.

THE MASTER'S PROGRAM IN COLLEGE STU DENT PERSONNEL

This program is designed for individuals interested in entering the field of student personnel administration in colleges and universities and in community or junior colleges. The program has both a thesis and non-thesis option. A minimum of 36 hours, which includes 6 hours of practicum experience, is required in either option.

THE EDUCATIONAL SPECIALIST PROGRAM

Thesis Option

A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 518 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the thesis.

Non-Thesis Option

A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 503 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the problem papers.
548 Introductory Supervision and Personnel (3) Basic supervisory and personnel concepts and related competencies; building (or micro-organizational) level; interviewing, personnel planning, collecting and maintaining educational personnel information, interpersonal and non-instructional personnel, clinical supervision, staff evaluation and staff development. Prereq: Introductory M.S. core or consent of an instructor. F, Su

553 Strategies of Educational Planning (3) Processes for improving decision-making function through use of both quantitative and qualitative planning techniques. Prereq: 518 Educational Specialist Research and Thesis. F, Su

554 School Law (3) Logical arrangement of case and statutory materials for public school administrators and teachers; problems of 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. At end of planned program of study. Placement by department assignment. Some on-campus classes in conjunction with 583 or 582. Prereq: 21 hrs in educational administration and supervision or consent of instructor. E

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

583 Educational Leadership--Principalship (3) Knowledge, skills and relationships for principal to be effective instructional leader. Simulation materials and field-based activities. Culminating course with internship and problems paper. At end of planned program 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

593 Independent Study in Educational Administration (3) Prereq: Consent of instructor. May be repeated. E

595 Elementary Principals Seminar (1-3) For in-service training of elementary school administrators. Development of 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 of 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

597 Secondary Administrator Seminar (1-3) For in-service training of secondary school administrators. Development of problems, programs, and trends of secondary schools and management skills of secondary school administrators. Prereq: Presently secondary school administrator or consent of instructor. May be repeated. S/NC or letter grade. F, Sp

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

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

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 practicing administrators. Prereq: 21 hrs in educational administration and supervision or consent of instructor. May be repeated at discretion of student's committee. Maximum 12 hrs. S/NC only. E

611 Current Issues in Educational Administration (1-3) Current topics for practicing school administrators, collected each semester and presented by specialist. Prereq: Presently school supervisor or administrator, or consent of instructor. May be repeated. S/NC or letter grade. E

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

615 Research Designs (3) Statistical methods through multivariate techniques applicable 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

622 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) Exploring designs and methodology for training school administrators at both pre-service and in-service levels. F

626 Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school systems and higher educational institutions. Interdisciplinary discussion of community power structures and special interest groups, based on literature and research from education, sociology, and political science. Prereq: 525, 516 or equivalent or consent of instructor. F

638 Advanced Supervision (3) Supervision at district level; roles, responsibilities, and operations: goal development, instructional supervision, staffing evaluation, curriculum development, program evaluation, and personnel evaluation. Prereq: 548 or consent of instructor. Sp

644 Educational Finance and Business Management (3) Contemporary educational finance problems and their influence upon education, nation and citizens. Preparation for success in community college, school district or business positions. Prereq: 544 or consent of instructor. F

646 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational programs: supervision, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Prereq: 548 or consent of instructor. F, Sp

653 Seminar in Educational Planning Methods (3) Exploration of alternative futures and advanced planning methods. Sophisticated planning/forecasting techniques. Prereq: 553 or consent of instructor. F, Sp

655 State-Federal Relations in Education (3) Interrelationships of federal, state, and local responsibilities and organizations for education by analysis of traditional, legal, fiscal and functional aspects of educational partnership. Funding partnerships: discussion of grant proposal development processes. Sp, Su

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

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

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

667 Seminar in Educational Facility Planning (3) Concepts and techniques for evaluating educational facilities, conducting comprehensive school surveys, and developing educational specifications. Prereq: 547 or consent of instructor. Sp

690 Specialized Seminar (3) Prereq: Consent of instructor. May be repeated. E
Higher Education

GRADUATE COURSES

455 Seminar in Student Leadership (1) Knowledge and skills in leadership roles for resident assistants, student government leaders, student activities, and other student organizations. Topics to be assigned. May be repeated. E

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

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

503 Problems in Lieu of Thesis (3-6) May be repeated. S/NC only. E

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

542 The College Student and the Court (3) Legal precedent affecting student personnel services in public higher education. Student discipline, housing, dress, organizations, activities fees, tuition and related federal regulations. F

543 American Higher Education in Transition (3) History, philosophy, purposes, functions, organizations and programs in American higher education. F

570 Introduction to Student Personnel Work in Higher Education (3) Historical, philosophical and organizational perspective. Functional areas comprising field and major issues. F

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

596 The Community-Junior College (3) History and role of two-year college, major functions, organization and administration, problems and issues. Sp

593 Independent Study (3) Prereq: Consent of supervisor. Instructor. May be repeated. S/NC or letter grade. E

599 Practicum in College Student Personnel (1-6) Prereq: Consent of instructor. May be repeated. S/NC only. E

619 Administration and Governance of Higher Education (3) Trends, structure and process of collegiate governance. Development of understanding of administrative theory and practice in higher education. Prereq: 543 or consent of instructor: F

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

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

645 Curriculum and Instruction in Undergraduate Higher Education (3) Content and organization of institutional strategies and curricular structure in higher education. F:Su

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

693 Independent Study (3) Prereq: Consent of supervisor. Instructor. May be repeated. S/NC or letter grade. E

695 Practicum in Higher Education (1-6) Supervised practicum in selected areas of higher education administration. Prereq: Consent of instructor. May be repeated. S/NC only. E

698 Seminar in Higher Education (3) Analysis of administrative and organizational structure, theory and practice in management of American colleges and universities. Prereq: 543 or consent of instructor. Su

Electrical and Computer Engineering

(Majors of Engineering)

MAJOR DEGREES

Electrical Engineering .............................................. M.S., Ph.D.

Joseph M. Googe, Head

Professors:

Alzof, Igor, Ph.D. ................................................. Wisconsin
Bailey, J. Milton, Ph.D. ............................................. Georgia Tech
Birdwell, J. Douglas, Ph.D. ........................................ MIT
Bishop, Asa O., Jr., Ph.D. .......................................... Clemson
Blakoe, T. Vaughn, Ph.D. .......................................... Tennessee
Bodenheimer, Robert E., Ph.D. ................................. Northwestern
Bose, Bimal K. (Condra Chair of Excellence), Ph.D. ........................ Calcutta
Boulton, Donald W., Ph.D. ....................................... Vanderbilt
Cunningham, James W. (UTSI), Ph.D. ......................... Tennessee

Gonzalez, Rafael C. (Distinguished Prof.), Ph.D. ............... Florida
Googe, Joseph M., Ph.D. ............................................ Georgia Tech
Green, Walter L., Ph.D. ............................................. Texas A&M
Hoffman, Graham W., Ph.D. ....................................... Harvard
Hung, James C. (Distinguished Prof.), Ph.D. .................... New York
Kennedy, Eldredge J., Ph.D. ....................................... Tennessee
Lawler, Jack S., Ph.D. .............................................. Michigan State
Leffell, Will O. (Emeritus), M.S. ................................. Tennessee
Neff, Herbert P., Ph.D. ............................................ Auburn
Pace, Marshall O., Ph.D. ........................................... Georgia Tech
Pierce, J. Frank (Distinguished Prof.), Ph.D. .................... (Emeritus), PE, Ph.D. ............................................ Pittsburgh
Rochelle, Robert W. (Emeritus), Ph.D. ......................... Maryland
Roth, J. Reece, Ph.D. .............................................. Cornell
Symonds, Frederick W., Ph.D. ................................. Nottingham
Tillman, James D. (Emeritus), Ph.D. ............................ Auburn
Weaver, Charles H. (Emeritus), PE, Ph.D. ....................... Wisconsin

Associate Professors:

Bomar, Bruce W. (UTSI), Ph.D. ................................. Tennessee
Joseph, Roy D. (UTSI), Ph.D. ................................. Case Western
Rosenberg, David, Ph.D. ......................................... New York
Rochelle, James M., Ph.D. ....................................... Tennessee
Trivedi, Mohan M., Ph.D. ......................................... Utah State
Walker, J. Wayne, Ph.D. ........................................... Tennessee

Assistant Professor:

Abidi, M. A., Ph.D. ............................................... Tennessee
Brzakovic, Dragana, Ph.D. ....................................... Florida
Cripps, Paul B., Ph.D. ............................................. New Mexico State
Koch, Daniel, Ph.D. ................................................. Missouri (Rolla)
Smith, L. Montgomery (UTSI), Ph.D. .......................... Tennessee

Lecturers:

Adams, Raymond K., M.S., P.E. ......................... Tennessee
Martin, Clyde D., Jr., M.S. ................................. Tennessee

The Electrical and Computer Engineering Department has a graduate committee to administer, promote, and advance the general well-being of the graduate program. The Department of Electrical and Computer Engineering and the Department of Nuclear Engineering jointly offer a Master's degree program in the field of fusion energy. Students may have the opportunity to do their Master's thesis at the Fusion Energy Division of the Oak Ridge National Laboratory or at the Plasma Science Laboratory, affiliated with the Electrical and Computer Engineering Department. A limited number of Graduate Research Assistantships are available at each location. Further information about this program is available from the department.

THE MASTER'S PROGRAM

Graduate work leading to the Master of Science degree in Electrical Engineering may be completed during one academic year of full-time study, or the degree may be obtained in two or three years of study in the evening. Graduate assistantships are available for outstanding students, who may obtain the Master's degree in one calendar year.

Admission Requirements

Students applying for admission to the Master of Science program and who hold a B.S. in Electrical Engineering are considered for admission on an individual basis. The minimum expectation is an undergraduate cumulative grade-point average of 3.0 out of 4.0 and a GPA of 3.0 for the senior year average of 3.0 in that field. These students should also have a background equivalent to that obtained by earning credit with a minimum 3.0 grade-point average in the Electrical Engineering courses normally taken at the 200 and 300 levels in the Bachelor's program in this department, and two senior electrical and computer engineering courses (and any labs associated with them) in the student's area of interest. Students from fields other than electrical engineering who have met the admission standards except for this background will be admitted only as non-degree students until they have completed coursework to provide this background.

Master's Degree Requirements

Specific degree requirements which must be met include:

1. Electrical and Computer Engineering 503 and 504.

2. Six semester hours of graduate credit in mathematics consisting of mathematics courses of 400 level or higher which have been approved by the ECE Graduate Committee.

3. An additional 12 semester hours of 500-level work in electrical and computer engineering courses or 6 semester hours of 500-level work in one area of electrical and computer engineering courses and 6 semester hours of 500-level work in another area approved by the
student’s Master’s committee. The 500-level work in electrical and computer engineering courses must receive at least 6 hours in the student’s major area.


