Art Printmaking

GRADUATE COURSES

462 Intaglio III (3-6) Exploration of individual projects through advanced color printing methods and combinations with other print media. Prereq: Intermediate Intaglio or consent of instructor. May be repeated. Maximum 12 hrs.

463 Lithography III (3-6) Exploration of individual projects through advanced lithographic methods in combination with other print media. Prereq: Intermediate Lithography or consent of instructor. May be repeated. Maximum 12 hrs.

464 Screen Printing III (3-6) Individual development of screen printing problems and techniques: development of image and personal concept. Prereq: Intermediate Screen Printing or consent of instructor. May be repeated. Maximum 12 hrs.

469 Special Topics in Printmaking (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

561 Printmaking I (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. Prereq: 561.

562 Printmaking II (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. Prereq: 561, 562.

563 Printmaking III (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. Prereq: 561, 562, 563.

564 Printmaking IV (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. Prereq: 561, 562, 563.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hrs.

599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hrs. S/NC only.

Art Sculpture

GRADUATE COURSES

441 Advanced Sculpture (3-6) Individual development of sculptural problems and techniques. Prereq: 6 hrs of 300 level sculpture. May be repeated. Maximum 12 hrs.

449 Special Topics in Sculpture (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Successful completion of any portfolio review. May be repeated. Maximum 12 hrs.

541 Graduate Sculpture I (2-6) May be repeated. Maximum 10 hrs.

542 Graduate Sculpture II (2-6) May be repeated. Maximum 10 hrs.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Consent of instructor.

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hrs.

599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hrs. S/NC only.

Arrowmont

GRADUATE COURSES

Courses listed below offered periodically only at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated. Upon admission to the M.F.A. program at UT, a student may apply certain graduate courses taken at Arrowmont toward the degree, subject to the approval of the student’s graduate committee.

400 Special Topics (2-4) Student- or instructor-initiated course offered at convenience of department. May be repeated.

410 Drawing (2-4) Intermediate to advanced. May be repeated.

420 Ceramics (2-4) Intermediate to advanced. May be repeated.

430 Photography (2-4) Intermediate to advanced. May be repeated.

440 Painting (2-4) Intermediate to advanced. May be repeated.

450 Metal Design (2-4) Intermediate to advanced. May be repeated.

460 Fiber (2-4) Intermediate to advanced. May be repeated.

470 Fabric (2-4) Intermediate to advanced. May be repeated.

480 Enameling (2-4) Intermediate to advanced. May be repeated.

490 Wood (2-4) Intermediate to advanced. May be repeated.

Astronomy

See Physics and Astronomy

Audiology and Speech Pathology

MAJORS DEGREES

Speech Pathology ........................................ M.A.

Audiology .................................................. M.A.

Speech and Hearing Science ......................... Ph.D.

Majors

Audiology and Speech Pathology

College of Arts and Sciences

Clinical Directors:

Steven W. Beckman, Ph.D. ....................... Tennessee

Christina E. Buehrer, Ph.D. ..................... Oregon

L. Jeanne C. Burchfield, M.S. ................. Tennessee

Stella L. Cline, Ph.D. .............................. Tennessee

Kathleen M. DeGennaro, M.S. .................. New York

Richard S. Flipsen, Ph.D. ....................... Wisconsin

Joyce A. Flippin, Ph.D. .......................... Tennessee

Carole S. Ford, Ph.D. ............................. Tennessee

Kathleen A. Forney, Ph.D. ..................... Tennessee

Frank R. Godfrey, Ph.D. ......................... Tennessee

Sandra G. Harkrider, Ph.D. ..................... Texas

Catherine J. Haynes, Ph.D. .................... Tennessee

Scott A. Harris, Ph.D. ............................ Tennessee

Richard P. Heidrick, Ph.D. ..................... Tennessee

Linda S. Hume, Ph.D. ............................ Tennessee

Robert E. Hutsell, Ph.D. ....................... Tennessee

Jackie E. Jenkins, Ph.D. ......................... Tennessee

William H. Johnston, Ph.D. ................... Tennessee

Karen R. Joling, Ph.D. ........................ Tennessee

Ilsa Schwarz, Ph.D. .............................. Tennessee

Susan L. Kail, Ph.D. .............................. Tennessee

Katherine A. Kerckhoff, Ph.D. ............... Tennessee

Eugene G. Keyes, Ph.D. ......................... Tennessee

Kathleen F. Kibler, Ph.D. ...................... Tennessee

Kathy L. Killian, Ph.D. ........................... Tennessee

Vivian K. Kline, Ph.D. ............................ Tennessee

Barbara A. Knapp, Ph.D. ....................... Tennessee

Sandra N. Kowalski, Ph.D. ..................... Tennessee

Eric R. Landrum, Ph.D. ......................... Tennessee

Clayton N. Ladd, Ph.D. ......................... Tennessee

Clifford E. Law, Ph.D. .......................... Tennessee

Walter A. Leitzel, Ph.D. ....................... Tennessee

Richard P. Lindsley, Ph.D. ..................... Tennessee

Patricia A. Lloyd, Ph.D. ....................... Tennessee

Carol M. Long, Ph.D. ........................... Tennessee

Mary Lou Long, Ph.D. .......................... Tennessee

Gail A. Marchetti, Ph.D. ....................... Tennessee

Linda L. Martin, Ph.D. ......................... Tennessee

Richard W. Martin, Ph.D. ..................... Tennessee

Ann Marie Masters, Ph.D. .................... Tennessee

Beverly W. Mayer, Ph.D. ...................... Tennessee

Spencer W. Maycock, Ph.D. ................. Tennessee

Beth A. McRae, Ph.D. .......................... Tennessee

Anthony G. Mendelson, Ph.D. ............... Tennessee

Joan W. Meko, Ph.D. .......................... Tennessee

Robert B. Meisinger, Ph.D. .................. Tennessee

James L. Miller, Ph.D. .......................... Tennessee

Debi G. Miller, Ph.D. ........................... Tennessee

Barbara J. Miller, Ph.D. ....................... Tennessee

Dennis J. Mize, Ph.D. .......................... Tennessee

E. Walter Moore, Ph.D. ......................... Tennessee

Sharon R. Moyer, Ph.D. .................... Tennessee

Dierdre C. Murphy, Ph.D. ................. Tennessee

Sharon A. Mynatt, Ph.D. ..................... Tennessee

Barbara rede, Ph.D. ............................. Tennessee

John W. N. Neeley, Ph.D. .................. Tennessee

June H. Neill, Ph.D. .......................... Tennessee

Joyce C. Novak, Ph.D. ....................... Tennessee

Kathleen O’Hayr, Ph.D. ...................... Tennessee

Dana R. O’Neill, Ph.D. ....................... Tennessee

Sara R. O’Reilly, Ph.D. ....................... Tennessee

Mary C. Parkman, Ph.D. ...................... Tennessee

Janet G. Peck, Ph.D. .......................... Tennessee

Karen M. Peck, Ph.D. .......................... Tennessee

Kathleen M. Peck, Ph.D. .................... Tennessee

Randy J. Peck, Ph.D. .......................... Tennessee

Diane L. Pendle, Ph.D. ....................... Tennessee

Bonnie Lee Phipps, Ph.D. ................. Tennessee

Teresa J. Pitts, Ph.D. .......................... Tennessee

Corey A. Popiel, Ph.D. ....................... Tennessee

Julia A. Pringle, Ph.D. ....................... Tennessee

Robert B. Proctor, Ph.D. ..................... Tennessee

Susan A. Proctor, Ph.D. ..................... Tennessee

Audiology and Speech Pathology 59

Effective Fall 2003, the Doctor of Audiology (Au.D.) with a major in Audiology will be offered. At that time the Master of Arts degree program with a major in Audiology will be terminated. Contact the department for complete details.
THE MASTER’S PROGRAM

A major is offered in Audiology or in Speech Pathology. Admission to these graduate programs is competitive. Both of these graduate programs are accredited by the Council on Academic Accreditation of the American Speech-Language-Hearing Association.

The master’s degree program in speech pathology is a two-year program and consists of the completion of 42 semester hours of academic content courses (including thesis) plus practicum. A minimum of three academic courses must be completed during all semesters (terms) except one. That is, students must take a minimum of nine semester hours of academic courses for at least four semesters or terms and six semester hours in the other semester or term.

The required courses are 506, 511, 526, 561, 582, 539 or 541, 520 or 524, and at least two seminars from the following courses: 522, 523, 525, 561, or 611 and at least 15 hours of elective courses. Undergraduate coursework may not be substituted for seminar courses. Students who have not completed an undergraduate course in each of the following three areas: articulation/phonological processing disorders, voice disorders, and fluency disorders, must complete one graduate course in each of the three areas.

Students majoring in speech pathology may elect either the thesis or non-thesis option. The master’s program in speech pathology with thesis includes six hours of 500 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. Students in the non-thesis option must pass a final written examination.

Students majoring in audiology may elect either the thesis or non-thesis option. Students in audiology are required to take 511. The master’s program with thesis will include a minimum of 33 semester hours of approved graduate credit in audiology, including a minimum of 500 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. Students at least two-thirds of these total hours 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 39 semester hours in the audiology program of approved graduate credit and pass a final written examination.

Graduate students in both Audiology and Speech Pathology may pursue a concentration in the area of aural habilitation. Admission to the aural habilitation concentration is competitive and applications will be processed during the first year of graduate study. The concentration requires: (1) Three semesters of clinical practicum in treatment of children with severe hearing impairments, totaling a minimum of 130 clock hours, and (2) completion of 6 hours of graduate level courses in language, audiology, and/or aural habilitation. Specific requirements are outlined in the Graduate Handbook for Audiology and Speech-Language Pathology, as well as on the Departmental website (http://web.utk.edu/~aspweb/).

THE DOCTORAL PROGRAM

The Ph.D. program in Speech and Hearing Science seeks to develop individuals for professional careers in a variety of positions including audiology, speech-language pathology, and related specialties. The program prepares students for careers in research and teaching in the concentration areas of speech and language pathology, audiology, speech-language science or hearing science. The degree program is research oriented with primary emphasis on processes involved in normal, or disordered speech, language and hearing. Students will be expected to demonstrate their knowledge in areas related to the concentrated field of study. These areas include:

1. Basic speech, hearing, or language processes;
2. Basic speech, hearing, or language disorders or differences;
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:
1. 24 semester hours in dissertation 600.
2. 6 semester hours in a research tool.
3. 6 semester hours in a cognate area outside the department.
4. 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 of related interest;
   c. 3 semester hours in 611; and
   d. 3 semester hours in supervised teaching experience.
5. A comprehensive examination to demonstrate knowledge in the concentration area and an examination of research competence.
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 on an in-state tuition basis. The M.A. program in Audiology is available to residents of the state of South Carolina. The Ph.D. program in Speech and Hearing Science is available to residents of the states of Arkansas or Delaware. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE COURSES

431 Stuttering (3) Nature, appraisal and treatment. Prereq: 300 Introduction to Communication Disorders or consent of instructor.
433 Observation of Clinical Practice (1) Prereq: 320 Speech and Language Development or consent of instructor.
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.

435 Introduction to Speech Sound Disorders (3) Etiology, diagnosis, and treatment of articulatory and phonological disorders. Prereq: 300 Introduction to Communication Disorders, 305 Phonetics, or consent of instructor.
440 Voice Disorders (3) Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 300 Introduction to Communication Disorders, 305 Anatomy and Physiology of Speech, or consent of instructor.
455 Problems in Speech Pathology (1-3) Prereq: Consent of instructor.
473 Introduction to Audiologic Assessment (3) Basic principles of clinical audiometry; pure tone, speech, masking and overview of special auditory tests. Prereq: 303 Introduction to Hearing Science.
494 Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification components/characteristics, assistive devices, speech acoustics, speech perception, speech reading, parent-infant, preschool school years of children, communication impairments/ accommodations/ rehabilitations of adults, effects of aging/remediation on the elderly, and case studies. Prereq: 305 Phonetics and 473 or equivalents or consent of instructor.
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E
504 Appraisal of Speech and Language Disorders (3) Diagnostic procedures for children and adults with speech and language problems including observation and practice with diagnostic tests. Prereq: 300 Introduction to Communication Disorders, 305 Phonetics, and 453 or equivalents or consent of instructor.
506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role in speech and language. Prereq: 306.
507 Anatomy and Physiology of Hearing (3) Structure and function of the peripheral and central auditory systems, and their roles in mediating auditory processes. Prereq: 473 or equivalent or consent of instructor.
511 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, fundamentals of data analysis, and completion of a proposal and hypothetical pilot research project. Prereq: 473 or 494. May be repeated. Maximum 9 hrs.
512 Clinical Practice in Audiology (1-4) Prereq: 473 and 494. May be repeated. Maximum 9 hrs.
513 Clinical Practice in Audiology: Off-Campus Sites. (1-4) Prereq: Consent of instructor. May be repeated.
514 Practicum in Verbo-Tonal Habilitation (1-4) Prereq: 494, 505, or consent of instructor. May be repeated. Maximum 6 hrs.
515 Practicum in Aural Rehabilitation (1-4) Prereq: 473 and 494. May be repeated. Maximum 6 hrs.
517 Instrumentation in Audiology and Speech Pathology (3) Principles of instrumentation in audiology and speech pathology; laboratory assignments for familiarization with equipment and instruments. Prereq: 300 Introduction to Communication Disorders, 305 Phonetics, or consent of instructor.
520 Aphasia (3) Historical review of aphasia literature, theories of brain functioning, aphasic classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 506 or equivalent or consent of instructor.
522 Seminar in Articulation and Phonological Processing Disorders (3) Current research in diagnosis and management of articulation and phonological
523 Seminar in Voice Disorders (3) Current research in diagnosis and management of voice disorders. Multicultural, gender and age-related issues. Prereq: 440 or equivalent or consent of instructor.

524 Traumatic Brain Injury (3) Advanced neurogenetics: cognitive-linguistic emphasis. Medical and speech-language pathology rehabilitation issues associated with traumatic brain injury (TBI) related to adult TBI population. Prereq: 506 and 523, or consent of instructor.

526 Dysphagia (3) Clinical diagnosis, evaluation, and treatment of adult swallowing disorders and critical interpretation of research literature on dysphagia. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.

527 Seminar in Speech Pathology (2-3) Current research in diagnosis and management of craniofacial speech disorders. Prereq: 9 hrs in speech pathology. May be repeated with consent of department. Maximum 9 hrs.

551 Seminar on Stuttering (3) Current significant research in stuttering. Prereq: 431 or consent of instructor.

532-33-34 Advanced Clinical Practice in Speech-Language Pathology 1-4, 1-4, 1-4 Prereq: 434 or equivalent and consent of instructor. 534 may be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.

535-36 Advanced Clinical Practice in Speech-Language Pathology Off-Campus Sites 1-4, 1-4 Prereq: 100 hrs clinical experience, consent of instructor. May be repeated. Maximum 6 hrs each. Enrollment for less than 2 semester hrs must have prior departmental approval.

538 Advanced Clinical Practice in Speech-Language Pathology 1-4, 1-4, 1-4 May be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.


540 Structural Speech Disorders (3) Etiology, diagnosis and clinical management of craniofacial speech disorders and laryngectomy. Prereq: 306 Anatomy and Physiology of Speech and 435.

541 Pediatric Oromotor Disorders (3) Evaluation, diagnosis, and treatment of pediatric oromotor disabilities that affect normal acquisition of feeding and swallowing behaviors. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

542 Hearing Disorders (3) Effects of heredity, development/aging, diseases, and physical agents on hearing. Prereq: 473 or equivalent or consent of instructor.

543 Amplification Technology (3) Description of hearing aid circuits, components and performance characteristics. Electroacoustical and real-ear analysis of hearing aids. Coupler material and geometry effects. Practical experience in troubleshooting, repair, and construction of hearing aids. Prereq: 473 and 507 or equivalents or consent of instructor.


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) Theoretical bases for behaviorial audiometry and acoustic immittance measurement. Prereq: 473 or equivalent or consent of instructor.

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

548 Special Study in Audiology (1-3) Special reading, consultation, and research activities in field of audiology. May be repeated. Maximum 6 hrs.

549 Hearing Science (3) Study of psychoacoustic phenomena and how they relate to perception and diagnostic audiology. Prereq: 473, 507, and 546 or equivalents or consent of instructor.

550 Seminar in Audiology (1-3) Significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 10 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.

558 Phonological Disorders (3) Current theories and approaches to assessment and intervention for individuals with difficulty acquiring or using speech sound system of English. Prereq: 435 or equivalent or consent of instructor.

561 Child Language Disorders (3) Current literature on assessment and intervention techniques for young language learners. Prereq: 461 or equivalent or consent of instructor.

563 Language Disorders: Birth to Three (3) Overview of family-focused, transdisciplinary intervention process. Assessment/treatment of infants, toddlers, and preschoolers. Description of disabilities and resulting communicative disorder. Prereq: 481 or equivalent or consent of instructor.

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

576 Electrophysiological Assessment of Auditory Function (3) Evoked potentials and their anatomical origin. Use of various evoked potentials in evaluation of auditory function and determination of site(s) of lesion. Prereq: 473, 507, 506, and 546, or equivalents or consent of instructor.

577 Vestibular Disorders (3) Anatomy, physiology, and pathophysiology of vestibular system and other systems that contribute to balance. Practicum in electroystagmography. Prereq: 507, 542, 546, and 576 or equivalents or consent of instructor.

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

582 Speech and Language Services in School (3) Organization and implementation of speech and language programs in schools.

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

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

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

594 Advanced Aural Habilitation/Rehabilitation of the Hearing-Impaired (3) Study of grieving process, counseling, group and individual amplification systems, classroom/speech acoustics, central auditory problems, therapy methods for habilitation and rehabilitation, speech reading, school-based programs, programs for adults and the elderly; student research reports/case studies. Prereq: Phonetics and Acoustics of Speech, 473 and 494 or equivalents or consent of instructor.

595 The Verbotonal System: Auditory/Speech Perception (3) Innovative therapy, therapy procedures, and SLUAG amplification/ filters for diagnosis/evaluation/remediation of spoken language/listening skills of hearing-impaired children/adults; use of rhythms, movements and suprasegments; special audiomotor tests, acoustic filters, correcting misarticulations through optimal listening; central auditory treatment; second (foreign) language through listening/spoken language; relationship of concepts to conventional concepts/practice; student research reports. Prereq: 305 Phonetics, 473, and 494 or equivalents of consent of instructor.

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 (3) Auditory perception and reception of nonspeech and speech stimuli. Prereq: 517.


609 Seminar in Speech Science (2) Experimental areas: speech physiology, acoustic analysis, recognition, perception and intelligibility of speech, communication theory, and psycholinguistic 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 (3) Analysis of experimental design in theses and related journals. Generation of experimental designs. Prereq: Consent of instructor.

626 Advanced Seminar in Neurologically-based Communication Disorders (3) Topics vary. Prereq: 520, 539, and 524, or consent of instructor. May be repeated. Maximum 6 hrs.

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 time and rhythm, language development or use, and language symbolization. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

656 Directed Research (1-4) Participation in ongoing or non-discretionary 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.

661 Advanced Seminar: Language Disorders in Children (3) Topics vary. Prereq: 561 or consent of instructor. May be repeated. Maximum 6 hrs.
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 in aviation engineering and associated media for videotaping and interactive systems, present and future. Socioeconomic base, technological trends and developments pertinent to aviation infrastructure and for air vehicle navigation, and aircraft flight-testing. Integration of GPS for navigation, satellite positioning, ionospheric delay, differential GPS, and GPS errors. Applications for navigation and aircraft flight-testing. Integration of GPS for aviation infrastructure and for air vehicle navigation, concepts of WAAS and LAA.