5. A final oral examination covering the thesis and related coursework.

THE DOCTORAL PROGRAM

The Ph.D. with a major in Electrical Engineering may include the core and in the concentration areas of circuit theory, computers, electrotechnics, communication theory, electromagnetic theory, plasma engineering, power systems, solid-state electronics, and control systems. All 500-level courses must be passed by the student’s major area. A comprehensive examination must be passed and a qualifying examination. Part of the comprehensive examination must be passed by the student’s major area. A comprehensive examination must be passed and a qualifying examination. The Departmental Graduate Record Exam. Specific departmental requirements for the Ph.D. include the following:

1. A Master of Science or Master of Engineering degree.

   a. A minimum of 24 semester hours of work in electrical and computer engineering courses at the 500 and 600 levels.
   b. A minimum of 9 semester hours of 600-level coursework. At least 3 semester hours of this work must be in an area other than the student’s major area.
   c. A minimum of 12 hours of mathematics courses approved by the Electrical and Computer Engineering Graduate Committee. All 12 hours must be at the 400 level or above, and at least 6 hours must be at the 500-level or above.

3. One foreign language if the student’s faculty committee feels that a reading knowledge of a foreign language is crucial to the student’s research efforts.

4. Satisfactory performance on both a qualifying and comprehensive examination. The qualifying examination is prepared by the student and computer engineering faculty and consists of a 3-hour written examination in each of four areas. Areas (1) mathematics and transform methods, and (2) basic electrical network analysis, are required of all Ph.D. students. Additional subjects are selected from two of the graduate course divisions in the department and cover material from undergraduate courses and first-year graduate courses. A student who fails the qualifying examination must pass the examination the next time it is offered to remain in the Ph.D. program. The qualifying examination is normally taken after the completion of 24 hours of graduate work or immediately after completion of a Master’s degree. A minimum of 18 hours of graduate coursework must be completed after the student has taken the qualifying examination the first time.

5. Participation in departmental seminars.


Many of the electrical and computer engineering courses offered in the evening, particularly those working in industry are encouraged to participate in the department’s graduate program. Departmental graduate programs are also available at the Space Institute, Tullahoma.

Departmental actions regarding a graduate student may be appealed in writing, first to the Department Graduate Committee and then to the Department Faculty.

GRADUATE COURSES

Courses required in the Electrical and Computer Engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. degree. A student may be used toward a graduate degree in Electrical and Computer Engineering except when required by the program.

405 Digital Signal Processing and Filter Design (3) Discrete-time signals and systems, sampling, discrete Fourier transforms, analog filter characteristics, nonrecursive and recursive filter design, and CAD tools for filter design. Includes laboratories and experiments and projects.


412 Linear Control System Design (3) Modern techniques for the design and compensation of linear feedback control systems. Prerequisite: Linear System Analysis.

413 Passive and Active Network Synthesis (3) Design of passive and active filter networks. Prerequisite: 412.

414 System Modeling and Simulation (3) Introduction to logic design of digital systems and digital computers. Includes laboratory experiments and projects.

415 Microprocessors in Computer Engineering (4) Programming and interfacing emphasis including use of C language and microcomputer kit having equalization digital communications in presence of noise. Digital communication concepts: binary and digital signal processing (filtering, multiplexing devices, Transmission line and waveguide components. Includes laboratory experiments and projects.

421 Electric Energy Systems (3) Structure and operation of power systems; energy flow; economic loading; planning; control; reliability. Balanced and unbalanced systems; protection, fault location. Prerequisite: Electric Energy System Components.

422 Machines (4) Dynamic behavior of rotating machines; transfer functions for common modes of operation of d.c. machines; response to different waveforms in supply; describing equations for a.c. machines and their numerical solutions. Includes laboratory experiments and projects. Prerequisite: Electric Energy System Components.

423 Power Electronics (4) Principles and characteristics of power semiconductor devices, single-phase and polyphase phase-controlled converters, converter control, ac phase controller, voltage-fed inverter and dc-dc converter principles, industry applications. Includes laboratory experiments and projects. Prerequisite: Electric Energy System Components.

424 Power Electronics Circuits (3) Voltage-fed inverters, PWM principles, control of inverters, dc-dc converters, dc machine drives, resonance converters, step motor drives, brushless dc machine principles. Prerequisite: 423.

425 Direct Electrical Energy Conversion (3) Principles and practices of energy conversion devices and interfacing them to loads. Photovoltaics, thermoelectrics, MHD, and fuel cells. Prerequisite: Electric Energy System Components, Electronic Devices.

431 Digital and Analog Integrated Electronics (4) Basic processing and fabrication of active and passive components for digital integrated circuits; characteristics of bipolar, MOS and JFET transistors in typical analog and digital integrated circuit designs; standard digital logic families: TTL, ECL, Schottky, NMOS, CMOS, and GaAs gates and arrays; design concepts for op-amps, comparators, references, regula- tors, and other linear functions. Includes laboratory experiments and projects. Prerequisite: Electronic Circuits.

432 Analog Signal Processing Electronics (4) Transconductance signal amplifiers, operational characteristics of high performance integrated operational amplifiers and digital logic; computer-aided design integrated circuits; applications: active filters, level and phase detection, multiplexers, modulators, differential amplifiers, and filters. Includes laboratory experiments and projects. Prerequisite: Electronic Circuits.

433 Electronic Amplifiers (4) Feedback amplifier principles; wideband linear amplifier design; radio frequency and audio power amplifier design. Includes laboratory experiments and projects. Prerequisite: Electronic Circuits.

441 Communication Systems II (3) Probability, random variables, and random processes as applied to communication systems. Analog modulation in presence of noise. Digital communication concepts: binary and M-array signaling, synchronization, equalization digital communications in presence of noise and matched filtering. Information and coding theory. Includes laboratory experiments and projects. Prerequisite: Communication Systems I.


453 Microprocessors in Computer Engineering (4) Programming and interfacing emphasis including use of C language and microcomputer kit having equalization digital communications in presence of noise. Digital communication concepts: binary and digital signal processing (filtering, multiplexing devices, Transmission line and waveguide components. Includes laboratory experiments and projects.


455 Microprocessors in Computer Engineering (4) Programming and interfacing emphasis including use of C language and microcomputer kit having equalization digital communications in presence of noise. Digital communication concepts: binary and digital signal processing (filtering, multiplexing devices, Transmission line and waveguide components. Includes laboratory experiments and projects.

456 Data Acquisition Systems (4) Digital-to-analog conversion techniques: Quad and R-2R ladder networks; error analysis of D/A converters; sample hold circuits; analog-to-digital conversion techniques: open loop systems; direct and matrix converters; closed loop systems; dual slope and successive approximation; error analysis of A/D converters; accuracy, linearity, drift, dynamic range, frequency response, gain, grounds and shielding; automated testing of A/D and D/A converters; device service routines, signature analysis. Includes laboratory experiments and projects. Prerequisite: Introduction to Logic Design of Digital Systems.


458 Open System Interconnection Reference Model Protocols (3) OSI reference model based networks. MAP and TOP: material from ISO standards, Draft International Standards Organization (ISO) standards, IEEE standards, IEEE standards, ISO standards, MAP and TOP Specification. Lab work on MAP 2.x and 3.0 network supporting programmable logic functions and personal computer network. Includes a system and design, including TCP-IA, Telnet, SMTP, and HTTP. Includes a system and design, including TCP-IA, Telnet, SMTP, and HTTP.
461 Plasma Magnetohydrodynamic Engineering (3) MHD approximation; MHD waves and instabilities; MHD in static and dynamic systems; MHD in pulsed and steady-state power generation; plasma flows, fusion energy, industry, and astrophysics. Prereq: 361.

462 Plasma Kinetic Theory Engineering (3) Kinetic theory; beam-plasma system; driven waves in plasma; transition from multiple beams to continuous. Vlasov-Landau theory; microwave generation in plasmas and traveling wave tubes; free electron masers in circular generators. Project illustrating material covered in this course. Prereq: 361; 461 or consent of instructor.

463 Introduction to Fusion Energy (3) High temperature plasma physics relevant to fusion plasmas, principles of fusion reactors, and engineering physics. Prereq: Consent of instructor. May be repeated. Project illustrating material covered in 461 and 462.

464 Introduction to Fusion Energy II (3) Continuation of 463. Design projects illustrating material covered in 461 and 462.

465 Plasma Laboratory I (4) Experiments and design project illustrating material covered in 461 and 462.


482 Electro-Optics II (4) Sensitivity, resolution, frequency, and bandwidth limitations for photodetectors and optical components. Optical communication channel design. Interferometry. Stimulated emission of radiation, traveling-wave amplification and optical resonators. Project laboratory. Includes laboratory experiments and projects. Prereq: 481.

493 Special Topics in Electrical and Computer Engineering (1-3) Topics related to recent developments and current practice. Prereq: Consent of Instructor. May be repeated.

494 Special Problems in Electrical Engineering (1-3) Problems involving laboratory and experimental research. Prereq: Consent of Instructor. May be repeated. Maximum 9 hrs.

495 Senior Seminar I (Topics of interest discussed in weekly seminar. Prereq: Consent of instructor. May be repeated. Maximum 1-3 hrs for letter grade.

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-sponsored generation. Prereq: toward degree requirements. May be repeated. S/NC only. E

503 Modern Transform Methods (3) Fourier and Laplace transforms and complex variables theory. Z-transform, difference equations and distributed parameter systems.

504 Random Process Theory for Engineers (3) Probability and random variables as approached by set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and power spectra, time and spectral analysis as applied to response of systems to random signals.

507 Advanced Digital Signal Processing I (3) Discrete-time signal and system representations, sampling, fast Fourier transform (FFT) and fast convolution, design of FIR filters and IIR filters.

508 Digital Signal Processing II (3) Filter properties in the Z-Transform domain, structure of digital filters, sampling and reconstruction, hardware implementation of digital filters.

511 Linear Systems Theory (3) State space models of linear dynamical systems, linear algebra, state transition matrix, map exponential, controllability, observability, realization theory, and stability theory. Coreq: 503.

512 Multivariable Linear Control System Design (3) Design of controllers, for multivariable systems, which satisfy constraints on robustness to plant uncertainties, disturbance rejection, command following. Prereq: 511.

515 Adaptive Control and System Identification (3) Adaptive control of linear deterministic and stochastic systems, adaptive filtering and prediction, parameter estimation for dynamic and stochastic systems. Prereq: 511 or 515-B.

516 Passive and Active Network Analysis and Synthesis I (3) Frequency and time domain techniques for network analysis, network reliability, synthesis algorithms.


518 Control Systems Design I (3) Analysis and design of continuous and discrete time control systems, feedback theory, stability, steady-state performance, compensation. Engineering aspects of control systems. Prereq: 511 or 515-B.

521 Power Systems Analysis I (3) Matrix-vector representations of power networks, sequence modeling of power system components, unbalanced shunt and series elements. Formulating and solving power problems in matrix-vector form with application to large scale power systems. Prereq: 520.

522 Power Systems Analysis II (3) Operation and control of interconnected power systems, transient and dynamic stability. Formulating and solving problems in matrix-vector form and application to large scale power systems. Prereq: 521.

523 Power Electronics and Drives (3) Forced commutated inverters, advanced PWM techniques, current-fed inverters, thyristor modeling, vector and scalar control of induction machines, parameter variations, control principles of synchronous machine.


527 Advanced Electrical Machines I (3) Fundamental processes of electromechanical energy conversion; applications in conventional devices. Differential equations for rotating machinery. Prereq: 422 or equivalent.

529 Advanced Electrical Machines II (3) Parallelism and the transition from isolated and interconnected rotating machines. Prereq: 528.

531 Advanced Analog Electronics I (3) Physical operation of modern electronic devices; semiconductor devices and circuits, integrated circuits, analog and digital FETs, MOS switches. Signal-equivalent circuit models and noise models of active devices. Project laboratory. Prereq: 431, 432, or consent of instructor.

532 Advanced Analog Electronics II (3) Design and analysis of linear and wide-band low-noise feedback amplifiers and radio-frequency amplifiers using discrete, monolithic and hybrid devices; voltage and current regulators, switched regulators. Project laboratory. Prereq: 531.

541 Electromagnetic Fields (3) Maxwell's equations, waveguides, antennas, aperture antennas, optical transfer function. Canonical problems of modern geometrical theory of diffraction (GTD) for electromagnetic waves; geometric optics approximation, and accuracies of far fields and near fields due to edge and surface diffraction. Horn lenses, and reflector antennas; computation of radar cross-sections. Prereq: 540.


543 Information Systems I (3) Mathematical treatment of information transmission in communication systems; modulation and demodulation; discrete and analog systems. Prereq: Communication Systems I, Numerical Techniques. Prereq: Consent of instructor. (Same as Nuclear Engineering 561.)

544 Information Systems II (3) Wiener's theory of filtering and prediction; linear and non-linear systems; sampled signals; extension to nonlinear systems. Detection of signals in noise. Application to radar tracking, target detection and resolution, low-noise receivers. Prereq: 543.

545 Introductory Microwave Networks and Components (3) Scattering and transfer representation for multi-element, unilateral, linear, passive networks. Application to millimeter wave devices. Component and system parameter measurement by modern network analyzers. Electronic oscillators, amplifiers, and frequency sweep oscillators, transit time devices, parametric devices, mixers, switches.


551 Digital System Design I (3) Design considerations for combinational and sequential circuits. Iterative network. Fault diagnostics of logic circuits.

552 Digital System Design II (3) State identification and structure of combinational and sequential machines. Digital system architecture design; microprogramming and interrupt control. Prereq: 551.

561 Plasma Diagnostics I (3) Principles of active, passive, and interferometric plasma diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction, and use of computer-based data handling and analysis, and reduction of time series data. Prereq: 451, 463, or consent of instructor. (Same as Nuclear Engineering 561.)

562 Plasma Diagnostics II (3) Laboratory instruction in operation of plasma diagnostic instruments in plasma science laboratory, experience with high voltage, vacuum, RF, and digital data handling techniques. Prereq: 561. (Same as Nuclear Engineering 562.)

563 Plasma Engineering (3) (Same as Nuclear Engineering 563.)

564 Fusion Technology (3) (Same as Nuclear Engineering 564.)

565 Industrial Plasma Engineering I (3) Low temperature plasma physics relevant to industrial applications: kinetic theory, particle dynamics in electric and magnetic fields, gaseous discharges, and electronic, ion, and plasma processes. Prereq: Graduate standing or consent of instructor.

566 Industrial Plasma Engineering II (3) Continuation of 565 to industrial applications: ion implantation in solids, plasma deposition and welding, space propulsion systems, plasma chemistry, plasma lighting devices, insulating dielectrics and breakdown, materials processing.
617 Special Topics in Systems Theory I (3) Topics of active analog filters and practical RC realizations. Prereq: Consent of instructor.

615 Analysis of Nonlinear Networks and Systems (3) Computational methods in optimal control. Prereq: 611.

614 Optimal Control (3) Deterministic and stochastic methods. Prereq: Consent of instructor.


612 Advanced Systems Theory (3) Game theory, dual control problem, hierarchical systems, and information structures. Prereq: 511.


598 Measurement Science I (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Engineering Science and Mechanics 588, Mechanical Engineering 588, and Aerospace Engineering 588.)

597 Measurement Science II (3) (Same as Nuclear Engineering 589, Chemical Engineering 589, Civil Engineering 589, Engineering Science and Mechanics 589, Mechanical Engineering 589, and Aerospace Engineering 589.)

596 Advanced Topics in Microwave Networks (3) Multistatic and hybrid networks. Prereq: 595.

595 Microwave Networks and Systems (3) Nonlinear and time-varying systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

594 Advanced System Theory (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

593 Advanced System Theory (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

592 Advanced System Theory (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

591 Advanced System Theory (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

586 Advanced System Theory (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.
Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in Engineering Science are available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program concentrations include solid mechanics, fluid mechanics, computational mechanics, biomedical engineering, and optical engineering (UTSI only.) In each of these concentrations, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant is advised to select a program that best meets his/her interests and career objectives.

A final examination is required under both options covering graduate coursework and the thesis.

THE DOCTORAL PROGRAM

Specific departmental requirements for the Ph.D. include:
1. A minimum of 72 semester hours beyond the Bachelor's degree. At least 36 semester hours must be in the Engineering Science and Mechanics Department.

Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.)

Thesis

*Engineering degrees under option II may include advanced laboratory work or special problem work, for example, Engineering Science and Mechanics 581 or analogous courses in other departments.

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 Engineering Science is available to residents of the state of Florida. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

Graduate Credit for 400-Level Courses

Four hundred-level courses in engineering may be used for graduate credit at the discretion of the advising committee. However, at least two-thirds of minimum required credit hours in a Master's degree program must be at or above the 500 level.

Graduate Courses

421 Materials of Engineering (3) Mechanical properties of engineering materials; data collection and processing; testing; and independent projects.

Pre Req: 321, Materials Science and Engineering 201. 3 hrs or 2 hrs and 1 lab.

423 Fracture-Safe Design (3) Critical review of variables controlling fracture toughness; part I and flaw geometry; part II. Pre Req: 321 and Materials Science and Engineering 201. (Same as Materials Science and Engineering 475.) 3 hrs or 2 hrs and 1 lab.

425 Principles of Nondestructive Testing (3) Principles and theory of nondestructive testing methods; liquid penetrant, magnetic particle, eddy current, ultrasonic, acoustic emission, and radiographic methods. Pre Req: 321, Materials Science and Engineering 201. (Same as Physics 475.)

431 Fundamentals of Vibrations (3) Free and forced vibrations of damped and undamped lumped parameter systems; energy methods; free vibration of continuous bodies. Pre Req: 231, Mathematics 231.

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

435 Engineering Acoustics (3) Concepts of acoustics, measures of sound and their units; noise generation and transmission, noise control principles and application, materials and procedures for noise abatement. Pre Req: Introductory course in vibrations oroustics.

442 Fluid Mechanics II (3) Differential forms of basic laws; compressibility, isentropic flow, shocks, duct flows with heat transfer and friction; open channel flow, critical flow, energy methods; internal and external viscous flows, boundary layers, elementary turbulent parameter models. Pre Req: 341, Mathematics 231.

461 Experimental Stress Analysis (3) Theory, techniques, and instrumentation of resistance strain gauges; theory and techniques of brittle coating method; introduction to other strain measuring devices. Pre Req: 321, Electrical and Computer Engineering 301. 2 hrs and 1 lab.

463 Photomechanics (3) Introduction to photelasticity, photoelastic coating method, Moire' method, interferometry, and holography. Pre Req: 321, Physics 232. 2 hrs and 1 lab.

465 Dynamic Data Acquisition (3) Use and calibration of instrumentation for measuring and recording dynamic events; Fourier analysis, transfer function analysis, digital signal processing, transduction, experimental pa...
539 Continuum Mechanics (3) Cartesian tensors, constitutive laws, Relativistic continuum mechanics concepts; stress, strain, deformation, constitutive equations. Conservation laws for mass, momentum, energy. Applications in solid and fluid mechanics.
542 Fluid Dynamics II (3) Development of basic concepts and governing equations for turbulence and turbulent field motion. Formulation for correlation function, energy spectrum, direct introduction to turbulent transport processes, free turbulence, wall turbulence; use of engineering turbulence closure models; examination of modern numerical and experimental methods. Prereq: 541.
557 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/structural mechanics. For departmental thesis students only. May be repeated.
559 Computational Mechanics Laboratory (1) Introduction to networked computer/engrering work station environment for graphics/numerical engineering numerical analysis. Coreq: 551.
561 Photoelasticity (3) Polarized light; basic principles of photoelasticity; experimental techniques and equipment; numerical methods in photoelasticity; applications. Prereq: Mathematics 431. 2 hrs and 1 lab.
566 Optical Engineering I (4) Wave optics; scalar diffraction theory, introduction to Fourier optics; ray or geometric optics; optical design methods: introduction to aberrations.
567 Optical Engineering Laboratory I (3) Laboratory in support of Optical Engineering II (566); Prereq or coreq: 566.
568 Optical Engineering II (4) Statistical optics; spontaneous and induced emission: black and gray body radiation; incoherent, partial and totally coherent radiations; structural coherence function; detectors; radiometry. Prereq: 566.
569 Optical Engineering Laboratory II (3) Prereq: 567, Coreq: 566.
575 Applied Artificial Intelligence (3) (Same as Nuclear Engineering 575.)
576 Expert Systems in Engineering (3) (Same as Nuclear Engineering 576.)
577 Neural Networks in Engineering (3) (Same as Nuclear Engineering 557.)
581 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments and practice. Prereq: Consent of instructor. May be repeated with consent of department.
588 Measurement Science I (3) (Same as Nuclear Engineering 588, Electrical and Computer Engineering 588, Aerospace Engineering 588, and Mechanical Engineering 589.)
589 Measurement Science II (3) (Same as Nuclear Engineering 589, Chemical Engineering 589, Civil Engineering 589, Electrical and Computer Engineering 589, Aerospace Engineering 589, and Mechanical Engineering 589.)
600 Doctoral Research and Dissertation (3-15) P/NP only. E
621 Analysis and Design of Thin Shell Structures (3) Geometry of surfaces, derivation of thin shell theory for arbitrary shell geometry; selected applications of theory in structural engineering. Prereq: 525 or Civil Engineering 562.
624 Viscoelasticity (3) Viscoelastic constitutive relations; isothermal boundary value problems; wave propagation in viscoelastic materials; stability problems; determination of viscoelastic properties. Prereq: 523 and 539 or Polymer Engineering 541.
625 Theory of Plasticity (3) Yield conditions; strain hardening; general constitutive equations; plastic potential; uniqueness theorems; extremum and variational principles. Problems in perfectly plastic solids; finite plastic deformations; piecewise linear plasticity. Applications. Prereq: 523.
English
(College of Liberal Arts)

MAJOR

DEGREES

English.................. M.A., Ph.D.