501 Theory and Aviation Applications of GPS (3) Theoretical development of flight testing. Theoretical derivation of flight test techniques. Participation in series of flight test experiments demonstrating acquisition of flight test data. Instrumentation and data reduction techniques.

513 Helicopter Stability and Control Flight Test Techniques (3) Experimental test techniques for helicopter performance flight testing. Theoretical derivation of flight test techniques. Participation in series of flight test experiments demonstrating acquisition of flight test data. Instrumentation and data reduction techniques.

514 Systems Flight Testing (3) Experimental test techniques for helicopter and airplane flight systems. Approach and design for testing airborne systems. Theory and operation of typical flight systems: aircraft systems, navigation systems, communications systems, and specific mission systems.

515 Aviation Human Factors (3) Human factors pertinent to aviation: concept of human factors, human error, fatigue, body rhythms, performances, motivation, vision and visual illusions, communication, attitudes, training and devices, displays and controls.
space and layout, anthropometry, flight deck design and evaluation, aircraft cabin design and evaluation, flying qualities evaluation, and performance measurement techniques. Applied aviation systems.

516 Aircraft Flight Controls (3) Feedback control concepts, root locus techniques, bode analysis, PID control design, and controller and observer design concepts applied to aircraft. Complex analysis and matrix algebra.


550 Project in Aviation Systems (3) Enrollment limited to Aviation System students in non-thesis program. May be repeated. Maximum 3 hrs allowed toward degree.

Biochemistry and Cellular and Molecular Biology
(College of Arts and Sciences)

MAJOR DEGREES
Biochemistry and Cellular and Molecular Biology .................. M.S., Ph.D.

Bruce D. McKee, Head

Professors:
Bagby, R. M., Ph.D. ..................... Illinois
Becker, J. M., Ph.D. .............. Cincinnati
Carlson, J. G. (Emeritus) (Distinguished Prof.), Ph.D. .......... Pennsylvania
Handel, Mary Ann (Distinguished Prof.), Ph.D. ............ Illinois
Hoehn, Ben (Emeritus), Ph.D. ........... California
Howell, Elizabeth E., Ph.D. ............... Lehigh
Jeon, K. W., Ph.D. .................. London
Joshi, J. G. (Emeritus), Ph.D. ............ Poona
Kennedy, J. R., Ph.D. ............... Iowa
Kooznt, John W. (Liaison), Ph.D. ...... Kentucky
Liles, J. N. (Emeritus), Ph.D. ............. Ohio State
MacCabe, J.A, Ph.D. ........... California (Davis)
Mckee, B. D., Ph.D. ............ Michigan State
Monty, Kenneth J., Ph.D. .......... Rochester
Roberts, Daniel M., Ph.D. .......... California (Davis)
Roth, L Evans (Emeritus), Ph.D. ......... Chicago
Salo, T. P. (Emeritus), Ph.D. ............. Michigan
Serpersu, Engin H., Ph.D. ......... Indiana
Shivers, C. A. (Emeritus), Ph.D. ........... Michigan State
Welch, H. G. (Emeritus), Ph.D. .......... Florida
Whitson, G. L. (Emeritus), Ph.D. ............. Iowa
Wicks, Wesley D., Ph.D. .............. Illinois

Associate Professors:
Bruce, Barry, Ph.D. .................. California
Ganguly, R., Ph.D. ................. Nebraska
Hall, J. C., Ph.D. ............... Illinois

Peterson, Cynthia B., Ph.D. .................. LSU
Prosser, R. A., Ph.D. ................. Illinois

Assistant Professors:
Dealwis, C., Ph.D. ...................... London
Fernandez, E., Ph.D. ................ Loyola
Park, J., Ph.D. ..................... Texas A&M

Research Professors:
Mazur, Peter, Ph.D. ............. Harvard
Rinchik, Eugene, Ph.D. .......... Duke

Research Assistant Professor:
Kleib, Mitch, Ph.D. ............. Tennessee

REQUIREMENTS FOR ADMISSION
Applicants for graduate study are expected to have a background equivalent to that required of undergraduate majors in this department. This includes a knowledge of the basic principles of biochemistry, cell biology, genetics and physiology. Requirements for admission are:
1. One year of general biology or the equivalent;
2. A minimum of 8 semester hours of approved biology courses beyond the introductory level and including the subject areas of genetics, cell biology and physiology;
3. Two years of chemistry including one year of general chemistry and one year of Introductory Organic Chemistry with laboratory;
4. At least one semester of biochemistry;
5. One year of calculus;
6. One year of physics;
7. Graduate Record Examination scores; and
8. A minimum grade-point average of 3.0 out of 4.0.
Otherwise superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the department’s Graduate Recruiting Committee.

THE MASTER’S PROGRAM
1. Biochemistry and Cellular and Molecular Biology 511-12-13, 515-16, and 517.
2. Completion of course requirements as determined by the candidate’s faculty committee.
3. Achievement of a 3.0 or better GPA in all courses taken for graduate credit.
4. Participation in 601 and 603 during the entire period of residence. Participation in at least one journal club chosen from among 605-608 for six semesters.
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. Biochemistry and Cellular and Molecular Biology 511-12-13, 515-16, and 517.
2. At least two additional approved graduate courses in the life sciences or chemistry, or physics, or other physical science to be determined upon consultation with the mentor and the dissertation committee. No survey courses will be accepted.
3. At least 6 hours of topics offered in 615 or its equivalent.
4. Participation in 601 and 603 during the entire period of residence. Participation in at least one journal club chosen from among 605-608 for six semesters.
5. Comprehensive examination, taken before the end of the third year of study.
6. A dissertation reporting the results of original and significant research carried out during the term of candidacy.
7. A final oral examination which will be concerned primarily with the student’s dissertation.

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.
2. Publication of at least one full-length paper in a major scientific journal as senior author.

GRADUATE COURSES

401-402 Biochemistry-Molecular Biology I, II (3,3)
401—Amino acid structure and chemistry, protein structure and chemistry, protein folding, enzyme behavior and function, reaction mechanisms, catalysis and energy transfer, synthetic metabolism including photosynthesis, and protein transport. 402—Structure of DNA and RNA, experimental methods of analyzing nucleic acids, mechanisms of RNA and protein synthesis, mechanisms of DNA replication and repair and recombination, chromosome structure and function, regulation of gene expression, genome structure and genomics, and mechanisms of biological regulation. Prereq: Biology 240 General Genetics, Chemistry 350-360-369 Organic Chemistry and Lab.

403 Advanced Genetics Laboratory (3) Experiments illustrating methods in modern genetics: techniques in classical, cytological, molecular and developmental genetics. Model organisms, Drosophila and mouse. Prereq: General Genetics and Organic Chemistry.

410 Cellular and Comparative Biochemistry (4)
Electrolyte 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 biological processes. May not be counted if credit received for 401. Prereq: Chemistry 350-360-369 Organic Chemistry and Lab. Biology 140 Organization and Function of the Cell, and Biology 240 General Genetics. 3 hrs and 1 discussion.

419 Cellular and Comparative Biochemistry Lab (2) Experiments with enzymes, nucleic acids, and membranes and organelles. Chromatography, kinetics, hybridization, sequencing, and immunochromatographic methods. Prereq or coreq: 401 or 410. F,Sp

421 Cell and Tissue Structure and Function (4)
Study of animal cells and tissues at light and electron microscopic levels. Prereq: Biology 140 Organization and Function of the Cell. 2 hrs and 1 lab.

429 Cell Biology Laboratory (3) Series of open-ended, discovery-based exercises developed to design and test new drugs using modern cell biology and computer technologies. Experimental modules: techniques used in cell isolation, purification, culturing,
fluorescent microscopy, receptor binding and signal transduction, apoptosis, cell cycle analysis, protein and steroid secretion, computer modeling, and state-of-the-art equipment. Emphasis on design, execution, data analysis, and peer evaluation. Prereq: or coreq: 401 or 410. F


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

480 Physiology of Exercise (3) (Same as Exercise Science 480.)

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

502 Registration for Use of Facilities (1-15) Required for the use of facilities 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. Prereq: Consent of E. F

511 Advanced Protein Chemistry and Cellular Biology (3) Cellular structure and function at molecular and supramolecular level in progression: protein structure and function; membrane structure and function; bioenergetics and membrane proteins. Prereq: Prior knowledge of cell biology and biochemistry and/or consent of instructor. F

512 Advanced Molecular Biology (3) Regulation of nucleic acid expression and protein activity. Nucleic acid structure and function; replication and repair of nucleic acids; gene expression; protein synthesis; post-translational protein modification; mitosis and meiosis; cell cycle and cell growth. Prereq: 511 or consent of instructor. Sp

513 Advanced Protein Biochemistry and Cell Biology II (3) Advanced topics of cellular function and regulation of cell division and growth, and structure and function of supramolecular structures: cytoskeleton and cell junctions and adhesions. Prereq: 511. Sp

515 Experimental Techniques 1 (4) Modern experimental methodology and instrumentation lab. cell growth; spectrophotometry; microscopy; nucleic acid purification and analysis; protein assays; enzyme purification; electrophysiology; computer analysis of nucleic acid and protein sequences. Lecture on theory of laboratory to accompany two lab periods per week. Primarily for departmental graduate students. Prereq: Consent of instructor. F

516 Experimental Techniques 11 (3) Laboratory rotations. Students work in laboratory of faculty member on clearly defined research project. Written proposal and oral report. Primarily for departmental graduate students. Prereq: 515. S/NC only. Sp

517 Physical Biochemistry (3) Physics and chemistry of biological systems and molecules. Thermodynamics, diffusion, and transport; physical chemistry of macromolecules; enzyme kinetics; binding reactions; spectroscopy; electrophysiology. Prereq: 511 or consent of instructor. F

520 Special Topics (1-2) Selected directed readings or special courses in topics of current interest. Consult departmental listing for offerings. May be repeated with consent of instructor. Maximum 6 hrs. S/NC only.

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

530 Experimental Design and Analysis (3) Development of skills in experimental design and interpretation of experimental results. Critical discussion of research articles illustrating issues in experimental design. Preparation of grant proposal in standard format to be read and discussed by class and by panel of faculty expert in area of proposal. Prereq: 511-12-13, 515-16-17. Sp

550 Advanced Concepts in Neurobiology/Physiology (3) Concepts related to neurobiology/physiology with information taken from current literature. Prereq: Coreq: 511. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

552 Physiology of Hormones (3) Cellular and organismal action of hormones in invertebrate and vertebrate animals. Prereq: Consent of instructor. Recommended prereq: 410. 2 hrs and 1 lab. Sp

560 Advanced Concepts in Structural Biology/ Biochemistry (3) Concepts related to structural biology/biochemistry with information taken from current literature. Prereq: Coreq: 511. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated. Sp

561 Environmental Toxicology (3) (Same as Ecology and Evolutionary Biology 561.)

562 Introduction to Electron Microscopy - Transmission Electron Microscope (4) Practical application of techniques for preparation of biological samples for viewing in transmission electron microscopy. Use of microscope and ancillary equipment, darkroom techniques, preparation of materials for publication of special project. Admission limited only to departmentally approved graduate students. (Same as Botany 510. 2-9 hrs labs. Sp

564 Introduction to Electron Microscopy-Scanning Electron Microscope (3) Preparation of techniques for electron microscopy and to scanning electron microscope. Use of microscope, introduction to darkroom techniques and digital image processing, preparation of samples for observation, and special project. Prereq: Consent of instructor. 2 hrs and 1 lab. Sp

570 Advanced Concepts in Cellular/Molecular Biology (3) Concepts related to cellular/ molecular biology with information taken from current literature. Prereq: Coreq: 511. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.


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

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

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

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

601 Departmental Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. S/NC only. F,Sp

603 Graduate Research Colloquium (1) Seminars and lectures dealing with current advances in fields of biochemical and biological physical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell ultrastructure and physiology, neurobiology, and related topics. Required every semester in residence. S/NC only. F,Sp

605 Journal Club in Neurophysiology/Physiology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hrs. S/NC only.

606 Journal Club in Structural Biology/Biochemistry (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hrs. S/NC only.

607 Journal Club in Cellular/Molecular Biology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hrs. S/NC only.


610 Current Topics in Biochemistry, Cellular, and Molecular Biology (1) Critical reviews of research problems and methods in biochemistry, cell biology and/or molecular biology. Oral presentations, written reports, computer simulations by faculty and students. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.

612 Advanced Topics in Environmental Toxicology (1-3) (Same as Ecology and Evolutionary Biology 612.)

615 Special Topics in Biochemistry, Cellular, and Molecular Biology (3) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell ultrastructure and physiology, neurobiology, and related topics. Prereq: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.

Biosystems Engineering and Environmental Science

(College of Agricultural Sciences and Natural Resources)

MAJORS DEGREES

Biosystems Engineering ..................... M.S., Ph.D.
Biosystems Engineering Technology ........ M.S., Ph.D.
Plant and Soil Sciences ..................... M.S., Ph.D.

Ronald E. Yoder, Head

Professors:

Ammon, J. Tom, Ph.D. ....................... West Virginia
Ayers, P. D., PE, Ph.D. ..................... NC State
Bell, F. F. (Emeritus), Ph.D. ............... Iowa State
Buscherhoffe, M. J., Ph.D. ............... Clemson
Denton, H. P., Ph.D. ....................... NC State
Foss, J. E. (Emeritus), Ph.D. ............... Minnesota
Henry, Z. A. (Emeritus), Ph.D. .......... NC State
Luttrel, D. H. (Emeritus), Ph.D. ......... Iowa State
McDow, J. J. (Emeritus), Ph.D. .......... Michigan State
Mote, C. R., Ph.D. ......................... Ohio State
Sewell, J. I. (Emeritus), Ph.D. ............ NC State
Shelton, C. H. (Emeritus), M.S. .......... VPI
Springer, M. E. (Emeritus), Ph.D. .......... California
Tompkins, F. D., PE, Ph.D. ............... Tennessee
Tyler, D. D., Ph.D. ....................... Kentucky
Wilhelm, L. R., PE, Ph.D. ............... Tennessee
Wills, J. B., M.S. .......................... Tennessee
Yoder, D. C., Ph.D. ....................... Purdue
Yoder, R. E. (Liaison), PE, Ph.D. ........ Colorado State

Associate Professors:

Burns, R. T., PE, Ph.D. ................... Tennessee
Essington, M. E. ......................... California (Riverside)
Freeland, R. S., PE, Ph.D. ............... Tennessee
Grandle, G. F., Ph.D. ..................... Tennessee
Hart, W. E., Ph.D. ....................... Purdue
Logan, J., Ph.D. .......................... Nebraska
Pordesimo, L. O., Ph.D. ................. Penn State
Raman, D. R., PE, Ph.D. ................. Cornell
THE MASTER'S PROGRAMS

Biosystems Engineering

Applicants accepted into the program must complete at least 30 semester hours to earn a degree. Of these 30 hours, 20 must be in courses numbered 500 or greater (6 hours of thesis plus 14 hours of other courses). Other specific requirements for the 30 hours are:

Biosystems Engineering 507 (1), 505 (1), and other major subject courses 12
Coursework in computational methods (mathematics, computer science, statistics, or any course containing appropriate computational components that may be approved by the department) 6
Program electives 6
Thesis 500 6

In addition to completing the 30 semester hours, master's students must pass a final oral examination covering the thesis, related areas, and graduate coursework.

Biosystems Engineering Technology

Thesis Option: Applicants accepted into the program must complete at least 30 semester hours to earn a degree. Of these 30 hours, 20 must be in courses numbered 500 or greater (6 hours of thesis plus 14 hours of other courses). Other specific requirements for the 30 hours are:

Biosystems Engineering Technology 507 (1), 505 (1), and other major subject courses 12
Coursework in computational methods (mathematics, computer science, statistics, or any course containing appropriate computational components that may be approved by the department) 6
Program electives 6
Thesis 500 6

In addition to completing the 30 semester hours, master's students must pass a final oral examination covering the thesis, related areas, and graduate coursework.

Non-Thesis Option: A non-thesis option in Biosystems Engineering Technology is available to qualified students. Applicants accepted into the program must complete at least 33 semester hours to earn a degree. Of these 33 hours, 20 must be in courses numbered greater than 500. Other specific requirements for the 33 hours are:

Biosystems Engineering Technology 507 (1), 505 (1), and other major subject courses 12
Coursework in computational methods (mathematics, computer science, statistics, or any course containing appropriate computational components that may be approved by the department) 6
Program electives 6
Capstone Experience (project and report, typically 508) 3

In addition to completing the 33 semester hours, non-thesis students must pass a comprehensive written final examination covering the graduate program, including the capstone experience. At the discretion of the candidate's committee, an oral examination may also be required.

Plant and Soil Sciences

The environmental and soil sciences faculty in the Department of Biosystems Engineering and Environmental Science participate in the Plant and Soil Sciences. The approved master's thesis will usually be acceptable for this purpose.

To earn a degree, each doctoral student must complete at least 75 hours of approved graduate credit (beyond the baccalaureate degree) in Biosystems Engineering and Environmental Science and the Department of Biosystems Engineering and Environmental Science and the Department of Plant Sciences and Landscape Systems.

THE DOCTORAL PROGRAM

Biosystems Engineering

Students applying for admission into the doctoral program must submit evidence of ability to perform and report independent research to the satisfaction of the faculty of the department. An approved master's thesis will usually be acceptable for this purpose.

To earn a degree, each doctoral student must complete at least 75 hours of approved graduate credit (beyond the baccalaureate degree) in Biosystems Engineering and Environmental Science and the Department of Biosystems Engineering and Environmental Science and the Department of Plant Sciences and Landscape Systems.

Major subject courses 18
Coursework in computational methods (mathematics, computer science, statistics, or any course containing appropriate computational components that may be approved by the department) 9
Program electives 21
Seminars (507, 505 or equivalent courses) 3
Dissertation 600 24

In addition to completing the minimum 75 hours of graduate credit required for a degree, each doctoral student must also pass a comprehensive examination as required by the Graduate Council.

Plant and Soil Sciences

The environmental and soil sciences faculty in the Department of Biosystems Engineering and Environmental Science participate in the Plant and Soil Sciences doctoral program.

A minimum of 72 hours beyond the Bachelor's degree, exclusive of credit for Thesis 500, is required. Of this number, 24 hours must be Doctoral Research and Dissertation 600. A minimum of 26 hours must be completed in courses numbered above 500 exclusive of doctoral research and dissertation, of which 6 must be in courses numbered above 600. A minimum of 9 hours of graduate course work taken during the doctoral program must be outside the major in one or more cognate areas.

Major courses include those in: Plant and Soil Sciences, Environmental and Soil Sciences, integrated Plant Systems, Ornamental...

The student and the major professor identify a doctoral committee composed of at least four faculty members holding the rank of assistant professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be from outside the department. The committee must approve all coursework applied toward the degree, certify the student’s mastery of the major field and any cognate fields, direct the research, and recommend the dissertation for approval and acceptance by the Office of Graduate Student Services.

See the Department of Plant Sciences and Landscape Systems for additional details and additional major courses offered.