Dorothy M. Scura, Head

Professors:

Bratton, Edward W., Ph.D. .......... Illinois
Carroll, D. Allen, Ph.D. .......... North Carolina
Cox, Don R., Ph.D. .......... Missouri
Duke, Robert Y., Jr., Ph.D. .......... Yale
Dykeman, Wilma (Adjunct), B.A. .......... Northwestern
Emor, Allison R., Ph.D. .......... Indiana
Finneman, Richard J. (Hodges Chair of Excellence), Ph.D. .......... North Carolina
Fitzgerald, Mary (Adjunct), Ph.D. .......... Princeton
Goslee, Nancy M., Ph.D. .......... Yale
Heffernan, Thomas J., Ph.D. .......... Cambridge
Kelly, Richard M. (Lindsay Young Prof.). Ph.D. .......... Florida

Lofaro, Michael A., Ph.D. .......... Maryland
Maland, Charles J., Ph.D. .......... Michigan
Miller, R. Baxter, Ph.D. .......... Brown
Pennner, A. Richard, Ph.D. .......... Colorado
Reese, Jack E., Ph.D. .......... Kentucky
Sanderson, Norman J. (Lindsay Young Prof.). Ph.D. .......... Arizona
Scara, Dorothy M., Ph.D. .......... North Carolina
Shurr, William (Distinguished Prof.). Ph.D. .......... Arizona

Associate Professors:

Dumas, Bethany K., Ph.D. .......... Arkansas
Garnet, Stanton B., Jr., Ph.D. .......... Princeton
Gill, J. E., Ph.D. .......... North Carolina
Goslee, David F., Ph.D. .......... Yale
Hutchinson, George, Ph.D. .......... Indiana
Kallet, Marilyn, Ph.D. .......... Rutgers
Keene, Michael, Ph.D. .......... Texas
Leki, Ilona, Ph.D. .......... Illinois
Robinson, Frank K., Ph.D. .......... Texas
Stillman, Robert, Ph.D. .......... Pennsylvania
Thomas, Joyce Carol, M.A. .......... Stanford

Assistant Professors:

Atwill, Janet, Ph.D. .......... Purdue
Barton, Kerri, Ph.D. .......... Texas Christian
Bensel-Myers, Linda D., Ph.D. .......... Oregon
Dunn, Allen, Ph.D. .......... Washington
Hamamoto, Patti G., M.A. .......... Tennessee
Hirt, Russel, Ph.D. .......... Brown
Hows, Laura L., Ph.D. .......... Columbia
Hubbard, Dolan, Ph.D. .......... Illinois
Jennings, La Vinia, Ph.D. .......... North Carolina
Papke, Mary E., Ph.D. .......... McGill
Smith, Arthur, Ph.D. .......... Houston
Wallace, Ray, D. A. .......... Illinois State
Zomchick, John, Ph.D. .......... Columbia

The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. The thesis and non-thesis options are available for the M.A. as well as a special concentration in writing.

Detailed information about the Master’s and doctoral programs, and about individual graduate committees may be obtained by writing the Director of Graduate Studies in English, 306 McClung Tower.

THE MASTER’S PROGRAM

Requirements

Coursework: A minimum of 24 semester hours in English beyond the B.A., to include 6 hours at the 600 level; 12 additional hours at the 500-600 level (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 6 hours for graduate credit at any level, including the 400 level. In this coursework, students must maintain at least a 3.0 GPA.

Thesis Option: Written under the direction of a faculty member of the department and approved by a committee of two other faculty members. Six semester hours of credit will be given.

Non-Thesis Option: Six hours of additional courses at the 500-600 level, making a total of 30 hours of required coursework.

Language Requirement: Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:

1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT Knoxville with a grade of B or better.
3. Passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.
4. Passing the Graduate Student Foreign Language Test (GSFLT) as currently administered through the English Department.

Final Examination: A candidate presenting a thesis or creative project must pass a ninety-minute oral examination, consisting of a short thesis defense, but chiefly of questions covering the general history of English and American literature, not merely the coursework taken. A reading list of primary works designed to help the student prepare for these questions is available in the office of the Director of Graduate Studies in English.

A non-thesis student must pass a written examination, followed by a one-hour oral examination, both consisting of the same sort of questions as the examination taken by the thesis student.

Residence Requirement: There is no residence requirement for the M.A., but students should attempt to pursue a full-time program whenever possible.

WRITING CONCENTRATION

The Master’s program with writing concentration is intended for those students who plan to do free-lance writing, specialize in teaching writing courses at the college level, or work as professional writers in business or industry.

Requirements

The requirements for the writing concentration are the same as those for the thesis option above with the following exceptions:

Coursework: Writing students may substitute two 400-level writing courses for two 500-level courses. Students must take at least 9 hours in writing and 9 in literature, the remaining 6 to be selected from any English courses at the proper level. Of the courses in writing, at least 3 hours must be taken at the 500 level; additional 500-level courses are strongly recommended.

Writing Projects: One of the following writing projects for six hours of credit:

1. A thesis, using research to analyze some aspect of writing or rhetorical theory.
2. A creative project, such as a collection of poems or short stories, a novel, or a piece of non-fiction prose.

The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and the project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be from the literature faculty.

Final Examination: The reading list may be modified by the M.A. examining committee, meeting as a body with the student, to reflect the candidate’s particular writing emphasis. However, most of the oral examination should focus upon the literature outlined in the original reading list.
THE DOCTORAL PROGRAM

Requirements
A student must successfully complete a program of study, normally 6 full semesters as outlined below, approved by the candidate's committee or the Director of Graduate Studies in English.

Coursework: At least 51 semester hours beyond the B.A. to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above (only 3 hours of 593 Independent Study may be applied toward the M.A. and 3 after the M.A.); a special three-hour course in teaching composition; and 12 additional hours at any level, including the 400 level. Up to 6 of these additional hours may be taken in some cognate field or fields such as history, philosophy, French. These courses must be drawn from those approved for graduate credit. All other coursework must be in the English department. In this coursework, students must normally maintain a 3.5 GPA.

Dissertation: Twenty-four semester hours of dissertation. These represent the research for and writing of the dissertation. The research and dissertation will be directed by a faculty member of the department and approved by a doctoral committee of three or four other faculty members.

Language Requirement: A language requirement met in one of the following ways:
1. Two languages approved by the Director of Graduate Studies in English. The requirement for each language may be fulfilled by (a) completion of French 302 or German 332 with a grade of B or better; (b) completion at UT Knoxville of any two courses on the 300 level or above in the foreign language or literature, with at least a grade of B in each course; (c) passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville; or (d) passing the Graduate Student Foreign Language Test (GSFLT) as currently administered through the English Department.
2. One modern language approved by the Director of Graduate Studies in English. This requirement must be fulfilled by a passing grade on the language examination given by UT Knoxville and completion of two courses given in the foreign language at the 400 level or above, at least one course to be at the 500 or 600 level. A minimum grade of B must be received in each course.
3. One modern language approved by the Director of Graduate Studies in English and intensive study of the English language. This requirement must be fulfilled by completion of (a), (b), or (c) as option 1. for one foreign language; and completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509 History of the English Language (offered in alternate years only). For the other 3 hours, the student may either complete the history of the language sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D. For anyone electing this language option may not take the comprehensive examination in linguistics.

Examinations: (1) A 4-hour qualifying examination taken before the end of the first year. The Ph.D. comprehensive examination is given three times a year, with the M.A. written examination. (2) A comprehensive written examination which may be divided as the department directs; see the English Department graduate brochure. The comprehensive examination is given twice a year, normally in March and September. Before a student may take it, he/she must have completed all coursework required. A student must also have met all requirements for the foreign languages before beginning the first part of the examination.

Dissertation Defense: A one-hour examination on the dissertation and other related areas.

Residence Requirement: Two consecutive semesters as a full-time student. For students not on teaching assistantships, full-time consists of 9 or more hours of coursework and dissertation hours each semester. For students on assistantships, full-time consists of at least 6 hours of courses and/or dissertation hours and 3 hours of teaching each semester.

GRADUATE COURSES

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.
402 Chaucer (3) Reading and analysis of Canterbury Tales and Troilus and Criseyde in Middle English.
404 Shakespeare I: Early Plays (3) Shakespeare's dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night, English histories, including Henry IV, and early tragedy, including Hamlet.
405 Shakespeare II: Later Plays (3) Shakespeare's dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from great tragedies, including Othello, problem plays, including Measure for Measure, and dramatic romances, including The Tempest.
406 Renaissance Drama (3) English theatre between 1590 and 1640 through reading of representative plays by Shakespeare's contemporaries: Marlowe, Webster, Jonson.
409 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of sixteenth century authors; Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.
410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of seventeenth century: poetry of Milton, Donne, Marvell, and prose of Browne, Bacon, Walton.
411 Restoration and Eighteenth-Century Poetry and Prose (3) Dryden, Swift, Pope, Johnson, and their contemporaries; major works: MacFlecknoe, Rape of the Lock, Gulliver's Travels, and Rasselas.
412 British Drama from 1660 to 1680 (3) Playwrights from Dryden and Wycherley to Goethe and Sheridan; formal developments: heroic play, cynical comedy, affective tragedy, and exemplary drama.
413 The Eighteenth-Century British Novel (3) Defoe to Austen.
414 Romantic Poetry and Prose I (3) Wordsworth, Coleridge, and Blake; readings from Lamb, De Quincey, and other prose writers.
415 Romantic Poetry and Prose II (3) Keats, Shelley and Byron; readings from Hazlitt, Peacock, and other prose writers.
416 Victorian Poetry and Prose I (3) Tennyson, Pre-Raphaelites, Carlyle, Newman, and Mill.
419 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskin, Darwin, and Wilde.
420 The Nineteenth-Century British Novel (3) Scott to Hardy.
421 Modern British Novel (3) Lawrence, Joyce, and Woolf.
422 Women Writers in England (3) Literary consciousness and works of British women writers in nineteenth and twentieth centuries. (Same as Women's Studies 422.)
431 Colonial, Federal, and Early National American Literature (3) From Columbus to Washington Irving.
432 American Romanticism and Transcendentalism (3)
433 American Realism and Naturalism (3)
434 Modern American Literature (3) World War I to present.
435 American Novel before 1900 (3) From earliest sentimental novelists through Brown, Cooper, and major figures to 1900: Hawthorne, Melville, Stowe, Clemens, and James.
441 Southern Literature (3) Southern writing from colonial science; frontier; frontier; local color writers, and Southern literary renaissance.
442 American Humor (3) Early nineteenth century to twentieth century; Mark Twain.
443 Topics in Black Literature (3) Contents vary: particular genres, authors, or themes. Prereq: 1649. To present: Langston Hughes and Harlem Renaissance, Richard Wright and Gwendolyn Brooks, writing by Black women, African-American literature in English, and Black American autobiography.
451 Modern British and American Poetry (3) From Yeats and Frost to Auden, Stevens, and more recent poets.
452 Modern British and American Drama (3) Ibsen's works as precursors to modern dramatists: Williams, Miller, Albee, and representatives of Black theater, Bullins and Baraka.
453 Continental Drama (3) Selection of plays in English (translation) by major European writers from late Renaissance to present; twentieth-century achievement.
454 Twentieth-Century International Novel (3) Joyce, Camus, Kafka, Nabokov.
455 Persuasive Writing (3) Persuasive strategies in both student and professional writing. Practice in mastering effective logical and emotional appeals.
460 Technical Editing (3) Editing technical material for publication. Principles of style, format, graphics, layout, and production management. Prereq: 456 and 459, or consent of instructor.
461 Advanced Technical and Professional Writing (3) For students planning careers in industry, education, and government work who need technical writing skills. Writing of definitions, process descriptions, sets of instructions, descriptions of mechanisms, recommendation reports, abstracts, proposals, and major reports. Prereq: Junior standing in student's major or consent of instructor.
462 Writing for Publication (3) Principles and practices of writing for publication. Dissertation, theses, articles, and reports in science and technology. Prereq: 459 or consent of instructor.
463 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 351 or 352, consent of instructor.
464 Advanced Fiction Writing (3) Further development of skills acquired in basic writing fiction course. Prereq: 355 or 356, consent of instructor.
471 Sociolinguistics (3) Study of language in relation to society. Empirical and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 471 and Sociology 471.)
472 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 472.)
474 Teaching English as a Second or Foreign Language (3) Grammatical structures of English; particular
grammatical difficulties of non-native learners of English. Basic phonological structures of English. Teaching grammar and phonology to non-native speakers: content, structure, and teaching preparation of materials. Observations of and team teaching with experienced staff member. Prereq: English 474. (Same as Linguistics 475.)


481 Studies in Folklore (3) Topics vary. May be repeated with different topics. Maximum 6 hrs.

482 Major Authors (3) Content varies. Concentrated study of at least one of most influential writers in British or American literary history: e.g., Donne, Tennyson, Jane Austen, Whitman, Faulkner, Baldwin or Lawrence.

483 Special Topics in Literature (3) Topics vary. May be repeated. Maximum 6 hrs.

484 Special Topics in Writing (3) Original writing integrated with techniques taught by professors. Topics vary. May be repeated. Maximum 6 hrs.

485 Special Topics in Language (3) May be repeated. Maximum 6 hrs with consent of department. (Same as Linguistics 485.)

486 Special Topics in Criticism (3) Content varies. Theoretical and practical approaches to British and American literature. May be repeated with consent of department. Maximum 6 hrs.

489 Special Topics in Film (3) Content varies. Particular directors, film genres, national/cultural movements, or other topics. May be repeated with consent of department. Maximum 6 hrs. (Same as Cinema Studies 489.)

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

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

505 Teaching Freshman Composition (3) Introduction to teaching Freshman English through study of various techniques and philosophies of composition. Required of all first-year teaching associates.


507 Applied Criticism: The Rhetoric of Literary Forms (3) Study and application of ways in which major critics have used poetry and prose fiction.

508 History of the English Language I (3) Historical, morphological, and syntactic development of the English language with concentration on development after 1500, especially in American English.

509 History of the English Language II (3) Historical, morphological, and syntactic development of the English language with concentration on development of Old and Middle English.

510 History of the English Language III (3) Historical, morphological, and syntactic development of the English language with concentration on development of Old and Middle English.

513-14 Readings in Medieval Literature (3,3) Reading and analysis of selected masterpieces of Old and Middle English literature and their Continental sources in Modern English.

520-21 Readings and Analysis in Selected Areas of Sixteenth- and Seventeenth-Century Prose, Poetry, and Drama (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

530-31 Readings in English Literature of the Restoration and Eighteenth Century (3,3) Topics vary. Genre: poetry, prose, fiction, drama; or period: Restoration, early 18th century, later eighteenth century.

540-41 Readings in English Literature of the Nineteenth Century I and II (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

550-51 Readings in American Literature from the Colonial Period to the Present (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

552 Readings in Black American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis.

560-61 Readings in Twentieth-Century Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

576 Introduction to Contemporary Criticism (3) Introductory survey of twentieth-century literary criticism from New Criticism to present. Prereq: English 463 or consent of instructor.

581 Colloquium in Poetry Writing (3) Major poetic project or compilation of project begun in 463. Individual consultation with instructor supplementing class analysis; readings in contemporary poetry and theory. Prereq: English 463 or consent of instructor.

582 Special Topics in Writing (1-3) Topics vary. May be repeated. Maximum 6 hrs. Enrollment by consent of director of graduate studies only.

585 Issues in Invention, Style, and Audience (3) Theoretical and practical approaches to invention, style, and audience. Required of all doctoral students planning comprehensive exam in Rhetoric and Composition.

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

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, text linguistics.

590 Topics in Critical Theory (3) Topics vary.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Film History, Rhetoric, and Analysis (3) Film as narrative art form: historical development of film; the "rhetoric" of film; critical approaches to film study: genre, auteur, formalist, and historical; 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.

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

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

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer's writings. Prereq: Previous course in Chaucer.

630-31-32 Studies in Renaissance Literature (3,3,3) Seminar in work of Shakespeare, sixteenth-century prose and poetry, non-Shakespearean drama.


650 Studies in English Romanticism (3) Seminar content varies: particular other coherent emphasis.

651-52 Studies in Victorian Literature (3,3) Seminar content varies: particular literary figure or figures, genre, theme, or other coherent focus.


670-71-72 Studies in Twentieth-Century Literature (3,3,3) Seminar content varies: particular literary figure or figures, genre, theme, or other coherent focus.

680 Topics in English Language (3) May be repeated with consent of director of graduate studies. Maximum 6 hrs.

682 Studies in Rhetoric and Composition (3) Content varies. Advanced work in theory and/or history of rhetoric and composition. Issues in invention, textuality, literary, historiography, style and ethics.


686 Studies in Creative Writing (3) Content varies. Connection between theory and practice in writing.

688 Studies in Literary Criticism (3) Content varies. Advanced work in theory and history of literary criticism.

690 Special Topics (3) Content varies. History of ideas, biography, autobiography, extra-literary disciplines.

694 Studies in Film (3) Content varies. Advanced work in film history and analyses.

Entomology and Plant Pathology
(College of Agricultural Sciences and Natural Resources)

MAJOR

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

Carroll J. Southards. Head

Professors:

Bernard, Ernest C., Ph.D ................. Georgia
Gerhardt, Reid R., Ph.D ................. NC State

Hill, James W., Ph.D ................. Ohio State

Johnson, Lender (E.), Ph.D ................. ( Emeritus.), Ph.D ....... Louisiana State

Lambdin, Paris L., Ph.D ................. VPI

Pliess, Charles D., Ph.D ................. Clemson

Southards, Carroll J., Ph.D ................. NC State

Associate Professors:

Reddick, Bradford B., Ph.D ................. Clemson

Windham, Mark T., Ph.D ................. NC State

Assistant Professors:

Grant, Jerome F., Ph.D ................. Clemson

Gwinn, Kimberly D., 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 pest management, or biological control. Students in plant pathology may specialize in foliar and stem fungus diseases, soil-borne diseases, plant nematology, or 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 must have completed (1) 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 9 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 designating courses required for the minor.

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 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant pathogenic fungi. Isolation and identification of plant pathogenic fungi. Prereq: 313 or consent of instructor. 2 hrs and 2 labs. F,A
511 Plant Disease Diagnosis (3) Diagnosis of plant disease; disease symptoms, causal agents and control measures. Prereq: 510 or consent of instructor. 1 hr 4 labs. Su,A
512 Soil-Borne Plant Diseases (3) Causal agents, host-parasite-soil environment interactions, epidemiology, and control of soil-borne plant diseases. Prereq: 313. 2 hrs and 1 lab. F,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.
520 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships. Prereq: 8 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; serology; plant pathogenic 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 pathogens and vectors of pathogens of humans and animals. Ecology and behavior of vectors in relation to pathogen transmission and control. Prereq: 321 or 325, or Zoology 380, 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 maintain pest 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. F,Sp
533 Concentrated Study in Entomology (1-3) Selected subjects in entomology for advanced students, concentrated in time and subject matter. Prereq: 321 or basic entomology course. May be repeated. Maximum 6 hrs. F,Sp
541 Seminar (1) Review of literature and current research in entomology and plant pathology. May be repeated. Maximum 2 hrs. E

Environmental Engineering
See Civil Engineering

Environmental Practice

(College of Veterinary Medicine)

MAJOR DEGREE
Veterinary Medicine.......................... D.V.M.

L. N. D. Potgieter, Head

Professors:
Farkas, W. R., Ph.D.......................... Duke
Oliver, J. W., D.V.M., Ph.D.................. Purdue
Potgieter, L. N. D., Ph.D...................... Iowa State
Reed, C. F. (Emeritus), D.V.M................... Ohio State

Associate Professors:

Assistant Professors:

Clinical Associate:
Farrar, P. L., D.V.M......................... Missouri

Post-Doctoral Research Associate:

See Veterinary Medicine for program description.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
501 Special Topics in Environmental Medicine (1-3) Aberrant metabolism, pharmacokinetic studies, toxicokinetic studies, epidemiology and techniques in molecular biology, atomic absorption, gas chromatography, ultracentrifugation, extractive techniques and radiomunnoassays. 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
503 In Vitro Evaluation of Toxicity (3) Principles and techniques of in vitro evaluation of toxicity, mutagenesis, carcinogenesis, and teratogenesis. Prereq: Biochemistry 561 and consent of instructor. Sp,A
504 Experimental Animal Surgery (3) Competence in performing humane surgical modifications of experimental animals. Techniques of anesthesia, Drug administration and postoperative care. Prereq: Embryology, parasitology, physiology and/or consent of instructor. 1 hr and 2 labs. F
561 Pharmacology (4) Principles of pharmacokinetics and pharmacodynamics properties of drugs, mode of action, pharmacologic effects, chemical and physical properties, metabolism, toxicities, important idiosyncrasies and clinical applications. Prereq: Consent of instructor. F
600 Doctoral Research and Dissertation (3-15) P/NP only. E
610 Advanced Topics in Environmental Medicine (1-3) Current and future research methodology, laboratory situation, recent advances in instrumentation in analytical techniques for environmental medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

Finance

(College of Business Administration)

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

Harold A. Black, Head

Professors:

Associate Professors:

Assistant 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 521, plus two courses from the following: 511, 512, 522, 531, 532, 581, or 582. A fourth finance course of the student's choice is strongly advised. Courses selected must be approved by the Finance Department MBA advisor.