**Biosystems Engineering**

**GRADUATE COURSES**

411 Mechanical Systems Engineering (3) Fundamentals of power delivery systems and simple mechanisms; selection and design of mechanical, hydraulic, and tractive power transmission systems. Off-road vehicles andbioprocessing systems. Prereq: 431, Mechanical Engineering 231 Dynamics, Mechanical Engineering 321 Mechanics of Materials. 2 hrs and 1 lab. Sp

421 Natural Resource Engineering (3) Introduction to hydrosystemic: movement of water and interaction with environment through such processes as erosion and contamination. Water projects through estima-

tion and measurement, and controlling impacts through engineering design. Specific designs: waterways, erosion and sediment control structures, waste management systems, irrigation systems, and hydrologic monitoring systems. Prereq: 321 Fluid Mechanics, Environmental and Soil Sciences 210 Introduction to Soil Science, Civil Engineering 390 Hydraulics, or Aerospace Engineering 341 Fluid Mechanics. 2 hrs and 1 lab. F

431 Bioprocessing Engineering (3) Application of basic engineering principles to processing and handling of biological materials: chemical, physical, biological properties; materials handling; material conversion: operations; drying; heat processing; and bioprocessing. Prereq: 321 Biotechnology, Heat and Mass Transfer, Mathematics 231 Differential Equations 1. 2 hrs and 1 lab. Sp

441 Life Systems Engineering (3) Design of controlled environments to optimize conditions for organism growth and development: growth equations and population dynamics; plant growth systems; microbial growth systems; animal growth systems; biotechnological applications. Prereq: 321 Biothermodynamics, Heat and Mass Transfer, Mathematics 231 Differential Equations 1, 2 hrs and 1 lab. Sp

451 Electronic Systems (4) Basic electronics with biological applications. Analog and digital electronics; sensing and controlling physical and environmental parameters; sensor selection and interfacing; signal conditioning; process control; Laboratory experiments and design projects. Prereq: Circuits and Electro Mechanical Components. 3 hrs and 1 lab. Sp

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

502 Registration for Use of Facilities (3-15) Re-quired for the student not otherwise registered during the same 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/NC only. E

505 Professional Communications Seminar (1) Reviews, reports and discussion of ideas, recent advances and current topics: presentations by stu-dents. Should be taken in last full semester before graduation. Prereq: 504. May be repeated in doctoral program. Maximum 2 hrs. (Same as Biosystems Engineering Technology 505.) S/N/NC only. E

507 Professional Development Seminar (1) (Same as Agriculture and Natural Resources 507, Animal Science 507, Biosystems Engineering Technology 507, Food Science and Technology 507, Ornamental Horticulture and Landscape Design 507, and Plant and Soil Sciences 507.) S/N/NC only. F

510 Similitude in Design and Research (3) Dimen-sional analysis; governing equations; theory of mod-els; true, distorted, dissimilar models; prediction equa-tions; interpretation of data: applications to machinery, soil and water structures, agricultural buildings and other agricultural engineering-related problems. Prereq: Engineering Science 521, 341. 2 hrs and 1 lab. F, A

525 Soil Erosion and Sediment Yield (3) (Same as Environmental Engineering 525.)

530 Research Problems in Biosystems Engineer-
ing (1-3) Theoretical and experimental studies relating to current problems in agricultural engineering. May be repeated. Maximum 6 hrs. E

541 Principles of Compost Engineering (3) Comprehensive study of composting: survey of installed systems; thermodynamics of composting; biology of composting; kinetics of heat inactivation; feeding; conditioning; aeration; substrate characteristics; process kinetics; and odor control. Design component. Prereq: Thermodynamics, heat and mass transfer. F

543 Instrumentation and Measurement (3) Modern instrumentation techniques: response of instrumentation; signal conditioning; temperature, moisture, optical radiation, displacement, strain, pressure, velocity, acceleration, and flow measurements: digital data acquisition and control. Prereq: 451 or Electronics and Computer Circuits or equivalent. 2 hrs and 1 lab. (Same as Environmental Engineering 543.) A

545 Monitoring Hydrologic Phenomena (3) Applica-
tion of instrumentation techniques to monitoring hydrologic phenomena: strengths and weaknesses of current equipment and strategies; equipment operation and solution of environmental problems. Prereq: 543 and knowledge of basic hydrology. 2 hrs and 1 lab. (Same as Environmental Engineering 545.) S, A

550 Selected Topics (1-3) Lecture/group discussion on specialized topics. May be repeated. Maximum 6 hrs. F

552 Biological Treatment Theory (3) (Same as Environmental Engineering 552.)

555 GIS and GPS Applications to Biosystems (3) Theory and applications of Geographical Information Systems (GIS) and Global Positioning Systems (GPS): correlating data to manage resources. Prereq: 331 Computer Aided Drafting or consent of instructor. 2 hrs and 1 lab. Sp

557 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 575, Environmental Engineering 575, and Microbiology 575.)

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

620 Computer Simulation of Agricultural Systems (3) Scientific approach to digital simulation: static and dynamic nature of agriculture: simulation, modeling and experiment design; parameters of simulation and experimentation; model output: verification and calibration of simulation model results. Prereq: Knowledge of computer programming language. 2 hrs and 1 lab. F, A

630 Feedback and Control Systems (3) Differential equations for physical systems: solutions, transforms, and system response. Types of control, frequency response, operation, and system design. Prereq: 451 or equivalent. 2 hrs and 1 lab. F, A

650 Selected Topics (1-3) Lecture, group discussion, and individual study on specialized developments. May be repeated. Maximum 6 hrs. E

**Biosystems Engineering Technology**

**GRADUATE COURSES**

422 Food and Process Engineering Technology (3) Application of basic engineering principles to agricul-
tural production processes: past, present, and evolu-
tion: agricultural processes: process design: food pro-
duction: plant growth: animal growth: water manage-
tment: energy and mass transfer: evaporation, thermal processing, heating and cooling, refrigeration systems, and materials handling. Prereq: Basic Physics. 2 hrs and 1 lab. F

432 Agricultural Machinery and Tractors (3) Func-
tions: selection, matching, and management of agricul-
tural machinery systems. Tractor power ratings, en-
gine and transmission systems, hydraulic systems, hitching, and ballasting. Field and material capacity, field efficiency, cost analysis, and machinery replace-
ment strategies. Functional analyses of tillage opera-
tions, planters and drills, no-tillage systems, hay harvest systems, forage and small grain harvesting, and cotton harvesting. Crop drying processes, off-
road machinery safety considerations, and operator ergonomics. Prereq: Mathematics 123 Basic Calculus or 125 Finite Mathematics or consent of instructor. 2 hrs and 1 lab. Sp

442 Agricultural Waste Management and Pollution Control (3) Waste renovation fundamentals; charac-
teristics of animal manure; techniques for collection, transporting, storing, and utilizing livestock waste. Prereq: Basic Calculus or Finite Mathematics or equivalent. 2 hrs and 1 lab. F

452 Small Internal Combustion Engines (3) Theory, operation, and mechanics of small internal combustion engines; theoretical cycles; selection, operation, ad-
justment, troubleshooting and repair of single-cylinder engines. Prereq: Basic calculus or finite mathematics or equivalent or consent of instructor. 2 hrs and 1 lab. Sp

462 Agricultural Chemical Application Technology (3) Equipment for application of liquid, solid, and gaseous agricultural chemicals; system components; operational characteristics; calibration; selection and management; safety considerations; materials han-
dling and disposal methods. Prereq: Basic calculus or finite mathematics or equivalent or consent of instruc-
tor. 2 hrs and 1 lab. Sp

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

502 Registration for Use of Facilities (3-15) Re-
quired 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/NC only. E

505 Professional Communications Seminar (1) (Same as Biosystems Engineering 505.) S/N/NC only. E

506 Physical Phenomena (3) Properties of materials, fundamentals of hydraulics, principles of electricity, thermal phenomena, applications in biological sys-
tems. Prereq: Consent of instructor. 2 hrs and 1 lab. F

507 Professional Development Seminar (1) (Same as Agricultural and Natural Resources 507, Animal Science 507, Biosystems Engineering 507, Food Science and Technology 507, Ornamental Horticulture and Landscape Design 507, and Plant and Soil Sciences 507.) S/N/NC only. F

508 Special Problems in Biosystems Engineering Technology (1-3) Individual studies of current prob-
lems. May be repeated. Maximum 6 hrs. E

514 CAD Applications to Biosystems Engineering (3) Computer Aided Drafting (CAD) applications in agriculture: environmental outputs of CAD software to create drawings of components, systems, flow charts, and process diagrams. Applica-
tions in mechanical, structural, and biosystems. 2D applications with limited exposure to 3D applications. Computer intensive course. Hands-on experience. Prereq: Computer proficiency and admission to gradu-
ate program. (Students cannot receive credit for both 414 CAD Applications to Biosystems Engineering and 514.) Two 2-hr labs. F
Environmental and Soil Sciences

**GRADUATE COURSES**

434 Environmental Soil Chemistry (3) Composition and chemical properties of soils and processes that govern fate and behavior of chemicals in soil environment: clay mineralogy; soil organic matter; mineral weathering and stability; aeration and transpiration; surface chemistry; ion exchange, adsorption and molecular retention; oxidation-reduction; and soil acidity, alkalinity, and salinity. Prereq: Soil science and organic chemistry or equivalent. F

442 Soil Genesis and Classification (3) Soil genesis and formation; observing and describing morphology of agricultural and forest soils; chemical and physical properties. Field trips. Prereq: Soil and water science. 2 hrs and 1 lab. F

444 Environmental Soil Physics (3) Basic understanding of soil physical properties and processes; practical experience in measurement and analysis of soil physical properties; methods of analysis related to agricultural, environmental, and engineering issues. Prereq: 210 Introduction to Soil Science and Physics 221 Elements of Physics or equivalent. 2 hrs and 1 lab. Sp

462 Environmental Climatology (3) Study of atmosphere as environment. Physical, chemical and biological factors affecting climates of various earth environments; meteorological process affecting biosystems. Climatic change and the human impact on the atmosphere, consequences of climatic change and mitigation policies, microclimates and urban climates, atmospheric pollution, extreme events and ozone depletion. Design and operation of weather information systems; automated weather stations. Prereq: Agriculture and Natural Resources 290 Computer Applications to Problem Solving or equivalent. Sp

481 Capstone in Environmental and Soil Sciences (3) Integrative course in which students work individually and collaboratively to develop solutions for soil and water related environmental problems. Writing and oral communication emphasis course. Prereq: 434 and senior standing. Sp,A

**Botany**

*(College of Arts and Sciences)*

**MAJOR DEGREES**

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<tr>
<th>Botany</th>
<th>M.S., Ph.D.</th>
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<td>Edward E. Schilling, Head</td>
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**Professors:**

- Caponetti, J. D. (Emeritus), Ph.D. ....... Harvard
- Clebsch, E. E. C. (Emeritus), Ph.D. ........ Duke
- DeSelm, H. R. (Emeritus), Ph.D. .......... Ohio State
- Evans, A. M. (Emeritus), Ph.D. .......... Michgan
- Heilman, A. S. (Emeritus), Ph.D. ....... Ohio State
- Herndon, W. R. (Emeritus), Ph.D. ....... Vanderbilt
- Hickok, L. G. (Ph.D. .......... Massachusetts
- Holton, R. W. (Emeritus), Ph.D. ........... Michigan
- Hughes, K. W., Ph.D. ....................... Utah
- Mullin, B. C., Ph.D. ................. North Carolina State
- Petersen, R. H. (Distinguished Professor), Ph.D. ........ Columbia
- Schilling, E. E. (Liaison), Ph.D. ........ Indiana
- Schwartz, O. J., Ph.D. ........ North Carolina State
- Walne, P. L. (Emeritus), Ph.D. ........... Texas

**Associate Professors:**

- Amundsen, C. C., Ph.D. ............... Colorado
- Piglucci, M., Ph.D. ................. Connecticut
- Smith, D. K., Ph.D. ................. Tennessee
- Wofford, B. E. (Curator), Ph.D. ........ Tennessee

**Lecturer:**

- McFarland, K. D., Ph.D. ............... Tennessee

The Department of Botany offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, botany, cytology, cytogenetics, ecology, genetics, lichenology, molecular biology, morphology, mycology, photobiology, physiology, phylogenetics, and systematics. 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 portion of the Graduate Record Examination, at least three letters of recommendation or standard recommendation forms from academic or professional persons, a short 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 and a cumulative grade-point average of 3.0 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: 8 semester hours. 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 prerequisite courses but otherwise qualified may be admitted to graduate study 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 pro-tem 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 less extensive course of study than the Ph.D. program. However, the applicant must be equally well prepared and display an aptitude and ability for advanced study. The M.S. includes thesis and non-thesis options.

**Thesis Option**

The thesis program is the usual route taken by botany students for the M.S. It is important that the entering student promptly identify a major professor and a suitable research project. The requirements for the thesis option consist of the following:

1. Satisfactory preparation of a written and 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.
Botany or Biodiversity; Organization and Function of the Cell or equivalent.

419 Science as Method (3) (Same as Ecology and Evolutionary Biology 419 and Philosophy 419.)

431 Plant Ecology (4) 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: Field Botany or equivalent. (Same as Ecology and Evolutionary Biology 431.)

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organs: media preparation and maintenance of cultures. Prereq: General Botany or Biodiversity; Organization and Function of the Cell or equivalent. (Same as Plant Biology 451.)

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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 Phycology (4) Comparative study of major algal phyla with particular emphasis on 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 (B/W and Color) photomacro- and photomicrography, drawing, graphics and video recording and presentation for research and publication of data in pictorial and graphic form.

510 Introduction to Electron Microscopy - Transmission Electron Microscopy (4) (Same as Biochemistry and Cellular and Molecular Biology 562.)


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. Maximum 12 hrs.

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

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/NC only.

599 Advanced Evolutionary Biology (3) Advanced concepts in evolutionary and ecological genetics. Biogeography, climate, population genetics, evolution and natural selection, population growth and regulation, competition, niche, experimental evolution, predation, phylogenetics in ecology, biodiversity and conservation. Prereq: General Botany and General Ecology; one or more courses in organismal biology (ecology, evolution) at the upper undergraduate level or consent of instructor. Students cannot receive credit for both 499 and 599. (Same as Ecology and Evolutionary Biology 599.) Sp, A

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

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

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

Broadcasting

(Course of Communications)

MAJOR DEGREES

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

Barbara A. Moore, Head

Professors:

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

Howard, Herbert H. (Emeritus), Ph.D. .......... Ohio

Moore, Barbara A., Ph.D. ...................... Ohio

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

Associate Professor:

Bates, Benjamin J., Ph.D. ..................... Michigan

Assistant Professors:

Harmon, Mark, Ph.D. .......................... Ohio

Kaye, Barbara, Ph.D. ........................... Florida State

Luther, Catherine, Ph.D. ..................... Minnesota

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

440 Corporate Video (3) Special requirements of business, industrial, educational, and medical uses of video. Management, budgeting, planning, producing, and evaluating projects. Prereq: 430 or consent of instructor.


460 Broadcast News Operations (3) Production of news programs for broadcast on television stations. Electronic news gathering, editing and writing news packages and studio production. Prereq: 410 or consent of instructor.

470 Cable, Broadband, and Interactive Digital Media (3) History and structure of cable television and other broadband delivery systems: DBS, Internet. Development of digital broadcasting, interactive television, and other broadband media systems and digital technology. Regulatory, policy, programming, and management issues arising from new media and digital technologies. Prereq: 275 Introduction to Radio and Television or consent of instructor.


550 International Broadcasting (1) Broadcasting systems in other countries. Analysis of international broadcasting organizations. Intercultural communica-
Each of these programs serves a different group of students. Descriptions of the MBA programs in the executive track follow the description of the dual-degree programs.

To obtain an MBA application, contact the MBA Program Office, 337 Stokely Management Center, College of Business Administration, The University of Tennessee, Knoxville, TN 37996-0552, Tel: (865) 974-5033, Email: mba@utk.edu. The application may also be downloaded from the website at http://mba.bus.utk.edu. For the executive professional degree, contact the Executive MBA Program Office, 704 Stokely Management Center, College of Business Administration, The University of Tennessee, Knoxville, TN 37996-0575, Tel: (865) 974-1660.

THE MBA PROGRAM

The full-time MBA program is designed for students with undergraduate degrees in a wide variety of fields, including the social and natural sciences, humanities, and professional fields such as engineering, business, agriculture, and architecture. In addition, most students in this program should have two or more years of work experience beyond their undergraduate degree(s). The MBA program is a 17-month program with students beginning in late July of each year and graduating in December of the following year. During the summer between the second and third semesters, students must complete an internship with a company using the skills acquired during the first year of the MBA program.

The MBA program consists of a common core (32 hours) and a selection of concentration and elective courses (15 hours). The first-year core develops a general management foundation upon which specialization is introduced during the second year. The objective of the 17-month program is to develop leaders able to enhance the success of their organizations. Specific emphasis is placed upon competency in the area of integrated value chain management.

The managerial perspective acknowledges that an organization’s success is strongly related to its ability to function effectively and efficiently within a larger network of allied businesses. Managers must understand how to integrate business functions within their organizations, as well as across the other organizations within their value chain. Integrated value chain management rests upon a foundation including: supply chain management, information management, resource management, and customer relationship management. In addition, students will pursue concentrations and careers in a variety of areas, including finance, logistics and transportation, marketing, and operations management.

Admission Requirements

Applications are accepted for fall semester only. The application deadline for fall semester is March 1. Applications by U.S. citizens and permanent residents received after March 1 will be considered as space allowing.

To be considered for admission, the applicant’s file must be complete. A completed file includes the Application for Graduate Admission, 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 Office of Graduate Admissions one month before the MBA application deadline to allow for processing. Additional information is required by Graduate Admissions for international students.

For admission to the MBA program, consideration 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 that make up the total application; therefore, there is no automatic cut-off for either grade point averages or GMAT scores. However, admission preference will be given to applicants with full-time work experience after obtaining the undergraduate degree.

Prerequisites

There are no specific course prerequisites for admission. However, undergraduate courses and work experience should demonstrate ability with both qualitative and quantitative work.

MBA Core

The MBA core (32 hours total) consists of: a 3-hour foundations course taken during the three weeks prior to the beginning of fall semester, a 15-hour core course and a 1-hour career development course taken in the first semester (Fall 1), a 15-hour core course taken in the second semester (Spring 1), a 3-hour distance course taken during the internship (Summer), and a 1-hour capstone in the third semester (Fall 2). The topics introduced within these courses follow three major themes. The first theme introduces students to the “what every manager needs to know,” and includes such functional topics as finance, strategy, decision tools, environmental analysis, and leadership skills development. The second theme focuses on functions involved in the flows of product, information, and finances within an integrated value chain, to include, but not limited to, operations management, logistics management, demand management, customer relationship management, supplier management and resource management. The third theme involves integrating the content of the other two themes using information technology. Throughout all three themes, significant emphasis is placed on learning the topics in an integrated fashion. Students will understand how various business functions are integrated within an organization, as well as how integration should occur across organizations within the context of a value chain.

Students in the first-year core undertake active learning within a team-based environment. Many core requirements are experiential exercises in which self-discovery within a team setting is an important element of the learning process. Individualized support is

Business Administration

(College of Business Administration)

MAJOR DEGREES

Business Administration .................MBA, J.D.-MBA, M.S.-MBA, Ph.D.

The College of Business Administration offers two college-wide programs, the MBA and the Ph.D. with a major in Business Administration. Two tracks are available for the MBA: the regular, full-time program and the executive program.

The full-time MBA is for students seeking a full-time, weekday program that follows the traditional academic format. The nature of this program precludes students from simultaneously working full-time outside of school. In addition to the regular full-time program, there are two full-time dual-degree programs: the J.D.-MBA with the College of Law and the M.S.-MBA with the College of Engineering. Descriptions of these dual-degree programs follow the description of the regular, full-time program.

For students who wish to continue working full-time while they earn their MBA degree, there are four programs within the executive track of the MBA. In these programs, students carry a full academic course load in addition to their full-time jobs.
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 should be made after the first semester and must be made after completion of the first year. Requests for changes in concentration area must be submitted for approval to the MBA Program Office.

Among the 15 credit hours in the concentration/electives block, 9 credit hours must be taken in one of the following concentration areas. For specific courses required in concentration areas, see the appropriate field of instruction.

- Finance
- Logistics and Transportation
- Marketing
- Operations Management

The first course in each concentration is designed to provide a foundation upon which the concentration can be built. These courses will be delivered in the latter part of the spring semester of the first year, after the Spring core course has been completed. They are intended to prepare students for their summer internships. However, these courses should not be thought of as simply the first three hours in a nine-hour elective. Rather, these courses are self-contained, intensive introductions to a specialty area of business. Students will choose two of these courses in the spring semester, which will permit them flexibility for choosing concentrations in the second year of the program. Two additional courses in the concentration area will be taken in the second fall semester to meet the 9-hour requirement for a concentration.

Elective courses may be chosen from any 500 level courses in the College of Business. Courses outside the College of Business Administration as well as courses listed in the Graduate Catalog numbered below 500 may be included as an elective only with written prior permission via formal petition to the MBA Program Office.

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

Because of the fully integrated nature of the first-year curriculum, no credit hours are transferred into this core curriculum. The maximum number of hours that may be transferred to elective and concentration areas is 6 semester hours. Transfer credit will be considered upon formal petition to the Dean of the MBA Program and must meet all requirements of the Graduate Council.

Other Requirements
The Application for Admission to Candidacy must be approved by three faculty members in the student’s area of concentration and the Assistant Dean of the MBA Program. It should be submitted to the Graduate Student Services Office at least one full semester prior to the date the degree is conferred. (Admission to candidacy for the MBA degree must be submitted in the spring semester for graduation in the following fall 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 EXECUTIVE MBA PROGRAMS
Each of the four programs of the executive track is designed to serve the needs of a different student group. The programs share a common course structure of 36 credit hours of classroom learning (BA 551, 552, 553) and 9 credit hours of projects applied within the student’s business organization (BA 554, 555, 556, and 563). Students carry a full, 15-credit-hour load each semester. In each program, all participants begin and complete the program together.

The courses are functionally integrated, and the broad curriculum objectives are similar in each of the executive track programs. All are oriented toward applied learning and are highly interactive, making extensive use of experiential learning techniques. Emphasis and depth of subject material within the curriculum varies somewhat from program to program depending on the intended student group. All programs result in the same Master of Business Administration degree as the full-time MBA.

Admissions Criteria: Primary consideration is given to the applicant’s professional achievements and recommendations from the applicant’s organization. Applicants must meet the minimum requirements of the Graduate Council and submit transcripts of all undergraduate and graduate work. Applicants may need to take the Graduate Management Admission Test (GMAT) (see specific program descriptions). No specific cut-off score exists for either grade-point averages or GMAT scores; however, admission is competitive, and applicants will be evaluated on their ability to operate on a par with other high achieving participants. Students whose native language is not English must take the Test of English as a Foreign Language (TOEFL) unless they are U.S. citizens or have earned a degree from an accredited U.S. college or university within the past two years. A minimum TOEFL score of 213 on the computer-based test is required for admission to graduate study.

Prerequisites: Although there are no specific course prerequisites for admission, undergraduate studies and professional experience should demonstrate ability with both qualitative and quantitative work.

Transfer Credits: Because of the integrated nature of the executive track curricula, no credit hours may be transferred as substitutes for program curriculum.

Other Requirements: Other requirements are the same as those for the full-time MBA program.

Professional MBA Program
The weekend professional MBA is provided for fully-employed managers within commuting distance of the University of Tennessee. The group of students for whom this program is designed has approximately five years of work experience. The emphasis in this program is to provide a good grounding in the quantitative and qualitative tools of various business functions and a good basis in strategic thinking. Learning is expanded through applying these tools within the student’s own organization through a structured project each semester. The professional MBA is the right choice for individuals who wish to enhance their position within their organization by broadening their business knowledge beyond the functional area in which they are currently employed.

The professional program is three consecutive semesters completed in 16 months. Classes meet all day on Saturdays and occasionally on Friday evening and/or Sunday afternoon. The program begins in August with an intensive week of classes, then continues with weekend classes. The final fall semester also includes an intensive week of courses in addition to weekend classes. Graduation is in December.

Applications are accepted for fall semester only. The application priority deadline is April 10.

Additional information on the professional MBA can be found at www.promba.utk.edu.

Executive MBA Program
The executive MBA is provided for a national audience of managers holding middle and upper level positions in organizations that support their attainment of an MBA degree. The students for whom this program is designed have at least 10 years of work experience and are currently in management positions. Typical students bring a greater knowledge of business fundamentals than is true of other MBA programs. The executive MBA places considerable emphasis on global business and on individual skills of leadership. The executive MBA also has a heavy emphasis on strategic thinking and leadership management concepts. The executive MBA is the right choice for individuals who are in positions of broad responsibility or who have been designated to fulfill such roles within their organizations in the future.

The executive MBA is three consecutive semesters completed in 12 months. The class meets in Knoxville for 11-day residence periods in alternate months starting in January and ending in December. The May residence period is a global business seminar of two weeks and is held in South America, Asia or Europe. Off-campus work includes synchronous distance learning classes and requires substantial and regular contact with faculty and other participants. The project work in the executive MBA is a large-scale management project running throughout the year. Program participants work with managers in their own organizations to choose a project of significant scale and scope. Each student project has a faculty advisor.

Applications are accepted for January entry only. The early application deadline is June 1, and the final application deadline is September 15. The GMAT may be waived.
Taiwan Executive MBA

The Taiwan Executive MBA is provided for a national audience of physicians. The students for whom this program is designed have an M.D. or D.O. degree with five or more years of work experience. The curriculum objectives are the same as those for the executive MBA, but in the Taiwan Executive MBA, many of the functional skills are taught in the context of the health care industry, and there is specialized content related to the health care environment. The physician executive MBA is the right choice for physicians who want to have a voice in the health care industry and in their own careers and are seeking a program that allows them to continue their practice while earning their MBA degree.

The physician executive MBA is three consecutive semesters completed in 12 months. The class meets in Knoxville for 8-day residence periods in January, April, August, and December. Between residence periods, synchronous distance learning classes are held each Saturday morning, and there are asynchronous internet learning sessions each week.

Applications are accepted the first week of January. Applicants to the physician executive MBA are not required to take the GMAT. Additional information on the physician EMBA can be found at www.pemba.utk.edu.

Physician Executive MBA

The physician executive MBA can be found at www.pemba.utk.edu.

Physician Executive MBA

Business Administration
body of knowledge for rapid introduction of new products to the marketplace. The objective of the dual degree program is to prepare graduates to take a leading management role in companies that must react quickly to a dynamic market where forces of competition require rapid changes in design and manufacturing and a short product development cycle.

Admission Requirements

Applications are accepted for fall semester only. Applicants for the M.S.-MBA program must make separate application to, and be competitively and independently accepted by, Graduate Admissions for the Master of Business Administration degree program and the Master of Science degree program with a major in Engineering Science, Industrial Engineering, or Mechanical Engineering, and by the Dual Program Committee.

Students will initially apply for the MBA program, indicating on their application the intent to pursue the dual M.S.-MBA program and the appropriate engineering major (refer to the M.B.A. program for separate instructions). Students accepted for both the MBA and one of the engineering degree programs will be assigned to Dual Program Committee advisors, who will be responsible for course approval and supervision of the students' progress through the dual program.

Applications from U.S. citizens and permanent residents received after the MBA application deadline (March 1) will be considered as space allows. Additional information is required and different application dates are established by Graduate Admissions for international students.

Curriculum

All engineering students enrolled in the dual program must complete common coursework designed to provide them with an integrated, multidisciplinary teamwork experience. The M.B.A. curriculum consists of 33 hours of common coursework in the College of Business Administration and 15 hours of common coursework in the College of Engineering. Engineering common coursework includes a culminating 3-hour integrated project course requiring a comprehensive report, and a final examination as required by the Dual Program Committee, to be taken during the first session of summer following the second year.

During the second year dual degree candidates will take courses in their engineering major. The coursework for each option is designed to provide students with a concentration in their major and advanced skills to accomplish their teamwork assignments.

Dual degree candidates enrolled in Engineering Science option are required to take 18 hours of graduate level engineering courses during the second year of the program. This option requires a coursework plan, approved by the Dual Program Committee, including a concentration such that the student can accomplish his/her teamwork assignments.

Curriculum for Dual M.S.-MBA Degree

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<tr>
<th>August - First Year</th>
<th>Fall - First Year</th>
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<tbody>
<tr>
<td>BA 511 MBA Core I</td>
<td>BA 512 MBA Core II</td>
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<tr>
<td>IE/ME 504 Product Development Process</td>
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<td>BA 513 MBA Core III</td>
<td>IE/ME 506 Product Selection and Evaluation</td>
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<td>IE/ME 508 Integrated Product, Process, and Manufacturing System Design</td>
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<tr>
<td>Summer — Internship</td>
<td>BA 514 Integrated Business Simulation</td>
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<td>BA 514 Integrated Business Simulation</td>
<td>IE/ME 509 Project Management</td>
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<td>IE/ME 509 Project Management 1</td>
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<td>Spring — MBA “hub” elective</td>
<td>Spring — Project Management</td>
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<tr>
<td>IE 511 Business Planning and Commercialization</td>
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<tr>
<td>IE/ME 509 Project Management 1</td>
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<td>5-12</td>
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<td>Summer (first session) — MBA Travel</td>
<td>Summer (first session) — MBA Travel</td>
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<td>IE/ME 594 Culminating Integrated Project Report</td>
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<td>TOTAL 63-69</td>
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*Students in manufacturing systems engineering concentration may substitute other selected IE courses for these courses.

For additional requirements for Master of Science degree with majors in Engineering Science, Industrial Engineering, or Mechanical Engineering, refer to program descriptions for those majors.

- The dual degree candidate must satisfy the curriculum and graduation requirements of the engineering major being pursued and the College of Business Administration. Students withdrawing from the dual degree program before completing both degrees will not receive credit toward graduation in either degree program for courses taken in the other degree program, except as such courses qualify for credit without regard to the dual degree program. The M.S. and the MBA degrees will be awarded upon successful completion of the requirements of the dual program.

Approval Dual Credit

A maximum of 15 hours of the common program courses completed in the College of Engineering may be counted toward the MBA degree program.

THE 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 a Ph.D. degree must be recommended for acceptance by the College of Business Administration to the Office of Graduate Admissions. Actual admission is based on the applicant’s overall standing compared with other applicants and with the number of vacancies in each department. The Graduate Council requires the Graduate Admissions 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 four 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 and fourth years require completion of courses, the comprehensive exam, and completion of the dissertation. 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 departmental faculty, 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. Students with strong teaching skills may be assigned their own classes. 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. Instruction takes the form of regular 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 six concentrations offered in the Ph.D. program:

- Accounting
- Finance
- Logistics and Transportation Management (Operations Management and Strategic Management)
- Marketing
- Statistics
- More detailed information concerning these specific areas is available by writing directly to each department or by accessing the College of Business Administration website.

Degree Requirements

Doctoral students must file a program of study that has been approved by their doctoral committee within one year of
completing their first year of doctoral studies. 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 are required to have a sound broad base on which to build their Ph.D. coursework. The departmental doctoral advisor will work with the student to determine what, if any, courses need to be completed. All such work is subject to approval by the temporary doctoral advisory committee and the Dean of the MBA Program. Specific concentrations may have prerequisites.

3. 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 must 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.

4. 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 9 hours of dissertation seminar. 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, logistics/transportation, management, operations management and strategic management, and psychometrics. See the appropriate fields of instruction for specific course requirements.

5. A minimum of 5 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 six concentration business areas listed above, economics, or a related area in another school or college of the University.

Comprehensive Examinations
Comprehensive written examinations over the concentration area are required of each person seeking candidacy for the Ph.D. degree. This examination is administered in two sessions of approximately four hours each. Students qualify in the cognate area by completing a one-session, four-hour examination or an equivalent jointly approved by the student's major professor and the student's advisory committee, representing the cognate area. 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 completed 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 Council policy, the student and the major professor identify a doctoral committee composed of at least four faculty members, three of whom, including the chair, 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.

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 at least one full semester prior to the date the degree is conferred. (Admission in the fall term and graduation in the following spring semester.)

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 area). 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 before submission to the Office of the University Registrar.

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.

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 on an in-state basis. The Ph.D. in Business Administration is available to residents of Alabama, Florida, Kentucky, or West Virginia; the MBA is available to residents of Alabama, Florida, Kentucky, Louisiana, Texas, Virginia, or West Virginia. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

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

Business Administration

GRADUATE COURSES

501 MBA Career Development (1) Career opportunities available in each area of concentration. Prereq: Admission to MBA program or consent of Assistant Dean of MBA Program.

506 Enterprise Process Redesign (3) Enterprise Resource Planning (ERP) software as primary tool for redesigning business processes. Management methods required to facilitate redesign. Change management, consensus management, project management, and implementation methodologies. Configuration of ERP module and business-to-business e-commerce tools. (Same as Information Management 501.)

510 Customer Responsive Management (3) Management methods that provide flexibility required to respond to diverse customer needs and to adapt to competitive, technological, and operational change. Mass customization, interactive marketing, capacity management, and relationship management for industries; health care, consulting, temporary services, professional services, repair services, truck load transportation, emergency response organizations, customer service centers and other responsive organizations.

511 MBA Core I (3) Essential skills of manager: basic information technology skills, team building, and written and oral communication skills. Finance and accounting fundamentals. Introduction to integrated value chain. Prereq: Admission to MBA program or consent of Assistant Dean of MBA Program. S/N only.

512 MBA Core II (15) Development of roles and responsibilities of business managers. Functional fundamentals: marketing, operations, human resource management. Continuous systems improvement and delivery of customer value. Role of firm in society: stakeholder value, economics, and ethical and legal environment of firm. Personal leadership skills, and assessment of students' leadership abilities. Integration of value chain: demand management, operations management, process design and management, and logistics management. Prereq: 511 or consent of Assistant Dean of MBA Program.

513 MBA Core III (9) Continuation of the functional fundamentals from 512. Integration of value chain: supply management and resource management. Capstone integrated experience using information technology. Prereq: 511 or consent of Assistant Dean of MBA Program.

514 Integrated Business Simulation (3) Computer simulation. Teams manage business within competitive marketplace. Prereq: 511, 512, and 513 or consent of Assistant Dean of MBA Program.


551 Executive Core I (12) Integrated course with substantial reading, study and analyses during off-site periods. Exploration of business functions through strategic and business process perspective. Application of functional knowledge to tactical and strategic issues. Development of purpose of firm as delivering value to customers and other stakeholders. Ethics, environmental issues, financial and accounting principles. Economic and regulatory environment of business. Human resource and organizational behavior topics in context of current business systems and objectives. Personal development for leadership: individual personal skills of
522 Leveraging Information Through Descriptive and Prescriptive Modeling (3) (Same as Management Science 551.)
523 Geographic Software Design (3) (Same as Geography 510.)
522 Geographic Information Management and Processing (3) (Same as Geography 517.)

Chemical Engineering

(College of Engineering)

MAJOR DEGREES
Chemical Engineering ...................... M.S., Ph.D.
John R. Collier, Head
Professors:
Bieniokowski, Paul R., Ph.D. ............... Purdue
Collier, John R., Ph.D. .................. Case Western
Counce, Robert M., Ph.D. .................. Tennessee
Cummins, Peter T., (Distinguished Scientist), Ph.D. .............. Melbourne
Frazier, George C., Jr. (Emeritus).
D.Eng. ......................... Johns Hopkins
Moore, Charles F. (Alumni Prof.), Ph.D. ...................... Northwestern
Associate Professors:
Bruns, Duane D., Ph.D. ...................... Houston
Chialvo, Ariel (Research), Ph.D. .......... Clemson
Cui, Shen Ting (Research), Ph.D. ........ Virginia
Petrovian, Simoian (Research), Ph.D. ................. Iasi Tech
Pozhar, Ludmilla (Research), Ph.D. .............. NAS Ukraine
Wang, Tse-Wei, Ph.D. ........................ MT
Weber, Frederick E., Ph.D. ................. Minnesota
Assistant Professors:
Edward, Brian J., Ph.D. ..................... Delaware
Frymier, Paul D. (Liaison), Ph.D. .......... Virginia
Kefter, David J., 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

Thesis Option: 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 hours chosen from either of these two categories.
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.

Non-Thesis Option: 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 hours chosen from either 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.

Departmental 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 an 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.

CERTIFICATE IN MAINTENANCE AND RELIABILITY ENGINEERING

The College of Engineering offers a certificate program in maintenance and reliability engineering. The program is designed primarily for part-time students in that several of the courses are available through distance education.

The 12-credit certificate is earned by completing 483 and 484, which are cross-listed among all participating departments in the College of Engineering, plus two elective
courses selected from a list of courses provided by the participating departments. Currently, the available elective courses are Chemical Engineering 561, Industrial Engineering 516 and 591, Mechanical Engineering 534 and 599, and Nuclear Engineering 579 and 585. The selection of elective courses is determined through an advising conference with each individual student, and is based on the student’s personal interests, academic background, and work experience. Applicants must meet the minimum criteria established by the Graduate Council.

GRADUATE COURSES


467 Honors: Engineering Internship in Process Control (3) Advanced projects in small groups on industrial problems in process dynamics and control. Directed by faculty and engineers from host company. Prereq: Process Dynamics and Control and consent of instructor.

477 Honors: Applied Process Automation Laboratory (3) Interfacing flexible batch continuous processes to automation systems. Top down analysis with bottom up implementation, hierarchical structures and object oriented concepts used to design automation solutions: human-machine-interfaces. Workstations with modern industrial equipment, interactive graphics and visualization environment. Prereq: Process Dynamics and Control and consent of instructor.

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

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

507 Application of Linear Algebra in Engineering Systems (3) Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of systems matrix eigenvalue problems and similarity transformations in solving difference and differential equations; numerical stability of algorithms, various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects, B.S. graduate standing or consent of instructor. (Same as Electrical and Computer Engineering 507, Materials Science and Engineering 507, and Mechanical Engineering 507.)

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


541 Polymer Rheology (3) (Same as Materials Science and Engineering and Engineering.)

542 Diffusive and Stagewise Mass Transfer Operations (3) Analysis of mass transfer phenomena in packed towers and agitated vessels, membrane separations. Equilibrium stage concepts applied to mass transfer operation, emphasizing nonisothermal and multicomponent systems.

547 Transport Phenomena (3) Unified treatment of momentum transport (fluid flow), energy transport (heat conduction, convection, and radiation) and mass transport (diffusion). Fundamental basis of transport phenomena and momentum transport: viscous, viscoelastic, and potential flows. F

548 Transport Phenomena II (3) Unified treatment of momentum transport (fluid flow), energy transport (heat conduction, convection, and radiation) and mass transport (diffusion). Energy transport and mass transport coupled: chemical reactor systems, interactions between transport processes, and prediction of transport parameters. Sp

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


575 Applied Microbiology and Bioengineering (3) Microbial systems: metabolic processes, cellular biochemical and environmental engineering. Commercial processes, biodegradations wastewater treatment, waste minimization/management, and immobilization methods. Fundamental laboratory techniques during 6-week laboratory period. (Same as Environmental Engineering 575 and Biosystems Engineering 575.)