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/NC only.

511 Contemporary Issues in Corporate Finance (3) Selected topics in financial management, recent developments that have significant impact on strategic issues in financial management. Capital budgeting, financial and ownership structure, dividend policy and corporate growth and control. Prereq: 501.

512 Problems in Financial Management (3) Readings and cases that apply finance theory to real world investment, financing, and asset management problems. Prereq: 501.


599 Special Topics in Finance (1-3) Topics vary. Prereq: 501 or consent of instructor. May be repeated. Maximum 6 hrs.

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


642 Seminar in Finance II: Theory of the Firm (3) Financial theory of firm and financial decision making under conditions of uncertainty, equilibrium models of firm. Option pricing, agency theory, capital structure, economics of information, and dividend policy.

651 Advanced Seminar in Finance I (3) Recent theoretical and empirical developments in micro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

652 Advanced Seminar in Finance II (3) Recent theoretical and empirical developments in macro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

Food Technology and Science

(College of Agricultural Sciences and Natural Resources)

MAJOR

DEGREES

Food Technology and Science............ M.S., Ph.D.

Hugh O. Jaynes, Head

Professors:

Collins, J. L., Ph.D....................... Maryland
Draughn, F. A., Ph.D..................... Georgia
Drayton, F. A., Ph.D..................... Illinois
Hugh O. Jaynes, Head

Assistant Professors:

Christen, G. E., Ph.D..................... Missouri
Lovely, D. H., Ph.D...................... Kansas State
Mount, J. R., Ph.D...................... Ohio State

The Department of Food Technology and Science offers the Master of Science and Doctor of Philosophy degrees. Students in the doctoral program may choose research in the concentration area of food products, food chemistry, food microbiology, or sensory evaluation of foods. Commodity interests (meats, dairy, fruits, vegetables, bakery products) can be emphasized in any of the areas by careful selection of courses and the research topic. Minors are available in cognate fields. For detailed information, contact the department head.

Graduate School rating forms of letters of recommendation from three people are required. Respondents should be familiar with the applicant's scholastic ability and professional potential.

THE MASTER'S PROGRAM

Applicants must have a B.S. in food technology, food science or a related scientific field.

Thesis Option

1. Prior to research for the thesis, the student must develop a detailed written research plan. Registration for 6 hours of 501. Thesis is required.

2. In addition to the thesis requirement, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student's committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student's progress or background indicates such need.

3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate in discussions during their Master's program.

4. An oral, final examination covering the thesis and coursework is required.

Non-Thesis Option

1. In lieu of a thesis, students are required to complete a problem in cooperation with their employer (company or governmental agency) and their faculty committee. Students working on a problem must register for 6 hours of 503. In addition to the requirement for 6 hours of 503, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student's committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student's progress or background indicates such need.

3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate in discussions during their Master's program. Completion of 510 or equivalent is also required.

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

THE DOCTORAL PROGRAM

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


3. A minimum of 72 hours beyond the Bachelor's degree, excluding credit for the Master's thesis, is required. Of this, 24 semester hours must be 500 Doctoral Research and Dissertation.

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

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

410 Food Chemistry I (3) Reactions of proteins, enzymes, and additives in foods. Physicochemical interactions of food materials. Prereq: Chemistry 110 or equivalent. 2 hrs and 1 lab. F

411 Food Chemistry II (3) Reactions of inorganic compounds, carbohydrates, lipids and vitamins in foods. Prereq: Chemistry 110 or equivalent. 2 hrs and 1 lab. Sp.

420 Food Microbiology I (3) Physical, chemical and environmental factors moderating growth and survival of foodborne microorganisms, pathogenic and spoilage microorganisms affecting quality of foods and their control. Prereq: Microbiology 210. Coreq: 429. F


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


451 Dairy Products (3) Science and technology of processing dairy products. Chemical, physical, and microbiological changes that occur during manufacture. Prereq: Principles of Chemistry, Introduction to Organic and Biochemistry, General Microbiology. 2 hrs and 1 lab. F

460 Meat Products Technology (4) Processing methods for making cured, smoked, fresh, flaked and formed products. Effect of processing methods on product characteristics. Prereq: 360 or consent of instructor. 3 hrs and 1 lab. F

470 Food Crop Products (3) Food products from plants. Types, manufacturing systems, quality attributes and utility. Prereq: 3 hrs biological science. 2 hrs and 1 lab. Sp.

480 Cereal Science and Bakery Products (3) Chemistry and technology of processing cereal grains, interactions of ingredients during production and storage of baked products. Prereq: 410 or 411 or equivalent. 2 hrs and 1 lab. F, A

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

501 Seminar (1) Individual reports and discussion on topics from current literature. May be repeated. Maximum 3 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

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

510 Instrumental Analysis of Food (3) Modern instrumental methods for control of food manufacturing processes. Prereq: 410-11. 2 hrs and 1 lab. F

511 Color and Flavor of Foods (3) Chemical basis, measurement of the reactions involved in color and flavor changes in foods. Manufacture and application of materials used to modify color and flavor. Prereq: 410-11. 2 hrs and 1 lab. F

520 Food and Industrial Fermentations (3) Microbiology, biochemistry and technology of food-related fermentations involving dairy products, meat, cereals, fruits and vegetables. Production of food ingredients and by-product utilization. Prereq: 420-29, 440. Biochemistry 410 or equivalent. 2 hrs and 1 lab. Sp.


540 Food Product Development (3) Art, science and technology of developing and marketing new food products. Prereq: 440. 2 hrs and 1 lab. Sp.

560 Advanced Meat Science (3) Physical and chemical changes that occur in conversion of muscle to meat; effect of postmortem treatments on meat quality, composition and palatability; packaging, preservation and quality control. Prereq: 460. 2 hrs and 1 lab. Sp.

580 Oilseed Products (3) Chemistry and technology of oils and food ingredients produced from oilseeds. Prereq: 410-11 or equivalent. 2 hrs and 1 lab. Sp.

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

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

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

610 Seminar (1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hrs. F, Sp.

620 Food Toxicology (2) Basic and applied concepts in food toxicology; toxicological aspects of processed foods. Mode of action, prevention and control of food toxicants in food supply. Prereq: 410-11, 521, or consent of instructor. Sp.

640 Advanced Food Processing (3) Role of processing treatments in modification of food properties; toxicological aspects of food processing treatments; methods of sensory evaluation of foods. Prereq: 440, 510, 511 or consent of instructor. Sp.

Forestry, Wildlife and Fisheries

(The College of Agricultural Sciences and Natural Resources)

MAJORS DEGREES

Forestry M.S.

Wildlife and Fisheries Science M.S.

George T. Weaver, Head

Professors:

Barrett, J. W. (Emeritus), Ph.D. Syracuse

Buckner, R. E., Ph.D. NC State

Conte, H. A. (Emeritus), Ph.D. Syracuse

Dinmick, R. W., Ph.D. Wyoming

Forber, D. C. (Adjunct), Ph.D. Florida

Little, R. L., Ph.D. NC State

McCae, C. E. (Adjunct), D.F. Duke

Ostomaler, D. M., Ph.D. Syracuse

Pelton, M. R., Ph.D. Georgia

Ripley, T. H. (Adjunct), Ph.D. VP

Schneider, G. H., Ph.D. Michigan State

Sharp, J. B., D.P.A. Harvard

Smalley, G. (Adjunct), Ph.D. Tennessee

Strange, R. J., Ph.D. Oregon State

Sturman, D. A., Ph.D. Minnesota

Thor, E. (Emeritus), Ph.D. NC State

Weaver, G. T., Ph.D. Tennessee

Wilson, J. L., Ph.D. Tennessee

Woods, F. W. (Emeritus), Ph.D. Tennessee

Associate Professors:

Dearden, B. L., Ph.D. Colorado State

Hay, R. L., Ph.D. Duke

Hopper, G. M., Ph.D. VPI

Nodvin, S. C. (Adjunct), Ph.D. Cornell

Rennie, J. C., Ph.D. NC State

Schlarbaum, S. E., Ph.D. Colorado State

Smith, K. G. (Adjunct), Ph.D. Utah State

Smith, W. P. (Adjunct), Ph.D. Oregon State

Wells, G. R., D.F. Duke

Winsteador, P. M., Ph.D. Iowa State

Assistant Professor:

King, M. M., Ph.D. Utah State

Graduate study leading to the Master of Science with majors in Forestry and in Wildlife and Fisheries Science is offered by the Department of Forestry, Wildlife and Fisheries. The Master of Business Administration, with a concentration in forest industries management, is available for qualified students. This degree program is offered by the College of Business Administration with participation by the Department of Forestry, Wildlife and Fisheries. The Doctor of Philosophy with a specialization in forest biology, wildlife science, or fisheries science can be achieved through the University's intercollegiate graduate program in Ecology.

THE MASTER'S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor's degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must also have taken the general Graduate Record Examination (GRE). Graduate School rating forms or letters of recommendation from three individuals familiar with the applicant's academic ability are required. The department also has an application that must be submitted at the time of application to The Graduate School.

Thesis Option

1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. Registration for 6 hours of Thesis (Forestry 500 or Wildlife and Fisheries Science 500) is required.