581 Industrial Pollution Prevention (3) Principles and practical aspects of industrial waste minimization. Regulatory environment, waste minimization strategies, economic analysis, process safety, case study: analysis of waste minimization and pollution prevention technologies. Prereq: Graduate standing in engineering or consent of instructor. (Same as Environmental Engineering 581 and Engineering Science 585.)

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

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

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

631 Advanced Topics in Statistical Thermodynamics and Molecular Dynamics (3) Statistical thermodynamics, molecular based computer simulations, Monte Carlo and molecular dynamics calculations and applications to supercritical fluids, macromolecules and biological systems. Prereq: 532.


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

647 Advanced Transport Phenomena (3) Theory of mass, momentum, and energy transport in reactive and non-reactive systems. Formulation of transport models useful for application to analysis and design of separation processes, and chemical and biochemical reactors. Prereq: 565, 547.


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 signal analysis, model development (deterministic, stochastic, phenomenological), sensitivity and limitations of approach. Prereq: 575 or consent of instructor.

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

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**Chemistry (College of Arts and Sciences)**

**MAJOR**

**DEGREES**

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

Michael Sepaniak, Head

Professors:

Adcock, J. L., Ph.D. ................................ Texas

Alexandrotos, S. D. (Hoechst-Celanese) ........................................... Ph.D.

Baker, D. C. (Paul and Wilma Ziegler Prof.), Ph.D. ............... Ohio State

Barnes, C. E., Ph.D. ....................................... Stanford

Bartmess, J. E., Ph.D. ....................................... Northwestern

Bloor, J. E. (Emeritus), Ph.D. ....................................... Manchester

Bull, W. E. (Emeritus), Ph.D. ....................................... Illinois

Chambers, J. Q., Ph.D. ....................................... Kansas

Cook, K. D., Ph.D. ....................................... Wisconsin

Eastham, J. F. (Emeritus), Ph.D. ....................................... California

Feigler, C. S., Ph.D. ....................................... Colorado

Fletcher, W. H. (Emeritus), Ph.D. ....................................... Minnesota

Grimm, F. A. (Emeritus), Ph.D. ....................................... Cornell

Guiochon, G. (Distinguished Scientist), Ph.D. ......................... Purdue

Kovac, J. D., Ph.D. ....................................... Princeton

Koc, D. C. (Emeritus), Ph.D. ....................................... Yale

Larsen, J. Z., Ph.D. ....................................... Wesleyan

Lie tze, M. H. (Emeritus), Ph.D. ....................................... Wisconsin

Magid, L. J., Ph.D. ....................................... Tennessee

Magn, R. M., Ph.D. ....................................... Yale

Mays, J. W. (Distinguished Prof.), Ph.D. ....................................... Wisconsin

Pagni, R. M., Ph.D. ....................................... Wisconsin

Peterson, J. R. (Emeritus), Ph.D. ....................................... California

Schweitzer, G. K. (Distinguished Prof.), Ph.D. ......................... Illinois

Van Sea, J. D., Ph.D. ....................................... Iowa State

VanHook, W. A. (Paul and Wilma Ziegler Prof.), Ph.D. ............... Johns Hopkins
Wehry, E. L. (Emeritus), Ph.D. ......... Purdue
Chemistry (except for the chemical physics 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 601.
5. 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, 570-71-72-73, and 590-94-95.
6. A final oral examination.
The Ph.D. program with concentration in chemical physics is conducted jointly with the Department of Physics. Requirements consist of the choice of the major department. Chemistry departmental requirements include passing the above degree requirements in chemistry with concentration in chemical physics 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 5.

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 Inorganic Chemistry. Sp
471-81 Biophysical Chemistry (3) (Same as Biochemistry and Cellular Molecular Biology 471-81.)
473-83 Physical Chemistry (3, 3) Students may not receive credit for both 471 and 473 nor for both 481 and 483. 473 - Properties of gases; first, second and third laws of thermodynamics; chemical equilibria; simple partial equilibria; properties of solutions; 483 - Introduction to statistical thermodynamics; kinetics of chemical reactions; introduction to quantum mechanics and applications to electronic structure of atoms and molecules; molecular spectroscopy. Prereq: General Chemistry, Elements of Physics or Fundamentals of Physics: Electricity and Magnetism, and Calculus III. F, Sp
479-89 Physical Chemistry Laboratory (2,2) Experiments on topics discussed in 471-81 or 473-83. Prereq or coreq: Corresponding courses 471 or 473 for 479 and 481 or 483 for 489. 1 lab. 479-E, 489-Sp
500 Thesis (1-15) P/NP only. E
501 Chemistry Seminar (1) Lectures and discussion on current research. May be repeated. Continuous registration required for residents graduate students. S, NC only. F, Sp
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
505 Special Problems (3) Specialy assigned theoretical or experimental work on problems not covered in other courses. Prereq: Consent of department. May be repeated. Maximum 6 hrs. S/NC only.
510 Analytical Spectrometry (3) Principles and practice of optical and mass spectrometric techniques in quantitative chemical analysis. Prereq: Background: Two semesters of physical chemistry.
511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena. Required background: Two semesters of physical chemistry.
512 Electroanalytical Chemistry (3) Fundamentals of electroanalytical processes; principles and practice of electroanalytical techniques in quantitative chemical analysis and applied to study of chemical systems. Required background: Two semesters of physical chemistry.
530 Chemical Bonding (3) Wave mechanical atom, group theory, quantum approach to molecular orbital theory, valence, ionic, and metallic bonding, ligand field theory, solid state. Required background: One semester of inorganic chemistry. F
531 Characteristics of Inorganic Compounds (3) Descriptive chemistry of elements; structure, reactions, kinetics, mechanisms, equilibria, and spectra of coordination, organometallic, and inorganic compounds. Required background: One semester of inorganic chemistry. F
532 Experimental Methods of Inorganic Chemistry (3) Electronic, infrared, Raman, microwave, NMR, ESR, X-Ray crystallography, quadrupole, Mossbauer, mass, and photoelectron spectroscopies for characterization of inorganic compounds. Required background: One semester of inorganic chemistry. F
540 Nuclear and Radiochemistry (3) Nuclear properties, radioactivity, radioactive decay processes, nuclear structure and models, nuclear reactions, radiations and matter, radiation detection. Required background: Two semesters of physical chemistry.
550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, stereochemistry, conformational analysis, and molecular mechanisms; substituent effects on acidity and reactivity, introduction to reaction mechanisms. Required background: Two semesters of organic chemistry. F
552 Organic Reaction Mechanisms (3) Techniques and principles in study of organic reaction mechanisms; applications and interpretations in polar, radical, and pericyclic reactions; active intermediates. Prereq: 550. Sp
553 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry. Required background: Two semesters of organic chemistry. F
554 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS and multinuclear FTNMR spectrometers, Development of problem-solving ability in area of spectroscopic characterization of organic molecules. Prereq: 360 or equivalent. Coreq: 553. F
570 Quantum Chemistry and Spectroscopy (3) Basic principles of quantum mechanics and their applications to molecular orbital theory, molecular structure, and spectroscopy; introduction to group theory. Required background: Two semesters of physical chemistry. F
571 Advanced Quantum Chemistry and Spectroscopy (3) Prereq: 570. F
572 Thermodynamics and Statistical Mechanics (2) Macroscopic and microscopic description of equilibrium systems. Basic principles of thermodynamics and statistical mechanics, and application to selected chemical systems. Required background: Two semesters of physical chemistry. F
573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory. Required background: Two semesters of physical chemistry. F
590 Polymer Chemistry (3) Fundamentals of polymer synthesis and characterization through application of organic and physical chemical principles. Required background: Two semesters of physical chemistry.
Assistant Professors:
Brandon, Denise, Ph.D. ................. Tennessee
Devereaux, Matt, Ph.D. ................. Tennessee
Moran, Mary Jane, Ph.D. ........... New Hampshire
Wass, Tara, Ph.D. ...................... Denver

The Department of Child and Family Studies provides coursework in human development and family studies. Integration of these areas creates a unique perspective for the study of individuals and families. Each graduate student’s program of study is carefully planned in conjunction with a faculty committee to establish a program consistent with program requirements and a student’s individual goals. All programs are characterized by a broad array of coursework, varied research experiences, and opportunities for experiences in applied settings.

ADMISSION REQUIREMENTS
A completed file for review includes a departmental application, Graduate Record Examination (GRE) scores for the general section, and completion of three Graduate Rating Forms by individuals who can attest to the applicant’s potential for graduate education. Forms may be obtained from the department.

Admission to the program is contingent upon faculty evaluation of GRE scores, undergraduate/graduate GPA, rating forms, work experience, and the match between student’s goals and department’s foci.
Prerequisites for admission to the master’s program are 9 semester hours of upper division undergraduate social science.
Prerequisites to the doctoral program are a master’s degree from a regionally accredited institution or equivalent, completion of the 18-hour core in the CFS master’s program (or appropriate substitutions), 3 hours of computational-based, graduate-level statistics, 3 hours of graduate-level research methods, and completion of a thesis as part of the master’s degree. The department provides a remedial mechanism for doctoral students who have earned a master’s degree but have not met the other prerequisite requirements.

THE MASTER’S PROGRAM
The Master of Science degree with a major in Child and Family Studies provides a broad foundation in the understanding of how children develop and how families function in today’s society. Two concentrations are available in child and family studies or in early childhood education.

Child and Family Studies requires a minimum of 36 credits of coursework: 18 credits in core coursework and 18 credits in specialization. Core requirements include: 510, 511, 540, 550, 552, and 562. Students then choose either the thesis option (research) or the non-thesis option (practice; internship or equivalent coursework). The non-thesis option is only available. All students in the early childhood education licensure program must enroll in Human Ecology 574, 575, 591, and Child and Family Studies 569. Students select one course from 511, 520, 521, 522, 525, 530, 540, 590; 3 hours of 500-level statistical methods or interpretation of statistics or research methods (requirement may be met with 569); and written comprehensive examination (36 credits).

THE PH.D. CONCENTRATION
The department participates in the doctoral program with a major in Human Ecology, concentration in child and family studies. Two themes are highlighted: the integration of human development and family studies and concentration in a selected area of study. A doctoral program that is concurrently specialized and integrative in nature reflects the complexity of the disciplinary subject matter, provides a broader context to formulate theoretical questions, and broadens the empirical literature for addressing those questions.

Requirements include:
2. Completion of the doctoral core: 640, 634, 691 or 650.
5. Three credits of advanced statistics.
6. Minimum 3 credits in specialized research methods.
7. Selection of one of the following specializations: teaching in higher education (requires UT GTA seminar, 3 credits of college teaching methods, and one semester of supervised teaching experience);
administration in community services (requires 566 or 563, 521 or HRD 512 or SW 541, and one semester of an administrative apprenticeship); research emphasis (requires 6 additional credits in research methods or statistics).

8. Minimum of 6 credits in a cognate area.
10. Minimum of 96 credits beyond the bachelor's degree.

GRADUATE COURSES

500 Thesis (1-15) P/ NP only. E
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
505 Development of Interpersonal and Supervision Skills (3) Refinement of interpersonal skills needed to work with families and other professionals. Supervisory training in others’ skill development, active listening, self-disclosure, relationship building, and negotiation. Skills adapted for use among family members.
510 Theory in Human Development (3) Theoretical models of human development: cognitive, social, learning, and ecological theory; analysis, synthesis, and discussion. Prereq: 505. 402 hrs graduate coursework in child and family studies; development of research: validity, reliability, causality, and generalizability. Preprq: 6 graduate hrs in major, or consent of instructor. May be repeated with different topics. Maximum 9 hrs. E
581 Directed Study in Human Development or Family Studies (1-3) Individual learning experiences in specific topics in child development or family development. Prereq: 6 graduate hrs in major or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E
591 Clinical Studies (1-6) Group and individual seminars focusing on the study and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.
600 Doctoral Research and Dissertation (3-15) P/ NP only. E
610 Advanced Special Topics in Human Development or Family Studies (1-3) Study of research and theory related to current issues. Preprq: 12 graduate hrs in major or consent of instructor. May be repeated with different topics. Maximum 6 hrs.
620 Advanced Directed Study 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.
631 Adolescent Development in Families (3) Normative and nonnormative adolescent development: physical, cognitive, moral, social, familial, sexual, and personality. Prereq: 510. 402 hrs graduate-level statistics. E
633 Survey Design and Analysis (3) (Same as Sociology 633.)
634 Advanced Survey of Family Theory and Research (3) Conceptualization, analysis, and critical assessment of pertinent conceptual and empirical literatures at advanced level for variety of contemporary family issues. Prereq: 570, master’s core. Required background: 6 hrs graduate-level statistics.
640 Advanced Theory in Human Development (3) Original conceptualizations and current theoretical perspectives influencing field of human development and empirical evaluations of these perspectives. Prereq: 550, 510, 511, or consent of instructor.
650 Advanced Qualitative Research Methods (3) Techniques and data analysis in qualitative research in human development and family studies. Use of methods: in-depth interviewing, participant observation, and case studies. Prereq: Communications 642 or Psychology 610.
670 Secondary Analysis of Survey Data (3) Applied seminar in secondary analysis of survey data. Identification of data archives, accessing data, evaluation, and analysis of social science survey data. Nationally representative data sets (e.g., NLSY, NELS, student survey, or youth, or children. SPSS analytic software. Preprq: 570 or equivalent, Statistics 532 or 537 or equivalent.
691 Analytic Reasoning (3) Analysis of quantitative methods and measures used in human development and family studies: data validity, reliability, and generalizability. Preprq: 570. Required background: 9 hrs graduate coursework in family and child studies, and 6 hrs graduate-level statistics.
Civil and Environmental Engineering

(College of Engineering)

MAJORS DEGREES

Civil Engineering ................. M.S., Ph.D.
Environmental Engineering .......... M.S.
(Ph.D. through Civil Engineering)

Gregory D. Reed, Head

Professors:

Bennett, R. M., PE, Ph.D. .................... Illinois
Burdette, E. G. (Fred N. Peebles Prof.), PE, Ph.D. ................. Oregon
Chatterjee, A., PE, Ph.D. ................. NC State
Davis, W. T., Ph.D. ....................... Tennessee
Deatherage, J. H., PE, Ph.D. .......... Texas Tech
Drumm, E. C., PE, Ph.D. ................ Arizona
Goodpasture, D. W., PE, Ph.D. .......... Illinois
Grecco, W. L. (Emeritus), Ph.D. .......... Michigan State
Heathington, K. W. (Emeritus), Ph.D. ......... Northwestern

Associate Professors:

Cox, C. D., Ph.D. ......................... Penn State
Han, L. D., Ph.D. ...................... California
Miller, T. L., PE, Ph.D. .................. Tennessee
Penumadu, D., Ph.D. .................... Georgia Tech
Richards, S. H., PE, Ph.D. ............... Tennessee
Robinson, K. G., Ph.D. .................... VPI

Assistant Professors:

Chu, K., Ph.D. ....................... California
Huang, B., Ph.D. .................... Louisiana State

The Department of Civil & Environmental 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, waste management, and environmental risk assessment. For further information, visit the website at http://www.engr.utk.edu/civil/.

THE MASTER'S PROGRAM

The Master of Science programs in Civil Engineering and Environmental Engineering are offered to graduates of recognized undergraduate 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 and Environmental 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 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: Engineering Fundamentals 101, 102; Nuclear Engineering 203 or Mechanical Engineering 331; Basic Engineering 121, 131; Engineering Science and Mechanics 231; Statistics 251; Civil Engineering 390, 395, 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 and Environmental Engineering offers both thesis and non-thesis options for work toward the Master of Science in Environmental Engineering.

Thesis Option: The student must present a minimum of 30 semester hours of approved graduate courses. The major shall include 6 semester hours of thesis and a minimum of 15 semester hours of approved environmental engineering coursework. 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 18 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 undergraduate 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 efforts.
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.

MINOR IN ENVIRONMENTAL POLICY

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

Civil Engineering

GRADUATE COURSES

421 Portland Cement Concrete Mix Design and Analysis (3) Aggregate properties and tests, tests of Portland cement and concrete, mix design methods, admixtures, and nondestructive testing. Prereq: 321. 2 hrs and 1 lab.
451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; application of various engineering principles and techniques to process of planning, locating and design of highway facilities; both geometric and pavement design. Prereq: 210, 251, 352.
452 Traffic Engineering (3) Characteristics of driver, vehicle, and roadway and their interrelationship; traffic studies; basic considerations of traffic circulation and control, lighting, capacity analysis, roadway safety analysis and design. Prereq: 210, 251, 352.
453 Airport/Railroad Planning and Design (3) Airport master planning and railroad engineering. Runway configuration, airfield capacity, geometrics and terminal layout and design. Railroad capacity, geometrics and system layout and design. Prereq: 210, 251, 352.
472 Steel Design (3) Design of plate girders and composite beams; consideration of members subjected to combined stresses; design of typical framed building, connections. Prereq: 471.
474 Reinforced Concrete Design (3) Design of continuous beams, floor slabs, and columns with combined axial loads and torsion and design for torsion. Prereq: Introduction to Structural Design.
485 Principles of Hydrogeology (3) (Same as Geological Sciences 485).
490 Water Resources Project Design (3) Coherent development of multipurpose reservoir and dam project, data acquisition; spillway and outlet works design; earth and gravity dam stability analyses; drains and
538 Finite Element Applications in Geotechnical Engineering (3) Applications of finite element method to typical problems in geotechnical engineering. Confining and unconfined flow through porous media, stresses and strains in elastic halfspace; representation of nonlinear soil behavior with elastic and elasto-plastic models; soil structure interaction effects. Prereq: Introduction to Structural Design.

539 Geotechnology Seminar (1) Seminar topics in geotechnical and geological engineering. Research contributions and case histories by graduate students and engineers and scientists from surrounding community. Prereq: Graduate standing and consent of advisor. May not apply toward degree. May be repeated. S/NC only.

540 Construction Management I (3) Management and organization of heavy and building construction projects. Prereq: Construction Methods and Equipment.

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

543 Construction Estimating (3) Project costs, estimating process, selection of market conditions, and feasibility of design to cost. Prereq: Construction Methods and Equipment.

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

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

553 Geometric Design and Layout of Roadways and Community Facilities (3) Functional and geometric design of roads and streets; identification and correction of high-accident locations and system deficiencies. Prereq: 552 or 452.

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

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control programs: machine hardware and design 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 and 556.

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, modeling of demand, proposing alternatives; limit analysis; planning and design of transportation system. Prereq: 554 or graduate standing. (Same as Planning 537.)

560 Special Problems in Civil Engineering (1-6) Selected advanced problems of current interest. Prereq: Consent of instructor. May be repeated.

561 Computer-Aided Structural Analysis (3) Fundamental concepts of computational methods used in structural analysis; matrix and finite element methods; practical application of structural analysis software. Prereq: Structural Analysis and Matrix Computation or equivalent.

562 Structural Systems (3) Structural system analysis and design; dead, live, wind, and earthquake loads on buildings; analysis of structures; use of computers in analysis and design. Prereq: Introduction to Structural Design.

563 Statically Indeterminate Structures (3) Elastic analysis of indeterminate articular and rigid frames with non-prismatic members using energy, slope-deflection, and moment distribution methods; plastic analysis of rigid frames; and stability analysis of compression members and portal frames. Prereq: Structural Analysis II.
Environmental Engineering

GRADUATE COURSES

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

502 Registration for Use of Facilities (1-15) Required for the student to be otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

510 Environmental Protection (3) Managing of water resources, wastewaters, 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 and non-uniform flow; flow in pipes; open channel design; unsteady flow theory and analysis: dynamic routing; spatially varied flow; non-linear alignment micromotions; applications, featuring HEC-2 model. Prereq: Hydraulics.

522 Floodplain and Urban Flood Management (3) Review of national, regional, and local flood problems: state of the art flood damage reduction alternatives: structural and non-structural: institutional responses, policies, programs, organizations, regulations, and legal aspects; floodplain hydrology and hydraulics, HECH-1, HECH-2: floodway encroachment, flood hazard zone and damage potential determinations; cast studies. Prereq: Hydraulics or consent of instructor for non-majors.

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

525 Soil Erosion and Sediment Yield (3) Theory of soil erosion and sediment yield processes from disturbed land; methods and computer models for estimating erosion and sediment yield; sediment conservation and management practices. Local and state regulations. Prereq: Civil Engineering 395. (Same as Biosystems Engineering 525). S/NC only.

530 Urban Hydrology and Stormwater Engineering (3) Planning, design, modeling, management, and maintenance of urban stormwater systems. Theory and application of hydraulic and hydrologic principles to design of stormwater management systems; design of inlet structures, conveyance systems, detention/retention basins and appurtenances, and selected best management practices (BMP’s); evaluation of land-use changes of runoff quantity and quality; review, selection and application of contemporary computer models. Prereq: Hydraulics, Hydrology.

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 and Hydrology or Civil Engineering 485 for geology majors. (Same as Geological Sciences 535.)

543 Instrumentation and Measurement (3) (Same as Biosystems Engineering 543.)

545 Monitoring Hydrologic Phenomena (3) (Same as Biosystems Engineering 545.)


552 Biological Treatment Theory (3) Theory and design applications of biological processes to treatment of wastewater and solid wastes. Prereq: Water and Waste Treatment, and 1 lab. (Same as Biosystems Engineering 552.)

553 Aquatic Chemistry (3) Theoretical, applied and analytical chemistry related to generation, measurement and treatment of environmental contaminants. Prereq: General Chemistry. 2 hrs and 1 lab.

554 Environmental Engineering Chemistry (3) Application of chemical principles in analyzing chemical, or biological interactions of chemical contaminants in various environmental compartments: atmosphere, hydrosphere, and lithosphere. Prereq: One year chemistry and consent of instructor.

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.

557 Hazardous Waste Site Remediation (3) Advanced study of processes for hazardous waste site remediation: soil vapor extraction, soil washing, chemical destruction, thermal destruction, bioremediation. Prereq: 556 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 emission of gaseous and particle air pollutants. Comprehensive design of specific devices and systems. Prereq: 570.

572 Air Quality Dispersion Modeling (3) Diffusion in atmosphere; application of atmospheric dispersion models and evaluation of meteorological and air quality data. Prereq: 570.

573 Sampling of Air Pollutants (3) Standard sampling methods for particulate and gaseous air pollutant emissions from industrial processes; ambient air monitoring instrumentation/techniques. Prereq: 570.

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

581 Industrial Pollution Prevention (3) (Same as Chemical Engineering 581 and Engineering Science 585)

590 Special Problems in Environmental Engineering (1-6) Enrollment limited to environmental engineering students in 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.

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

651 Industrial Waste Unit Operations and Processes (3) Theoretical design and laboratory modeling of industrial waste treatment processes and operations. Prereq: 551, 553. Prereq or coreq: 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 earthen solids in environment. Methods of assessing risk posed by presence of those chemicals. Prereq: 551.

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

GRADUATE COURSES


405-06 Selected Readings from Greek Literature (3,3) 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.

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.

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: 351-352 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.

561 Special Topics in Classical Civilization (1-3) Advanced tutorial work in Greek and Roman authors in English translation; problems in cultures of Greece and Rome. May be repeated. Maximum 9 hrs. Letter grade or S/NC.

562 Problems in Old World Archaeology (3) Selected topics and research problems in European, Asian and African prehistory. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
Communications
(College of Communications)

MAJOR DEGREES
Communications .................................. M.S., Ph.D.

The College of Communications offers the Master 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: Associate Dean for Graduate Studies, College of Communications, 426 Communications Building, The University of Tennessee, Knoxville, TN 37996-0347.

ADMISSION REQUIREMENTS
Applicants must meet admission requirements of the Graduate Council. 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 at or above the fiftieth percentile in verbal, quantitative and analytical 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 Graduate Studies Committee of the College of Communications.

Master's 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.

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 and communications industry, with an emphasis on communications management and a deeper understanding of the communication process and social role of media. The program follows a broad-based multi-media approach while allowing the student to concentrate in one of five fields: advertising, broadcasting, journalism, public relations or speech communication. Both thesis and non-thesis options are available.

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

Students planning to pursue a doctoral degree with a major in Communications may be accommodated in the M.S. program through special academic advising.

Degree Requirements
The M.S. program emphasizes communications management and industry in the areas of advertising, journalism (publications), public relations, and speech communication. For the thesis option, a minimum of 30 hours of approved graduate work is required. The non-thesis option requires 33 hours. Orientation attendance is required:

1. Six hours of core courses—Communications 512 and 540 to be taken during the first two semesters of the student's program, except with written approval of the Associate Dean for Graduate Studies for the College.

2. Fifteen 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) 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 Advertising 598, Broadcasting 598, Journalism 598, or Public Relations 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 must 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 begin only in the fall semester. Orientation attendance is required.

The master's degree is required for entry into the doctoral program. 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 master's degree.

The following are normally minimal requirements for admission to full potential candidate status:

1. A 3.0 (4.0 system) grade-point average in undergraduate studies, and 3.5 for graduate work in a master's degree.

2. At or above the fiftieth percentile in verbal, quantitative and analytical aptitude on the Graduate Record Examination.

3. Endorsement by at least three former teachers or professional colleagues; and 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 87 hours of approved graduate work is required for the Ph.D.

1. Twenty-seven hours of core courses—Communications 612, 620, 640, 641; 6 hours of statistics; and three of the following courses: Communications 622, 632, 642, and 652.

2. Fifteen hours in a primary concentration (advertising, broadcasting, information sciences, journalism, public relations, or speech communication) supplementing the core. Courses may be taken in one or more of the Departments of Advertising, Broadcasting, Speech Communication, and/or the Schools of Information Sciences and Journalism.

3. Twelve hours in a secondary concentration (outside the College of Communications).


5. Twenty-four hours of dissertation. All courses require the approval of the 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.

Candidates without prior teaching experience must register for Communications 521, Tutorial in Communications Teaching.

Planned course offerings in the College of Communications for a full calendar year are available the preceding November. This information is available from the Graduate Studies Office, 426 Communications Building, 974-6851. See also courses listed under Advertising, Broadcasting, Information
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 on an in-state tuition basis. The M.S. program in Communications is available to residents of Arkansas or Kentucky. The Ph.D. program is available to residents of the states of Alabama, Arkansas, Louisiana, Virginia, or West Virginia. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

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 3.0 or higher 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 Associate Dean for Graduate Studies of the College of Communications on recommendation of the student's faculty committee.

GRADUATE COURSES

400 Mass Communications Law and Ethics (3) Legal issues directly affecting the mass media: libel, privacy, free press-fair trial, judicial controls, government regulations. Ethical standards and practices of mass media in America. Prereq: News Writing or Advertising Creative Strategy or Radio-TV News, Advertising Promotion or History of Rhetorical Theory or consent of instructor. (Same as Legal Studies 400.) E

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during the summer session who uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only, E

512 Mass Media Research Methods (3) Applications of communications research techniques for management. Gathering and analysis of data for assessing media audiences and message impacts. Prereq: Consent of instructor or admission to program. F

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

540 Communications Theory (3) Selected research hypotheses and theories in literature of mass communications. Prereq: Consent of instructor or admission to program. Sp

550 Seminar in Media Economics and New Technology (3) Electronic and print media ownership, finance and corporate structure. Roles of new technologies and marketing techniques in changing media content and function in future. Prereq: Consent of instructor or admission to program. Sp

551 Seminar in Science, Society, and the Mass Media (3) Investigation of interplay between scientific community and mass media: how scientific information reaches public and impact of journalism on scientific practice. Prereq: Consent of instructor.

552 Seminar in Health Communications (3) Methods, problems, and issues of communication in health field. Media's reporting of health issues. Setting of media's "health agenda"; strategic uses of media in social marketing efforts; public communication of complex social/medical issues. Prereq: Consent of instructor.

553 Seminar in Risk Communications (3) Interaction of scientists, journalists, and public on scientific, technological, and medical risks; analysis of methods for enhancing public understanding. Prereq: Consent of instructor.


590 Project (3) Capstone project under guidance of faculty. Application of principles from previous coursework. S/NC only.

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

597 Independent Study (1-3) Reading, research or projects on special topics in communication. On individual basis, under consent of faculty, with consent. May be repeated. Maximum 6 hrs. E

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

612 Fundamentals of Communications Research (3) Universal research process from defining ideas and problems to reporting results. 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. Sp

620 Seminar in Mass Communications Education (3) Role and scope of mass communications teaching unit, historical and curricular trends, testing 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. Su

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

632 Mass Communications History and Historiography (3) Origins and development of mass media in America. Philosophies of history. Historical sources and their verifications. Synthesis and interpretation of data. Prereq: 612 or consent of instructor. Su

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. Sp

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 of participant observation, life history, interviewing, archival analysis, and case studies. Prereq: 612 or consent of instructor. Su

652 Mass Communications Law and Legal Research (3) Legal restrictions under which mass media operate. Finding, interpreting and analyzing sources of legal information. Prereq: 612 or consent of instructor. Sp

692 Advanced Topics in Communications Theory and Methodology (3) Advanced study of communication issues, theories and methods. May use quantitative, qualitative, historical or legal approaches. May be repeated. Prereq: 622, 632, 642 or 652 or consent of instructor.
advanced study in biology such as biochemistry, mammalian anatomy, histology, cell biology, or other appropriate biomedical courses from an accredited university is recommended.

Applicants for admission to the Master of Science degree program whose background include not formal training in the biomedical field beyond the baccalaureate degree will be required to score at least 1000 on the quantitative and verbal portions of the Graduate Record Examination.

Doctor of Philosophy Degree Program

Applicants generally will be expected to have a professional degree in one of the medical sciences (e.g., M.D., D.D.S., DVM) or a master's degree in one of the biomedical sciences and a Graduate Record Examina-

The Master's Program

Core courses are required for the program. A basic science and/or applied science concentration must be selected at the first meeting of the student's master's committee. For the basic science concentration, students must take at least 4 credit hours in 500- or 600-level courses in basic mechanisms of disease and at least 6 credit hours of 500-level biochemistry or cell biology. See listings under the Biochemistry and Cellular and Molecular Biology program for information on these courses. For the applied science concentration, students must take at least 6 credit hours of 600-level epidemiology and at least 5 credit hours of 500- or 600-level statistics. In addition, students must complete a minimum of 8 hours of coursework in a specified discipline.

A comprehensive examination is given at the completion of coursework. A seminar and final oral defense of the dissertation culminate the program.

ACADEMIC COMMON MARKET

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

Comparative and Experimental Medicine--Veterinary Medicine

GRADUATE COURSES

Participating departments include: Animal Science, Comparative Medicine, Microbiology, Pathobiology, Large Animal Sciences, and Small Animal Clinical Sciences. Several faculty in the Department of Microbiology hold joint appointments in the College of Veterinary Medicine. See Microbiology under Fields of Instruction for additional courses.

Comparative and Experimental Medicine--Graduate School of Medicine

GRADUATE COURSES

Participating departments include: Anesthesiology, Medicine, Medical Genetics, Obstetrics and Gynecology, Pathology, Pediatrics, Radiology, and Surgery.

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E

503 Predictive Toxicology (3) Principles and techni-
530 Wildlife Diseases (2) (Same as Wildlife and Fisheries Science 530.) F

551 Mammalian Organology (3) (Same as Animal Science 551.) F

552 Anatomy of Domestic Carnivores (4) (Same as Animal Science 552.) 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 (1-15) P/ NP only. E

602 Surgical Pathology (1-2) Examination of biopsy specimens and interpretation of observations. Preparation of specimens for sectioning. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. E

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

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

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

606 Clinical Epidemiology (3) Theory and principles of design implementation and analysis of clinical research. Lab: appraisal of biomedical literature and design of proposal for clinical research project. Prereq: Consent of instructor. Sp

607 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (3) Advanced study of virus diseases important to domestic animals; virus biology, pathogenesis, pathology and diagnosis technical training in virus diseases diagnosis. Prereq: Consent of instructor. 2 hrs and 1 lab. Sp

608 Descriptive and Applied Epidemiology (3) Principles of epidemiology and historic and modern applications of disease transmission in animals. Host-agent relationships, measurement of disease frequency, animal production and disease monitoring and control. Field investigations, animal health economics. Prereq: Consent of instructor. F

609 Mechanisms of Disease (4) Advanced topics in pathobiology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, hemostasis. Principal biochemical and morphologic responses of various cells, tissues, and organs to injury and other metabolic derangements. Selected contemporary topics from current literature and textbooks. Prereq: Consent of instructor. Sp,A

610 Advanced Topics in Comparative and Experimental Medicine (1-3) Specialized in-depth experience in various disciplines. Current and future research methodology, recent advances in instrumentation in analytical techniques for comparative medicine. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. E

651 Advanced Topics in Animal Anatomy (1-4) (Same as Animal Science 651.) E

652 Disorders of the Endocrine System (2) (Same as Animal Science 652.) Sp,A

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**Comparative Medicine**

See College of Veterinary Medicine and Comparative and Experimental Medicine.

**Computer Science**

(College of Arts and Sciences)

**MAJOR**

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

Robert C. Ward, Head

**Professors:**

Dongarra, Jack, Ph.D. ............. New Mexico
Langston, Michael A., Ph.D. ........ Texas A&M
Poore, J. H., Ph.D. ................. Georgia Tech
Sherman, Gordon R. (Emeritus), Ph.D. Purdue
Thomason, Michael G., Ph.D. ........ Duke
Ward, Robert C., Ph.D. ............. Virginia

**Associate Professors:**

Berry, Michael W., Ph.D. ............. Illinois
Goros, Greg, Ph.D. ............. Aalborg (Denmark)
MacLennan, Bruce J., Ph.D. ........ Purdue
Plank, James S., Ph.D. ............... Princeton
Vander Zanden, Bradley, Ph.D. .... Cornell
Vose, Michael D., Ph.D. ............. Texas

**Assistant Professors:**

Huang, Jian, Ph.D. ................. Ohio
Straight, David W., Ph.D. ............ Texas

**THE MASTER’S PROGRAM**

Two semesters of calculus plus two additional semesters of college mathematics (e.g. linear algebra, differential equations, probability) and a course in discrete structures and in systems programming are 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. Computer Science 530, 550 and 580 are required for the degree. Graduate courses taken outside the department are sometimes 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 departmental office.

**Problems in Lieu of Thesis Option**

The student must reach agreement on the problem topic with a faculty advisor and pass an oral exam on the problems before a committee of three or more faculty members, at least two of whom must be Computer Science faculty.

**Master's Minor in Computer Science**

The graduate minor consists of any two of the three core courses (530, 560, 580) plus an additional 3 hours of graded computer science graduate-level courses at or above the 400 level.

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**THE DOCTORAL PROGRAM**

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

1. The student must 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 Office of Graduate Admissions.

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 (i.e., beyond 30 graduate credit hours) graded A-F. Computer Science 530, 560 and 580 are required for the degree. At least six hours of 600-level graded courses must be taken in computer science at UT. 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.

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**GRADUATE COURSES**

420 Advanced Topics in Machine Intelligence (3)

Search, learning, expert systems, neural networks, pattern recognition and natural language processing. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

430 Advanced Topics in Hardware Systems (3)

Architecture, parallel processors, microprogramming, networks and communications. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

460 Advanced Topics in Software Systems (3)

Operating systems, compilers, parallel computation, software engineering, database systems and programing languages. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

470 Advanced Topics in Scientific Computation (3)

Numerical methods, supercomputers and computer modeling and simulation of physical systems. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.
The Department of Consumer and Industry Services Management offers a certificate program in services management for students seeking continuing education and career advancement opportunities in the services industry. The 12-credit hour certificate is available by completing the following courses: Retail and Consumer Sciences 541, 538, Hotel and Restaurant Administration 532, and Recreation and Tourism Management 510.
Hotel and Restaurant Administration

GRADUATE COURSES

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

531 Advanced Financial Management (3) Financial planning, operations and evaluation techniques used in the foodservice and lodging management field: developing budgets, accounting systems and financial reports. Prerequisite: Food and Lodging Cost Control or consent of instructor. F

532 Human Resource Management in Services Industry (3) Analysis of significant organizational processes and practices in management of human resources within consumer product and service industries. Prerequisite: Consent of instructor. May be repeated. E

534 Special Topics in Foodservice and Lodging Administration (1-3) Lecture/discussion format. Contemporary developments and trends in industry. Prerequisite: Consent of instructor. May be repeated. F

535 Directed Study in Foodservice and Lodging Administration (1-5) Problems selected for study by student with guidance of faculty member. Prerequisite: Consent of instructor. May be repeated. Maximum 5 hrs. E

537 Seminar in Foodservice and Lodging Administration (1) May be repeated. S/NC only. F

542 Advanced Hotel Administration (3) Strategic management of hotel organizations. Theoretical and applied literature on formation and implementation of strategy; external and internal factors relevant for business and corporate level decisions. Consideration of role of marketing in hotel firms. Analysis of industry and case studies. Prerequisite: 531, 532, Sp or A

547 Field Experience (3-9) Experience in food- or lodging-related industry or agency under supervision of faculty member. Prerequisite: Consent of instructor. S/NC only. E

555 Foodservice and Lodging Law (3) Management organization and policy as imposed or granted by law. Legal research to determine legal principles at state and federal levels which impact industry. Prerequisite: Hospitality Law or equivalent, or consent of instructor. Sp or A

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

Recreation and Tourism Management

GRADUATE COURSES

415 Development and Maintenance of Recreation, Tourism and Athletic Facilities (3) Principles of administration, planning, design, and operation of maintaining various facilities. Elements of risk management and safety in design process. Prerequisites: 310 Development and Evaluation of Recreation and Tourism Programs or consent of instructor. (Same as Sport Management 415.) F

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

440 Dimensions of Commercial Recreation and Tourism Enterprises (3) Organizational structures, delivery systems, financing private enterprises and operating selected profit centers in a variety of settings. Market performance and economic impact. Prerequisite: 110 Recreation Foundations of Leadership, junior standing or consent of instructor. Sp

450 Special Topics in Leisure Education and Tourism (1-6) Special topics in recreation, therapeutic recreation and tourism. May be repeated. Maximum 6 hrs. E

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

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Trends and Issues in Services Management (3) Examination of current and emerging trends and issues in consumer product and service industries. Implications of trends and their managerial and strategic applications in services management. F

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

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

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

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

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

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

590 Graduate Internship (3-6) Required of all graduate students. Minimum 50 clock hrs for each hour credit. Work experience, evaluation by agency and university and written paper required. E

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

592 Special Topics in Recreation & Leisure Studies (1-6) May be repeated. Maximum 8 hrs. E

Retail and Consumer Sciences

GRADUATE COURSES

411 Entrepreneurship and Small Business Management (3) Concepts of entrepreneurship within single ownership and other business organizations; risk taking and risk management; management of small business; current issues and problems. Prerequisite: Marketing 301 Principles of Marketing, Accounting 202 Principles of Managerial Accounting.