2. A graduate committee of no fewer than 3 faculty members 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 512, Seminar, in their programs. This is required of each graduate student in residence fall semester.
GRADUATE COURSES

422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; forest and wildland law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing. F

423 Forest 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: 321, 323, Ornamental Horticulture and Landscape Design 280, or consent of instructor. 2 hrs and 1 lab. Sp

431 Solid Wood Processing (3) Production processes for solid wood products: sawing, secondary machining, drying and preservation. Prereq: 331 and 332, or consent of instructor. 2 hrs and 1 lab. Sp

433 Wood Composites and Gluing (3) Principles of adhesion; wood adhesives; fundamentals of plywood and composite panel manufacture. Evaluation resin properties; testing bond strength and durability. Prereq: 351 and 332, or consent of instructor. 2 hrs and 1 lab. F

434 Measurement and Marketing of Wood Products (3) Measurement systems used for sale and transfer of wood products. Application of market principles and analysis to wood products market and economic structure of wood products industry. Prereq: 431, 433 and Forestry, Wildlife and Fisheries 317, or consent of instructor. 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

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resource management. Identiﬁcation, analysis and preparation of written report. Topic and report must have approval of graduate committee. Available only to students in nonthesis 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/NC only. F

520 Advanced Forest Tree Biology (3) Growth, reproduction, and physiology of trees; forest ecology; variability and taxonomy of forest trees. Prereq: Standing in forestry or biological science, or consent of instructor. Sp,A

530 Advanced Forest Resource Management (3) Analysis of forest management problems as exempliﬁed in public agencies and private ﬁrms. Forest organization and computerized regulation systems; ﬁnancial and operational ﬁeld tools, as applied to forest resource management. Prereq: Senior-level forest management or consent of instructor. Sp,A

540 Genetics in Forestry (3) Genetic improvement of forest trees, including selection and analysis of genetic variability; tree breeding; development of seed orchards; hybridization; tree cytology and tissue culture; use of biotechnical variation; planning and conducting forest genetics research. Prereq: Silvicultural methods and Biology 220 or consent of instructor. Sp,A

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

559 Forest Recreation Research Methods (3) Evaluation of research methodologies through readings and case studies; techniques of recreation resource monitoring and recreation impact and resource protection. Current research trends in forest recreation. Prereq: 321 or equivalent and statistics. F,A

565 Industrial Forestry I (3) Economic structure of forest products industry in the analyses of the industry structure and markets; domestic and foreign. Current trends in markets and industrial structure. Impacts on short and long term planning. Prereq: Senior-level forest management or consent of instructor. F,A

566 Industrial Forestry II (3) Evaluation of alternative strategies for firms in industry. Role of timber and timberland in integrated firm from standpoint of financial and strategic evaluations for different levels of self-sufﬁciency. Prereq: 565. F,A

570 Management & Policy of Forest Resource Organization (3) Theory and applications of management policy 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: Senior-level administration and policy of consent of instructor. F,A

580 Advanced Silviculture (3) Silvicultural characteristics, silvicultural practices and applications to commercially important hardwoods and softwoods. In-depth analysis of silvicultural principles involved and tools used, prescribed fire, 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

581 Cytogenetics (3) Chromosome structure and behavior during mitotic and meiotic divisions in relation to structural changes, genetic controls, hybridization, speciation, and polyploidy. Laboratory: normal and aberrant meiotic systems and somatic chromosomes from plants and animals. Prereq: 150 or 6 additional hrs in biological sciences. (Same as Botany 581.) Sp,A

585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory, fixed and variable plots, sampling, list sampling, regression estimators; multivariate and multiple sample plots. Growth and yield predictors for even-aged and uneven-aged forests. Prereq: 325 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
565 Fish Culture (3) Principles, concepts and techniques of cultivating economically important fish and shellfish species. Prereq: 443 or consent of instructor. 2 hrs. and 1 lab. Sp, A

560 Advanced Topics in Wildlife and Fisheries Science (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 (1-6) May be repeated. Maximum 6 hrs. E

French
See Romance Languages

Geography
(College of Liberal Arts)

MAJOR DEGREES

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

Sidney R. Jumper, Head

Professors:

Aiken, Charles S., Ph.D. ........................... Georgia
Bell, Thomas L., Ph.D. .............................. Iowa
Hammond, E. H. (Emeritus), Ph.D. ......... California
Jumper, Sidney R., Ph.D. ........................... Tennessee
Long, G. (Emeritus), Ph.D. ......................... Northwestern
Minkel, C. W., Ph.D. ............................... Syracuse
Paludan, O. T. (UTSI), Ph.D. ................. Denver
Raitson, B., Ph.D. ................................. Northwestern
Schmudder, T. H., Ph.D. ......................... Wisconsin
Wilbanks, T. J. (Adjunct), Ph.D. .............. Syracuse

Associate Professors:

Blasing, T. J. (Adjunct), Ph.D. ..................... Wisconsin
Brinkman, L. W., Jr., Ph.D. ....................... Wisconsin
Brown, Marilyn (Adjunct), Ph.D. ............ Ohio State
Foresta, R., Ph.D. ................................. Rutgers
Pulsipher, L., Ph.D. ............................... Southern Illinois
Rehder, J., Ph.D. ................................. Louisiana State

Assistant Professors:

Harden, Carol P., Ph.D. ......................... Colorado
Horn, Sally P., 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-qualified to direct research in geography of the natural environment (biogeography, biological conservation, geomorphology), spatial analysis (especially transportation and location analysis), Latin America, and the American South. Graduate concentrations include nonmetropolitan areas, land use, urban geography, transportation geography, geography of resources, geography of development, and regional and historical geography of the United States.

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), 504 and 3 semester hours at the 600 level. In the thesis option, 6 hours must be Thesis 500. A final examination is required in both programs.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those who demonstrate proficiency in conducting independent research. Students must have a broad foundation and understanding of the discipline; these should have been achieved in a comprehensive Master's program. Course requirements for the degree shall be determined by the student's faculty committee in accordance with specific interests and needs. The program must include 504, 515, 590, 12 hours of 600-level seminars, and (at each offering during residency) 501. A minimum of 12 hours must be earned in related fields outside the department. Competence in 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.

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, South Carolina, Virginia, or West Virginia. The Master's program is also available to residents of Virginia. Additional information may be obtained from the Residence Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

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

413 Remote Sensing: Types and Applications (3) Principles and uses of remote sensing imagery, digital data, and spectral data; geographic interpretation and 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 remote sensing data. Prereq: Mathemati- ics 115 or two semesters of calculus or consent of instructor.

421 Geography of Folk Societies (3) Geographical study of folk culture, traditional cultural material 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. Changing settlement, agricultural development of agricultural regions, and patterns of urban-industrial development. Prereq: 361 or consent of instructor.

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

434 Climatology (3) Consideration of the natural leading to world patterns of climates. Climatic change and modification, and interrelationships 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 a spatial and temporal scales. Effects of continental drift, Pleistocene climatic changes, and human activity on world biota. Prereq: Geography of 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 geographic perspectives. Prereq: Geography of the Natural Environment or consent of instructor.

441 Urban Geography (3) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities. Prereq: 101-02 or 141 or 340 or consent of instructor. (Same as Urban Studies 441.)

443 Rural Geography (3) Geographical appraisal of rural areas of United States; small towns and urban fringes. Problems and potentials of rural America. Prereq: 101-02 or 141 or 340 or consent of instructor.

445 Geography of Resources (3) Study of factors related to variation in resource availability from time to time and place to place; energy and metallic resources. Prereq: 101-02 or 141 or 340 or consent of instructor.

449 Geography of Transportation (3) Examination of transportation systems, their effects on trade patterns, land use, location problems, and development. Prereq: 141 or 340 or consent of instructor.

450 Process Geomorphology (3) (Same as Geology 450)

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

501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. Registration required of resident graduate students whenever offered. May be repeated. Maximum 4 hrs. May be applied toward graduate degree. S/NC only.

502 Registration for Use of Facilities (2-15) Required for 'the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

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

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/NC or letter grade.
509 Topics in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs. S/C or letter grade.

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

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

515 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography, research problems utilizing appropriate computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 415 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

517 Geographic Information Management and Processing (3) Concepts and methods in management of geographic information. Database design, manipulation, sampling and analysis. Prereq: Consent of instructor.

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

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

524 Topics in Political Geography (3) Geographic consequences of public decisions; understanding how administrative and political processes affect public land management, spatial distribution of public goods, and urban morphology. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

525 Topics in Historical Geography (3) Examination of trends, concepts, and methods in historical geography. Prereq: 425 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 systems in modern geography. Prereq: 433 or 434 and consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

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

536 Plant Communities and Plant Geography (4) (Same as Botany 506.)

541 Topics in Urban Geography (3) Analysis of recent trends and methods in urban geography. 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.)

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

591 Foreign Study (1-15) See page 31. Prereq: Written consent of department prior to registration. S/C or letter grade.

592 Off-Campus Study (1-15) See page 31. Prereq: Written consent of department prior to registration. S/C or letter grade.

593 Independent Study (1-15) See page 31. Prereq: Written consent of department prior to registration. S/C or letter grade.

599 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) P/NP only. E.

609 Seminar in Geography (3-3) Topics vary. Prereq: Consent of Instructor. May be repeated. Maximum 6 hrs.

625 Seminar in Historical Geography (3) Prereq: 525 or consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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

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

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

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

Geological Sciences

(College of Liberal Arts)

MAJOR DEGREES

Geology M.S., Ph.D.

Harry Y. McSween, Head

Professors:

Hatcher, Robert D., Jr. (Distinguished Scientist), Ph.D. Tennessee
Klepser, Harry J. (Emeritus), Ph.D. Ohio State
Kopp, Otto C., Ph.D. Columbia
McLaughlin, Robert E. (Emeritus), Ph.D. Tennessee
McSween, Harry Y., Ph.D. Harvard
Misra, Kula C., Ph.D. Western Ontario
Taylor, Lawrence A., Ph.D. Lehigh
Walker, Kenneth R. (Carden Prof.), Ph.D.
Walls, James G. (Emeritus), Ph.D.

Yale
North Carolina

Associate Professors:

Broadhead, Thomas W., Ph.D. Iowa
Byerly, Don W., Ph.D. Tennessee
Clark, G. Michael, Ph.D. Penn State
Delcourt, Paul A., Ph.D. Minnesota
Driese, Stephen G., Ph.D. Wisconsin
Dunne, William M., Ph.D. Bristol
Labotka, Theodore C., Ph.D. Cattech
Mckinney, Michael L., Ph.D. Yale
Williams, Richard T. II., Ph.D. VP & SU

Assistant Professors:

Delcourt, Hazel R., Ph.D. Minnesota
Mora, Claudia I., Ph.D. Wisconsin

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

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

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

THE MASTER'S PROGRAM

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

Course requirements are a minimum of 30 semester hours, including;

1. Six hours of Thesis 500.

Registration in 525 during the first two years in residence. Two hours may be counted toward the 30-hour minimum. This requirement may be waived in unusual circumstances.

2. Sixteen hours of geology courses, with at least 14 hours at the 500 or 600 level, including at least one course from each of the following groups:

Group I: 510, 530, 560, 580.

Group II: 521, 525, 545, 546, 550, 557, 561.

Group III: 570, 571, 576, 577.

3. Eight hours of additional graduate coursework.

4. Eight hours of additional graduate coursework.

THE DOCTORAL PROGRAM

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

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

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

A minimum of 24 hours of graded coursework is required in addition to the 24 hours of Dissertation 600. The coursework includes the sum of 6 hours of 600-level geology courses, 12 hours of 500-level or higher geology courses, and 6 hours of additional graduate courses.

Extra-departmental coursework is encouraged. Registration in 596 is required during the first four years in residence.
The student must demonstrate a reading knowledge of a foreign language in which there is a body of geologic literature, as approved by the student's dissertation committee.

GRADUATE COURSES

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

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

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

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

452 Evolution and Geologic Record (3) Evolution of life viewed from fossil record. Extinction, macroevolution and evolutionary rates. Prereq: 320, 2 hrs and 1 seminar. 2 hrs and 1 seminar.