412 Direct Retail Methods (3) Use of direct selling methods to sell goods and services. Analysis of consumers and product/service types for integrated direct retail methods. Direct mail, catalogs, telemarketing, infomercials, and electronic commerce (internet). Prerequisite: 376 Strategies for Growth.

415 Retail Promotion (3) In-store promotional activities; development of retail promotion strategies; evaluation of retail promotions; supplementary focus on advertising and other methods to communicate in-store promotions. Prerequisite: 376 Strategies for Growth.

450 Economics of Consumer Choice (3) Micro and macro economic approaches to consumer choice across life span; demographics; economic status of consumers; demand analysis; market structure and its impact on consumers; economics of information, implications on private and public sectors. Required background: Introductory economics.

476 Service Marketing Research (3) Design, conduct and utilization of service marketing research to improve customer service. Prerequisite: 376 Strategies for Growth. Required background: Introductory statistics and microcomputer applications.

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

501 Professional Project (3-6) Application-oriented, capstone project that shows completion in major academic area. Enrollment limited to retail and consumer sciences students in non-thesis program. Prerequisite: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Retail Strategy and Decision Making (3) Strategy, strategic management and strategic process in retail sector. Analytical decision-making skills in retailing. Retail industry structure. International differences
in retail systems. Prereq: Retail Management or equivalent. Sp


538 Consumer Product and Service Development (3) Critical analysis of consumer product and service development processes in services industry. Strategies for developing consumer products, services, programs, and service processes from conception to implementation and evaluation.

541 Consumer Analysis in Services Management (3) Analysis of consumer behavior in consumer products and services industry. Development of knowledge to positively impact services marketing organizations through marketing, environmental and product/servicest strategies based upon consumer behavior knowledge. Investigations of qualitative and quantitative methodologies to conduct elementary consumer research.

562 Research Methods (3) Fundamentals of science methods: advancement of science, methodology and method of research. Issues and concepts of basic and applied research. Prereq: Statistics 531 or equivalent. Sp

590 Research Seminar (1) Research topics in retail and consumer sciences. May be repeated. S/NC only. F,Sp

593 Directed Study (1-3) Individual problems in retailing and consumer sciences. Prereq: 9 hrs retailing and consumer sciences graduate coursework. May be repeated. Maximum 9 hrs.

595 Special Topics in Retail and Consumer Sciences (1-3) Lecture, group discussion on specialized topics: retail industry structure, international trade, international retailing, consumer affairs, entrepreneur-ship, sales management, issues in retail management, issues in retail strategy, quality perception by consumers, product and service value, retailing to children, retailing and special populations, special research methods. Prereq: 9 hrs graduate coursework. May be repeated. Maximum 9 hrs.

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


615 Retail and Consumer Sciences Literature and Thought (3) Evaluation of retail and consumer sciences literature with emphasis upon research literature, development of scholarly thought, and identification of potential areas of further study. Prereq: 562, Marketing 501, Economics 501, F,A

616 Research Methods, Models and Measurement in Retail and Consumer Sciences (3) Quantitative methods and analytical concepts in research process. Mathematical and statistical formulation of retail and consumer sciences phenomena, utilizing models, model building and measurement constructs. Prereq: 562, Statistics 538. Sp,A

625 Strategic Managerial Retailing (3) Decision-making orientation that integrates strategic framework components with preparation and analysis of specific retail case situations. Prereq: 510.

641 Retail Consumer Behavior (3) Theories and concepts from social science in relation to ultimate consumer’s behavior. Prereq: 6 hrs of sociology and/or psychology or consent of instructor.

651 The Consumer and Public Policy (3) Public policy issues within consumer environments. Analysis of past and present policies within economic, social, legal and business frameworks. Implications for consumer issues and policy alternatives. Literature and research focus. Prereq: 550 or consent of instructor.

695 Advanced Topics in Retail and Consumer Sciences (3) Lecture, group discussion, individual research on advanced topics and research areas of current significance to retail and consumer sciences. Prereq: 9 graduate hours in consumer sciences. May be repeated. Maximum 9 hrs.

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**Textile Science**

**GRADUATE COURSES**

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

501 Professional Project (3-6) Application-oriented, capstone project to show competence in major academic area. Enrollment limited to textile science students in non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC only.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Fiber Science (3) Physical properties, mechanical properties and microstructure of polymeric fibers; relation to end-use properties. Prereq: Organic Chemistry and Thermal Physics or equivalent.


521 Nonwovens Science and Technology I (3) Nonwoven fabric technology; different web forming processes; and relationships among the chemical, morphological and mechanical properties of fibers and orientation in web structures. Prereq: 510. F,A

526 Nonwovens Science and Technology II (3) Interrelations between mechanics of production and mechanical properties of nonwoven fabrics; characterization of fiber morphology and web structure; chemistry of nonwoven binders and finishes; and engineering of specific fabric properties. Prereq: 521 or equivalent.

528 Laboratory Methods in Nonwovens Processing and Characterization (3) Laboratory experience in nonwovens fabrication processes and characterization techniques. Effect of processing conditions on structure development and properties of different types of webs. Prereq: 510 and 521.

552 Economics of Textile Complex (3) Economics consideration of U.S. textile complex. Quantitative approaches to industry structure, production market- ing, distribution and institutions within both global and domestic settings. Current and future international issues and implications. Prereq: Calculus III or equivalent; micro economics. F,A


590 Research Seminar (1) Research topics in textile science. May be repeated. S/NC only. F,Sp

593 Directed Study (1-3) Individual problems in textile science. Prereq: 9 hrs textiles graduate coursework or consent of instructor. May be repeated. Maximum 9 hrs.

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

625 Physical Chemistry of Fibers (3) Physical chemistry of fibers and fiber forming polymers; surface chemistry and thermal properties. Prereq: 510.


695 Advanced Topics in Textile Science (3) Lecture, group discussion, individual research on advanced topics and research areas of current significance: future direction, professional issues, theoretical approaches. Prereq: Doctoral student and 9 hrs textiles graduate coursework. May be repeated. Maximum 9 hrs.
Theories and requirements.

The M.S. in Counseling and Ed.S. degree program with their respective concentrations are accredited by the Council for Accreditation of Counseling and Related Educational Programs. In addition, the counseling psychology concentration under the college-wide Ph.D. program is accredited by the American Psychological Association, and the concentration in counselor education is accredited by the Council for Accreditation of Counseling and Related Educational Programs.

The department includes several educational programs sponsored by the U.S. Department of Education, Office of Special Education and Rehabilitation Services, Rehabilitation Services Administration, including: Regional Rehabilitation Continuing Education Program, Orientation to Deafness, Southeastern Regional Interpreters Training Consortium, National Interpreter Training Center, and the Educational Interpreting Program.

The department emphasizes research-based practices that address the growth and development of the whole person throughout the lifespan. In its counseling programs, it concentrates on maximizing development and adjustment of individuals through prevention and treatment models in schools, colleges, community agencies, businesses, and private-practice settings. In its rehabilitation programs, it pursues improvement in the quality of life for persons with disabilities and the public at large, in the rehabilitation of disabled veterans, and in the development of new knowledge and technology to meet the unique educational, social, and employment needs of this population. A major goal of the department is the preparation of graduates for future leadership and professional roles in business and industry, education, and community and government service.

The application deadline for admission to the doctoral and Ed.S. programs is February 1; and November 1 and February 1 for the master’s program.

ADMISSION REQUIREMENTS

Admission requirements include up-to-date scores from the GRE for the major in Counseling, a departmental admissions application form and letters of recommendation. For the doctoral program, a writing sample is also required.

Counselor Education and Counseling Psychology

GRADUATE COURSES

410 Gender Role Development: Implications for Education and Counseling (3) Theories and research: development of gender roles and their relevance to identity and behavior in socio-psychological, educational, and counseling settings. (Same as Women’s Studies 410) E,F,Su

431 Personality and Mental Health (3) Various perspectives of mental health with application to education and other social institutions. E

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E


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

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

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

525 Formal Measurement in Education and Counseling (3) Principles of test construction and item analysis. Survey of standardized tests of intelligence, achievement, aptitude, vocational interest, attitudes and personality. Prereq: 520 or equivalent. F,Su

535 Ethical, Legal, and Professional Issues in Counseling (3) Professional practice issues in school and community counseling and related fields: education, research, standards of practice, credentialing, and policy. Prereq: Admission to counseling program or consent of instructor. Su,A

550 Introduction to Pupil Personnel Programs (3) History, philosophy, professional standards, counselor role in relation to school staff and mental health professionals, and ethics of profession. F

551 Theory and Practice of Counseling (3) Philosophical bases of helping relationships; 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

553 Career and Educational Information Systems and Resources (3) Use of print and non-print materials; computer-based systems, for career and educational planning. Prereq: 552 or consent of instructor and Internet access account. Sp

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

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

556 Orientation to Mental Health Counseling (3) Mental health counseling as profession: professional organizations, work settings, code of ethics, certification requirements, and role identity. F, Sp

558 Internship in School Counseling (1-6) Supervised practicum employment at academic unit approved site. Prereq: 550 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

559 Internship in Community Agency Counseling (1-6) Supervised practicum employment at academic unit approved site. Prereq: 550 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

561 Development and Operation of School Counseling Programs (3) Management of comprehensive school counseling programs to include needs assessment, program goals, resource identification, evaluation, and use of computer-based program management software. Prereq: 550. Sp,Su

565 Facilitation of Technical Task Groups (3) Technical and social aspects of group dynamics in context of technical task groups. Application of counseling techniques to facilitation of workplace teams. Prereq: 551, 554, or consent of instructor.

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

571 Individual Cognitive Assessment in Counseling (3) Basic concepts and applications in individual assessment of intelligence; proficiency in administrative scoring, interpretation for Wechsler, adults and children. Prereq: 525 and 520 and admission to counseling program or consent of instructor. S/NC only. Sp,A

585 Seminar in Gerontology (1) (Same as Human Ecology 585, Educational Psychology 585, Exercise Science 585, Nursing 585, Public Health 585, Social Work 585, and Sociology 585.)

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

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

602 Directed Research (1-3) Instructor- or student-initiated group 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 courses offered at convenience of academic unit on topics of interest. May be repeated. Maximum 15 hrs. S/NC or letter grade. E

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

635 Ethical, Legal, and Professional Issues in Psychology (3) (Same as Psychology 635 and Educational Psychology 635.) Sp

650 Seminar in Counseling Education (1) Professional issues related to role and function of counselor educator. Prereq: Admission to doctoral program in counselor education. May be repeated. Maximum 2 hrs. S/NC only. F

655 Practicum in Counselor 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

659 Internship in Counselor Education (1-6) Supervised employment in academic unit approved使之有效. Prereq: 516, and 541 or equivalent individual assessment course; or consent of instructor. Sp,A


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

529 Teaching Reading to Deaf/Hard of Hearing (3) Specific methods necessary to teach literacy to hearing impaired student. Practice in preparation of developmentally appropriate reading materials. Methods which assist in integrating hearing impaired students in regular reading curricula and materials. Prereq: 415.

530 Orientation to Rehabilitation (3) History, philosophy, legal and economic bases, current issues, and practices in public and private rehabilitation programs. Qualifications of service providers. Assessment, plan development, and provision of services to people who have disabilities and vocational handicaps. Identification, mobilization, and utilization of rehabilitation resources.

532 Caseload Management in Rehabilitation (3) Techniques and procedures involved in management of caseloads in Federal-State vocational rehabilitation agencies, private rehabilitation agencies, and public or private rehabilitation facilities. Analysis of appropriate industrial management models related to rehabilitation programs.

533 Job Analysis, Development, and Placement (3) Determining employment-readiness of people with disabilities, identifying appropriate jobs for selected clients, and assisting clients in seeking, obtaining, and retaining employment. Job analysis, job modification, and re-engineering, marketing, and employer-servicing techniques; legislation impacting job placement; supported work; and use of occupational information.

535 Vocational Evaluation: Statistical Methods (3) Principles and procedures used to develop techniques to identify vocational assets and liabilities of people with disabilities. Functional analysis of biographical and interview data; selection of relevant psychometric instruments; integration of statistical data into diagnostic reports; application of computer-generated reporting systems.

537 Vocational Evaluation: Clinical Methods (3) Principles, process, techniques used to assist individuals in determining and understanding their own work behavior and vocational potential. Selection and use of occupational exploration programs and work samples; application of situational tasks, job tryouts, and simulated work experiences in vocational evaluation. Clinical interpretation of data through formal staff conferences, vocational counseling, and report writing.

538 Disability Management (3) Return-to-work issues in disability management programs: early intervention, quality services, and cost containment; standards and procedures for rehabilitation counselors/case managers.

541 Psychosocial Aspects of Disability (3) Psycho-social impact of disability on person and family. Reaction to loss, coping with disability, and societal rehabilitation.

543 Medical Aspects of Disability (3) Etiology and clinical symptoms related to disabling conditions served by special education and rehabilitation personnel. Restrictive measures to eliminate or minimize resulting handicaps. Skill development to communicate with lay and professional persons.

545 The Rehabilitation Interview (3) Interview as used in assessment and planning with people who have disabilities and vocational handicaps.

547 Practicum in Rehabilitation (3) Supervised experience in area of rehabilitation; application of concepts, principles, and skills. Prereq: Consent of instructor.

549 Internship in Rehabilitation Counseling (12) Supervised practice in rehabilitation counseling. Full time clinical experience for second-year students (600 clock hrs required).

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

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

592 Assistive Technology in Special Education and Rehabilitation (3) Technology as applied to needs of school age and post-secondary age students/clients. Delivery of assistive technology software programs and assistive devices, delivery systems, interdisciplinary evaluation and planning, and funding issues.

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

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

601 Seminar in Educational Theories in Special Education and Rehabilitation (3) Education theories: education and rehabilitation of exceptional persons. Theory applications in educational settings. Prereq: Admission to doctoral program or consent of instructor.

602 Seminar in Social Processes in Special Education and Rehabilitation (3) Social phenomena which influence impact of disability on and on significant others, implications for habilitation. Prereq: Admission to doctoral program or consent of instructor.

603 Seminar in Research in Special Education and Rehabilitation (3) Development and implementation of research, Independent research studies. Research proposals. Prereq: 9 hrs of research core and consent of instructor.

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

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

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

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

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

Ecology and Evolutionary Biology

(College of Arts and Sciences)

MAJOR DEGREES

Ecology and Evolutionary Biology .......................... M.S., Ph.D.

T. G. Hallam, Head
C. R. B. Boake, Associate Head

Professors:
Boake, C. R. B., Ph.D. ........................................... Cornell
Bunting, D. L., II (Emeritus), Ph.D. .......................... Oklahoma State
Burghardt, G. M., Ph.D. ........................................... Chicago
Delcourt, H., Ph.D. ................................................. Minnesota
Delcourt, P. A., Ph.D. .............................................. Minnesota
Echternacht, A. C., Ph.D. ........................................ Kansas
Etner, D. A., Ph.D. ................................................ Minnesota
GRADUATE COURSES

411-12 Minicourse in Ecology and Evolutionary Biology (2) Selected advanced topics in ecology, behavior, and evolutionary biology, concentrated in time and subject matter. Consult departmental listing for topics offered. Prereq: As announced. May be repeated. Maximum 4 hrs may apply toward departmental major.

419 Science as Method (3) Dynamic process of scientific discovery. Comparisons of science, nonscience, pseudoscience, successful and unsuccessful science. Ethics of scientific research, philosophical aspects of scientific enterprise, and implications for teaching and writing about science. Prereq: introductory science or philosophy course, or consent of instructor. (Same as Botany 419 and Philosophy 419.)

431 Plant Ecology (4) (Same as Botany 431.)

446 Introduction to Oceanography (4) Basic oceanography: physical, chemical, geological and biological processes and patterns. Oceanic subsystems: upwellings, polar oceans, hydrothermal vents, gyres, coral reefs, estuaries, and coastal regions. Field trip to coast required. Prereq: General Biology and General Chemistry. General Ecology recommended.

450 Comparative Animal Behavior (3) Principles and methods of ethology: ecological, developmental, physiological and evolutionary aspects. (Same as Psychology 450.)

459 Comparative Animal Behavior Laboratory (3) Introduction to experimental research in ethology. Coreq: 450. (Same as Psychology 459.)


461 Special Topics in Organismal Biology (3) Evolution, ecology, biogeography, classification, and anatomy of selected animal and plant groups. Prereq: General Ecology or consent of instructor.

470 Aquatic Ecology (3) Introduction to the physiochemical nature of inland waters with description of biotic communities and their interrelationships. Prereq: Chemistry 120-130 General Chemistry, Biology 250 General Ecology. 2 hrs and 1 lab.


484 Conservation Biology (3) Application of principles and techniques of ecological research to conservation of biological diversity at genetic, population, community, and ecosystem levels. Prereq: Biology 240 General Genetics, 250 General Ecology.

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

503 Ecology and Evolutionary Biology Seminar (1) Advanced topics in ecology, behavior, and evolutionary biology. Senior departmental majors encouraged. Required of all first- and second-year graduate students. May be repeated. Maximum 4 hrs. S/NC only.

504 Special Topics (1-3) Selected directed readings or special course in topics of current interest. Consult departmental listing for offerings. May be repeated with consent of instructor. Maximum 9 hrs. S/NC only.

508 Introduction to Faculty Research (1) Orientation of new graduate students to current research of departmental graduate faculty. Prereq: Admission to program in Ecology and Evolutionary Biology. Required of all first-year students. S/NC only.

509 Foundations: Readings in Ecology (1-2) Readings and discussion of classic papers in field.

511 Foundations: Readings in Evolution (1-2) Readings and discussion of classic papers in field.
512 Foundations: Readings in Conservation Biology (2) Readings and discussion of classic papers in field.

514 Foundations: Readings in Mathematical and Computational Ecology (2) Readings and discussion of classic papers in field.

515 Foundations: Readings in Environmental Toxicology (1-2) Readings and discussion of classic papers in field.

516 Colloquium in Ethology (1) (Same as Psychology 516.)

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. Not intended for graduate students in Ecology and Evolutionary Biology.


535 Ecology and Development in the Amazon (3) Natural history, ecosystem diversity and function, and approaches to sustainable economic development in the Amazon Basin. Includes field trip of 7-10 days to Manaus, Brazil.

540 Insect Taxonomy I: Major Orders (3) Survey of classification of major orders of insects, with practical experience in identification of insects at family level. Prereq: Consent of instructor. 4 hrs combined lecture and lab.

541 Insect Taxonomy II: Minor Orders (3) Survey of classification of minor orders of insects, with practical experience in identification of insects at family level. Prereq: 540 or consent of instructor. 4 hrs combined lecture and lab.

542 Insect Structure and Function (3) Integrated study of morphology and physiology at tissue and cellular levels. Prereq: Consent of instructor.

543 Aquatic Insects (3) Taxonomy and biology of aquatic insects; immature forms. Prereq: Consent of instructor. 2 hrs and 1 lab.

544 Fresh Water Invertebrate Zoology (3) Ecology and taxonomy of fresh water invertebrates exclusive of insects. Prereq: Comparative Invertebrate Biology or equivalent and consent of instructor. 3 hrs lab and field study.