426 Paleobotany and Palynology (3) Evolutionary history of terrestrial plant life through examination of fossil record of macrobotanical remains, sponges, and pollen grains. Interpretation of climatic, palaeogeographic, evolution and land plant diatoms. Prereq: 102; Botany 310-20 or consent of instructor. (Same as Botany 426.) 3 hrs and 1 lab.

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


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-hr lab.

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


470 Applied Geophysics (3) Basic principles and applications of seismic, gravity, magnetic, and electrical prospecting methods. Recommended prereq: Mathematics 141-42 or 147-48 and Physics 131. 2 hrs and 1 lab.

480 Principles of Economic Geology (4) Ore-forming processes; ore deposits; distribution of different types of mineral deposits with examples, and metallogeny. Prereq: 310 and 330 or equivalents. Recommend prereq: 101-02. 2 hrs and 1 2-hr lab.

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

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

502 Registration for Use of Facilities (3-15) Required for the student's dissertation research 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 Appalachians (2) Structural development of Southern and Central Appalachians, Dayak and Late Proterozoic; Early Paleozoic rift-platform margin through processes related to compressional events producing structural elements that formed Appalachian structures. Prereq: Compared to similar orogenic events. Prereq: Structural Geology.

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

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

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

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

530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metamorphic rocks, magmatic and subvolcanic processes and physical conditions. 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 353.)

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

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

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

550 Regional Geomorphology (3) Integrative approach to study of geomorphological regions stressing links and similarities across boundaries, unique characteristics of major divisions, provinces, sections, and subprovinces not otherwise covered in the instructor. Maximum 6 hrs. (Same as Geography 550.)

555 Seminar in Quaternary Studies (3) Interdisciplinary examination of contemporary issues in the dynamics of pattern and process in Quaternary landscapes; responses of plant, animal and human populations to environmental changes during glacial/interglacial cycles. Prereq: Consent of instructor. Maximum 6 hrs. (Same as Botany 555 and Zoology 555.)

556 Quaternary Geology of North America (3) Interpretation of geomorphological, stratigraphic and sedimentologic evidence in order to reconstruct Quaternary landscapes in glaciated, periglacial, and nonglacial regions of North America. Prereq: Geography 555 or equivalent. American glacial with paleo-oceanographic changes in Atlantic and Pacific Oceans. Prereq: 101 or consent of instructor. Maximum 6 hrs.


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

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

559 Competitive Study (1-15) See page 31.

560 Off-Campus Study (1-15) See page 31.

565 Experimental Geochemistry Laboratory (1-3) Independent lab study of problems in geochemistry using experimental and analytical techniques. Prereq: Consent of instructor.

567 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts; recent literature. Prereq: 370 or equivalent, or consent of instructor. 3 hrs and 1 lab or seminar.

570 Regional Tectonics and Structural Geology (3) Major tectonics in continental crust and processes that form them. Comparison of internal structure of mountain chains and how they function in increasing continental crust. Examples from around the world. Prereq: Structural geology or consent of instructor.

575 Plate Tectonics and Orogeny (4) Tectonic development of orogenic belts in context of newest aspects of plate tectonic theory; current literature and ongoing research for both modern and ancient examples. Prereq: 370 or consent of instructor. 3 hrs and 1 seminar.

576 Reflection Seismology (3) Interpretation of geologic structure and stratigraphy using seismic data. Effects of velocity anomalies, multiples and complex reflection geometry. Application to hydrocarbon exploration. Prereq: Stratigraphy and sedimentology; structural geology, and 470 or consent of instructor.


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

580 Regional Tectonics and Structural Geology (3) Major tectonics in continental crust and processes that form them. Comparison of internal structure of mountain chains and how they function in increasing continental crust. Examples from around the world. Prereq: Structural geology or consent of instructor.

590 Special Problems in Geology (1-3) Directed study or special topics. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

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

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

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

610 Seminar in Mineralogy (2) May be repeated with consent of department. Maximum 6 hrs.

620 Seminar in Paleontology (2) May be repeated with consent of department. Maximum 6 hrs.

630 Seminar in Petrology (2) May be repeated with consent of department. Maximum 6 hrs.

640 Seminar in Sedimentary Geology (2) May be repeated with consent of department. Maximum 6 hrs.

650 Seminar in Geomorphology and Quaternary Geology (2) May be repeated with consent of department. Maximum 6 hrs.

660 Seminar in Geochemistry (2) May be repeated with consent of department. Maximum 6 hrs.
Germanic and Slavic Languages  
(College of Liberal Arts)

<table>
<thead>
<tr>
<th>MAJORS</th>
<th>DEGREES</th>
</tr>
</thead>
<tbody>
<tr>
<td>German</td>
<td>M.A.</td>
</tr>
<tr>
<td>Modern Foreign Languages</td>
<td>Ph.D.</td>
</tr>
</tbody>
</table>

David E. Lee, Head

Professors:
- Falen, James E., Ph.D., Pennsylvania
- Fiene, Donald M., Ph.D., Northwestern
- Kratz, Henry, Ph.D., Ohio State
- Rice, Martin P., Ph.D., Vanderbilt
- Hodges, Carolyn R., Ph.D., Chicago
- Lauckner, Nancy A., Ph.D., Wisconsin
- Lee, David E., Ph.D., Stanford
- Mellor, C. J., Ph.D., Chicago

Associate Professors:
- Osborne, J. C., Ph.D., Northwestern
- Rice, Martin P., Ph.D., Vanderbilt
- Hodges, Carolyn R., Ph.D., Chicago
- Lauckner, Nancy A., Ph.D., Wisconsin
- Lee, David E., Ph.D., Stanford
- Mellor, C. J., Ph.D., Chicago

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

THE MASTER’S PROGRAM

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

THE DOCTORAL PROGRAM

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

Admission Requirements

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

Degree Requirements

Candidates must complete a minimum of 83 semester hours of course work beyond the Bachelor's degree in addition to 24 hours of doctoral research and dissertation. The program consists of a first concentration, a second concentration, and a cognate field.

1. First Concentration: French, German, or Spanish. It consists of a minimum of 39 semester hours beyond the Bachelor's degree, distributed as follows:
   - A minimum of 24 hours at the 500 level (exclusive of thesis hours) including French 584 (3), German 560 (3), or Spanish 650 (3); French 512 (3), German 512 (3), or Spanish 512 (3); French 515-16 (2.2) or German 520 (3).
   - At least 12 hours at the 600 level (exclusive of dissertation hours).

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

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

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

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

Graduate Teaching Assistants in the program should have the opportunity and will be encouraged to instruct at least two foreign languages, subject to staffing needs.

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

ACADEMIC COMMON MARKET

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

German

GRADUATE COURSES

331-32 Elements of German for Upper-Division and Graduate Students (3,3) Elements of language, elementary and advanced readings, and a final 10,000 word translation project. Open to graduate students preparing for language examinations, and upper-division students desiring a knowledge of the language. No credit for students having completed 101-02 or 167. 332 may be repeated. Maximum 6 hrs. Undergraduate credit only.

411-12 Advanced Conversation and Composition (4,4) Prereq: 331-12 or equivalent or consent of department.

420 Selected Topics in German Literature from 1750 to the Present (3) Prereq: 6 hrs of 500-level courses (excluding 331-32 and courses in English translation) or equivalent.

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

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

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

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

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

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

435 Structure of the German Language (3) Contrastive English-German segmental and suprasegmental phonemes, contrastive English-German linguistic structures, selected topics in advanced German grammar and syntactic analysis. Prereq: 6 hrs of upper division German language courses (excluding courses in translation and graduate reading courses). (Same as Linguistics 435.)

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 linguistic history of German speech. Prereq: 6 hrs of upper division German language courses (excluding courses in translation or graduate reading courses). (Same as Linguistics 436.)

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

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

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

510 German Phonetics and Advanced Grammar (3) Advanced work in phonetics, pronunciation, and select-
512 Teaching a Foreign Language (3) Practical application of methods for teaching and evaluating basic language skills and foreign language skills, and cultural knowledge through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all M.A. and Ph.D. students holding GTA's, except those whose previous training or experience warrants excuse by department.

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

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

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

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

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

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

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

555 Modern German Language 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)

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

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

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31. Letter grade or S/N.

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

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

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

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

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

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

---

**Health, Leisure, and Safety**

(Choose from the following courses according to your major or interest.)

**MAJORS**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Health</td>
<td>M.P.H.</td>
</tr>
<tr>
<td>Recreation and Leisure Studies</td>
<td>M.S.</td>
</tr>
<tr>
<td>Safety Education and Service</td>
<td>M.S., Ed.S</td>
</tr>
<tr>
<td>School Health Education</td>
<td>M.S.</td>
</tr>
<tr>
<td>Health Education</td>
<td>Ed.D.</td>
</tr>
<tr>
<td>Education</td>
<td>Ph.D.</td>
</tr>
</tbody>
</table>

**Professors:**

- Gorski, June, Dr.P.H. .......... UCLA
- Hamilton, Charles B., Dr.P.H. .......... Oklahoma
- Hayes, Gene E., Ph.D. ............ North Texas State
- Kirk, Robert H.., H.S.D. ............ Indiana
- Neuwets, James (Adjunct), Ph.D. .......... Illinois
- Wallace, Bill C., Ed.D. .............. Northern Colorado

**Associate Professors:**

- Haughton, Betsy (Adjunct), Ed.D. .......... Columbia
- Knick, Ken L., Re.D. ................. Indiana
- New, John C., Jr. (Adjunct), D.V.M. Texas A&M
- Pursley, R. Jack, Ph.D. ............... Iowa
- Rockett, Ian R., Ph.D. ................. Brown
- Thompson, A. F., Ph.D. ............... Michigan State

**Research Associate Professor:**

- Putnam, Sandra L. (Adjunct), Ph.D. ........ Brown

**Assistant Professors:**

- Aldrich, Tim E. (Adjunct), Ph.D. .......... Texas
- Blackmon, James T., Ed.D. ............. Tennessee
- Blanton, Mary Dale, Re.D. ............. Indiana
- Ellison, Jack S., Ed.D. ............... Tennessee
- Levin, Barbara (Adjunct), M.D. .......... California(San Francisco
- Pressly, Velma W., Ed.D. .............. Tennessee
- Zeuem, Paula C., (Adjunct), Ph.D. .......... Wayne State

**Lecturer:**

- Duffey, Mary, M.D. ................. Pennsylvania

The Department of Health, Leisure, and Safety offers graduate programs leading to the Master of Science, the Master of Public Health, the Specialist in Education, the Doctor of Education, and the Doctor of Philosophy with a major in Education. Inquiries should be directed to the department head.

---

**Russian**

**GRADUATE COURSES**

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

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

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

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

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

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

550 Studies in Russian Literature (3) Content varies. May be repeated. Maximum 9 hrs.

591 Foreign Study (1-15) See page 31.