545 Advanced Animal Behavior (3) Second-level course in ethology, stressing evolution, genetics, physiology, and behavior. Prereq: 450 or equivalent. (Same as Psychology 545.)

546 Ethological Psychology (3) (Same as Psychology 546.)

547 Conceptual Foundations of Evolution and Behavior (3) (Same as Psychology 547.)

552 Development Planning in the Third World (3) (Same as Planning 552.)

555 Environmental Planning (3) (Same as Planning 555.)

556 Ice-Age Environments and Global Climate Change (3) Glacial-interglacial cyclic changes and dynamic responses of landscapes within glacial, periglacial, and non-glacial environments across North America over past 2.5 million years. (Same as Geologic Science 556.)

557 Quaternary Ecology (3) Perturbation, process, and pattern within Quaternary ecosystems; climatic change and vegetational response during last 2.5 million years. Prereq: Consent of instructor. (Same as Geologic Science 557.)

560 Biometry (3) Statistical applications in biological research. Prereq: Statistics course or consent of instructor.

561 Environmental Toxicology (3) Basic concepts in toxicology; molecular toxicology and detoxification; reproductive toxicology; mutagenesis, teratogenesis, carcinogenesis, pathologic changes and environmen-
established by the degree program for part-time students.

STUDENT’S RIGHT TO PETITION

Graduate students in good academic standing have the right to petition the department for modification of departmental degree requirements and redress of grievances. Petitions must be in writing and addressed to the Director of Graduate Studies.

THE MASTER’S PROGRAM

Admission to the M.A. program is based on undergraduate academic performance and on scores from the general portion of 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 of 18 hours in economics at the 500 level or above, 12 hours must consist of 511, 512 and 513, 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 thesis option requires 30 hours of coursework at the 400 level or above, including at least 24 hours at the 500 level or above, 6 hours of which may be thesis hours. Of the remaining 18 hours at the 500 level or above, at least 15 hours must be in economics and must include 511, 512, 513, and 514. A maximum of 6 hours may be in an area other than economics.

THE DOCTORAL PROGRAM

Admission to the Ph.D. program is based on promise of outstanding scholarship as demonstrated by previous academic performance, by scores achieved on the general portion of the GRE, and by recommendations. The program requires a minimum of 48 hours of coursework beyond the bachelor’s degree or 24 hours beyond the master’s degree, at least 24 hours of 600 Doctoral Research and Dissertation, and successful completion of the following:

1. Students are required to complete the following core requirements:
   a. Economic Theory: Microeconomic theory and macroeconomic theory by a qualifying exam taken not later than the beginning of the fourth semester of study.
   b. History of Economics: Completion of 515 or 615 with a grade of B or better, or by qualifying examination.
   c. Quantitative Methods: Completion of 581, 582 and 583 with grades of B or better, or by qualifying examination.
   Students failing a qualifying examination must retake the test the next time offered. A qualifying examination may be taken a third time only with approval of the department. Failing a qualifying examination for a third time will result in dismissal from the doctoral program.
   2. Students are required to demonstrate competence by comprehensive examination in at least two fields of specialization in economics. Students failing a comprehensive examination must retake the examination the next time offered. A comprehensive examination in a specific field may be taken a third time only with approval of the department.
   3. Students are required to complete with a grade of B or better two elective courses in economics at the 500 level or above, outside the core subject areas and outside the fields of specialization.
   4. Students are required to complete a doctoral dissertation and to defend it successfully before the faculty.

MINOR IN ENVIRONMENTAL POLICY

The program is designed to give master’s and doctoral level graduate students an opportunity to develop an interdisciplinary specialization in environmental policy. While administered through the Economics Department, the program is coordinated by a committee of representatives of the following participating departments and programs: Agricultural Economics and Rural Sociology; Botany; Civil and Environmental Engineering; Ecology and Evolutionary Biology; Economics; Forestry, Wildlife and Fisheries; Geography; Management; Planning; Political Science; and Sociology.

Students may request admission to the minor following admission to a graduate program in one of the participating departments. Students in good standing in one of these programs may apply for admission to the minor in environmental policy. The coordinating committee will consider the admission of interested students. Applicants should have a background in both natural and social sciences evidenced by prior coursework or experience. One course in environmental studies from the student’s major discipline and one course in quantitative methods are required. These requirements may be fulfilled before or after admission to the minor. All students admitted to the minor will be required to register for at least three hours of Economics 579, Environmental Policy Research Workshop, and to complete successfully the following:

1. Ecology and Evolutionary Biology 520 or Plant and Soil Sciences 414 or Geography 433 or an equivalent course approved by the coordinating committee.
2. Six hours of coursework outside the major discipline approved by the coordinating committee.

Doctoral students seeking a minor in environmental policy must also complete, in addition to above, a policy-relevant dissertation approved by the coordinating 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 on an in-state tuition basis. The Ph.D. program in Economics is available to residents of the state of Kentucky. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE COURSES

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

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 economy. Major writing requirement. Prereq: Intermediate Macroeconomics or consent of instructor.


462 Economics of Resources and Environmental Policy (3) Economic analysis of environmental policy and legislation at state and federal levels. Prereq: 201.

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

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

482 Introduction to Mathematical Economics (3) Application of basic mathematical tools: calculus, matrix algebra, etc. to topics of economic theory. Prereq: Intermediate Microeconomics and B or better, and Calculus.

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

511-12 Microeconomic Theory (3.3) Theory of consumer choice and demand, theory of revealed preference, 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, pure 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.


525 Economic History of Europe (3) Nature and functions of economic systems and policies in history of Western civilization, major issues of method and interpretation. Prereq: Graduate standing in economics or consent of instructor.

537 Managing in a Regulated Economy (3) Economic effects of antitrust and public policy, international and environmental regulation on business. Development of decision-making skills in area of governmental-business relations.

577 Environmental Economics and Policy Management (3) Interdisciplinary perspective on goals of sustainable economic development and environmental quality. Development of decision-making tools and conflict resolution.


Education

MAJORS DEGREES

College Student Personnel ................. M.S.
Counseling ..................................... M.S.
Education ................................. M.S., Ed.S., Ed.D., Ph.D.
Educational Administration and Policy Studies .... M.S.
Educational Psychology ........................ M.S.
Human Performance and Sport Studies ........................ M.S.

The College of Education offers the Master of Science, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees through six departments:
- Counseling, Deafness and Human Services
- Educational Administration and Cultural Studies
- Educational Psychology
- Exercise Science and Sport Management
- Information Technology, Curriculum and Evaluation
- Theory and Practice in Teacher Education

The College also offers initial teacher licensure programs at the graduate level. The program features a professional year internship with accompanying coursework which may lead to a master’s degree with a major in Education. See Track 2 under Master’s Programs, Education, and Teacher Licensure.

For admission, most programs require scores from the GRE general section, and all require a departmental application form and letters of recommendation as indicated on the chart of Majors and Degree Options. Both options require completion of 36 hours of course work, including practicum and internship experiences working with clients. A thesis examination is required of all students.

Education

The master’s degree with a major in Education has two tracks. Track 1 is intended for students who are licensed to teach English, elementary education, foreign language, mathematics, natural science, social science, early childhood special education, or education of the deaf and hard of hearing. (Non-licensed applicants to Track 1 will be reviewed on a case-by-case basis and must have a strong disciplinary background and professional goals which can be fostered through participation in this non-licensure program.) Track 2 is designed for students seeking initial teacher licensure in one of the above fields. Thesis and non-thesis options are available for both tracks.

THE MASTER’S PROGRAMS

College Student Personnel

Students who major in College Student Personnel are prepared to enter the field of student personnel administration in colleges, universities, and 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. Students must complete a minimum of 12 hours in Higher Education courses.

Counseling

The master’s degree with a major in Counseling offers concentrations in:

Mental health counseling
Rehabilitation counseling
School counseling

The major includes thesis and non-thesis options. The concentration in mental health counseling is fully accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP) and requires completion of 60 hours of coursework including supervised practicum and internship experiences working with clients. The concentration in rehabilitation counseling is fully accredited by the Council on Rehabilitation Education, Inc. and requires 54 semester hours, including internship. A minimum of 12 hours of Rehabilitation and Deafness courses is required. The concentration in school counseling is fully accredited by the Council for Accreditation of Counseling and Related Educational Programs and requires 48 hours of coursework, including supervised practicum and internship experiences working with clients. A final examination is required of all students.

Education

The master’s degree with a major in Education has two tracks. Track 1 is intended for students who are licensed to teach English, elementary education, foreign language, mathematics, natural science, social science, early childhood special education, or education of the deaf and hard of hearing. (Non-licensed applicants to Track 1 will be reviewed on a case-by-case basis and must have a strong disciplinary background and professional goals which can be fostered through participation in this non-licensure program.) Track 2 is designed for students seeking initial teacher licensure in one of the above fields. Thesis and non-thesis options are available for both tracks.

Track 1 - Concentrations are available in:
- Art education
- Curriculum
- Education of the deaf and hard of hearing
- Elementary education
- English education
- Foreign language/ESL education
- Instructional technology
- Mathematics education
- Modified and comprehensive special education
- Reading education
- Science education
- Social foundations
- Social science education
- Special education: early childhood

The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500 (36 hours for instructional technology concentration). The non-thesis option requires the completion of 33 hours of coursework (36 hours for special education and instructional technology concentrations). Both options require a minimum of 12 hours in the major discipline (18 hours for special education concentration).

Track 2 - Concentrations are available in:
- Art education
- Education of the deaf and hard of hearing
- Elementary teaching
- Modified and comprehensive special education
- Secondary teaching
- Special education: early childhood
FIELDS OF INSTRUCTION
The thesis option requires completion of 36 hours, plus 6 hours of Thesis 500 for a total of 42 hours. The non-thesis option requires 36 hours, including 24 hours of prescribed licensure coursework and 12 hours in the academic discipline as approved by the student’s committee.

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

Educational Administration and Policy Studies

The master’s degree program with a major in Educational Administration and Policy Studies offers a concentration in educational administration and supervision, requiring a minimum of 36 hours, including 6 hours of Thesis 500 for the thesis option, or 36 hours for the non-thesis option.

The concentration in educational administration and supervision consists of a minimum of 18 hours coursework in Educational Administration and Supervision. A final oral examination is required for the thesis option, with a written exam at the option of the committee. A final written comprehensive examination is required for the non-thesis option, 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. These courses are prerequisites to other courses in the unit.

Educational Psychology

The master’s degree with a major in Educational Psychology is offered with concentrations in:

- Adult education
- Individual & collaborative learning
- Both programs include thesis and non-thesis options. The major in Educational Psychology requires 36 hours. The concentration in adult education requires a minimum of 12 hours in adult education courses. A final examination is required of all master’s degree students.

Human Performance and Sport Studies

The master’s degree with a major in Human Performance and Sport Studies offers concentrations in:

- Exercise science
- Sport management
- Sport studies
- Applicants must submit an admission application and 3 letters of recommendation. Both thesis and non-thesis options are available. The non-thesis option requires 32 hours (sport management concentration requires 33 hours), including a project, and a course in research design or an approved specialized research class. The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. Both options require a minimum of 12 hours of sport studies, exercise science, or sport management courses.

THE SPECIALIST IN EDUCATION PROGRAM

The Educational Specialist degree program with a major in Education encompasses concentrations in:

- Curriculum
- Educational administration & supervision
- Elementary education
- English education
- Foreign language/ESL education
- Instructional technology
- Mathematics education
- Reading education
- School counseling
- School psychology
- Science education
- Social science education
- Special education
- The instructional and curricular concentrations require completion of a minimum of 30 hours of coursework beyond the master’s degree, including 6 hours in core courses, 18 hours in specialized courses, and 6 hours to be determined by the student’s committee.

The educational administration and supervision concentration requires the completion of a minimum of 30 hours beyond the master’s degree. Both thesis and non-thesis options are available. The school counseling concentration requires a minimum of 22 hours beyond the master’s degree but not fewer than 60 hours beyond the baccalaureate, including practicum and internship experiences. The school psychology concentration requires the completion of a minimum of 66 semester hours beyond the baccalaureate. Refer to Degree Requirements under Graduate Studies for complete program requirements.

THE DOCTOR OF EDUCATION PROGRAM

The Ed.D. program with a major in Education is available in the following concentrations and specializations:

- Curriculum, educational research, and evaluation (curriculum, educational research, evaluation)
- Educational administration and policy studies (educational administration and supervision, higher education)
- Educational psychology (collaborative learning, instructional technology (educational applications of technology)
- Literacy, language education, and ESL education (literacy, ESL education)
- Teacher education (elementary education, social science education, mathematics education, science education)

In addition to the requirements of the Graduate Council, the hour requirements in the curricular and instructional concentration areas are determined by the student’s doctoral committee. A comprehensive examination and an oral examination on the dissertation are required.

The concentration in educational psychology with a specialization in collaborative learning requires the completion of a minimum of 90 hours beyond the baccalaureate degree and incorporates a cohort model through which students participate in core courses as a group. This program offers an alternative residency which includes a two-year, on-campus, continuous enrollment in six to nine hours per semester including summers. During this time period, students are enrolled in a doctoral seminar (EP630) for four of the six semesters and participate with faculty on research teams for 12 of the required hours. Contact the program coordinator for additional information and program requirements.

The requirements for the concentration in educational administration and policy studies are determined on an individual basis by each student’s doctoral committee. Course requirements include a 6-9 hour cognate within the college and a 6-9 hour minimum external to the college. Additional course requirements include completion of two consecutive semesters of Educational Administration and Policy Studies 604 during residence. Though an internship is highly recommended, it is not required. A foreign language requirement is at the discretion of the committee. A written comprehensive examination, as well as an oral examination on the dissertation, is required. An alternative residency, which includes a two-year, on-campus, continuous enrollment in Educational Administration and Policy Studies 606, Leadership Forum, is available for qualified students.

THE DOCTOR OF PHILOSOPHY PROGRAM

Faculty from all six departments participate in the delivery of the Ph.D. degree program with a major in Education. Concentrations and specializations are available in the following areas:

- Counseling psychology (gender and cultural issues in counseling, career development, group process, counseling service, assessment)
- Counselor education (school counseling, counseling service) (Not currently accepting new students)
- Cultural studies in education (social and cultural theory)
- Curriculum, educational research, and evaluation (curriculum, educational research, evaluation, educational applications of technology)
- Early childhood education (early childhood special education)
- Educational administration and policy studies (educational administration and supervision, higher education)
- Educational psychology (adult education, applied educational psychology)
- Exercise science (biomechanics/sports medicine, exercise physiology, physical activity and population health)
- Instructional technology (educational applications of technology)
- Literacy, language education, and ESL education (literacy, ESL education)
- Teacher education (elementary education, gifted and talented education, mathematics education, science education, social science education)

The program requirements are:
### Requirements

<table>
<thead>
<tr>
<th>Core Requirements</th>
<th>Minimum Hours</th>
</tr>
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<tbody>
<tr>
<td>Seminar in primary concentration</td>
<td>3</td>
</tr>
<tr>
<td>Philosophy of science or history/philosophy of education (select one from Philosophy 446 or 546 or courses identified in addendum to Ph.D. guidelines or Cultural Studies in Education 607)</td>
<td>3</td>
</tr>
<tr>
<td>Theoretical foundations and/or applications (select one)</td>
<td>3</td>
</tr>
<tr>
<td>Learning curriculum theory (Educational Psychology 609, 515, or Psychology 560)</td>
<td>3</td>
</tr>
<tr>
<td>Administrative/leadership theory (Educational Administration and Supervision 513, 680 or Educational Administration and Policy Studies 514)</td>
<td>3</td>
</tr>
<tr>
<td>Group dynamics (Counselor Education and Counseling Psychology 554)</td>
<td>2</td>
</tr>
<tr>
<td>Instructional technology (Instructional Technology, Curriculum and Evaluation 573 or 575)</td>
<td>2</td>
</tr>
<tr>
<td>Trans-college seminar: two consecutive semesters (Education 601)</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Concentration
- A minimum of 15 hours selected from one concentration | 15
- A minimum of 9 hours selected from a specialization | 9
- A minimum of 6 hours selected from outside the college in addition to the designated research courses | 6
- Dissertation | 24

The residence requirement consists of three consecutive semesters of full-time enrollment. Additional details are available through the College’s Student Services Center, Claxton Complex A332, (865) 974-8194, or edadmin@utk.edu.

### TEACHER LICENSURE

In addition to the above cited degree programs, the College of Education offers graduate level teacher licensure courses. Students completing requirements for initial teacher licensure earn 24 semester hours of graduate credit which may be applied to a 36 semester hour Track 2 master’s degree with a major in Education.

To earn initial teacher licensure, students must complete undergraduate prerequisite courses, gain admission to graduate study as a degree seeking student, and the following 24 hours of coursework:

#### Fall Semester
- 575 Internship | 4
- Specialty Studies | 6
- 574 Analysis of Teaching for Professional Development | 2

#### Spring Semester
- 575 Internship | 8
- 591 Clinical Studies | 4
- TOTAL | 24

Further details concerning the teacher licensure program and the Track 2 master’s degree program are available through the College of Education Student Services Center, Claxton Complex A332, (865)974-8194, or ldmorgan@utk.edu.

### CERTIFICATE IN URBAN EDUCATION

The Department of Theory and Practice in Teacher Education offers a certificate program in urban education for experienced urban teachers. A cohort group is competitively selected each year.

Participants complete a 12-credit, four-course program of study over a two-year period. First-year courses are Theory and Practice in Teacher Education 595 Special Topics (Trends and Issues in Urban Education) and Education 540 Topics in Improvement of instruction (Improving Teaching and Learning in Urban Schools). Second-year courses are Theory and Practice in Teacher Education 595 Special Topics (Accommodating Diverse Student Needs in Urban Classrooms) and 550 Action Research and Practical Inquiry in Education.

### MINOR IN GERONTOLOGY

Graduate students with majors/concentrations in counseling, exercise science, or educational psychology, may pursue a specialized minor in gerontology. This interdepartmental/interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

### ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT on an in-state tuition basis.

The M.S. Counseling is available to residents of the state of Florida (concentration in rehabilitation counseling) or Kentucky (concentration in mental health counseling). The M.S. program in Education (concentration in education of the deaf and hard of hearing) is available to residents of the states of Alabama, Maryland, South Carolina, Virginia, or West Virginia. The M.S. program in Human Performance and Sport Studies is available to residents of Alabama, Arkansas, Maryland, South Carolina, or Virginia. The Ed.D. program in Education (concentration in educational psychology) is available to residents of Kentucky.

Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

### GRADUATE COURSES

- 510 Advanced Educational and Clinical Procedures (3-6) Integration of advanced educational and clinical procedures; skills and knowledge for implementing instruction and for consulting with other persons in treatment of exceptional individuals. May be repeated. Maximum 6 hrs. Prereq: Admission to Teacher Education program. Maximum 6 hrs. S/NC only. F,E
- 540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and inservice programs. May be repeated. Maximum 6 hrs. S/NC only. E
- 562 Direction and Supervision of Student Teaching (3) Roles and responsibilities of cooperating teachers and student teacher; objectives and policies of student teaching program; elements of clinical supervision; overview of research. F,Su
- 568 Teacher-Parent-Community Relations (3) Techniques for effective relations between parents and teachers; examination of roles and expectations; parental involvement; volunteer programs; influence of community on educational process. Prereq: Consent of instructor. Sp,Su
- 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 (1-8) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to postbaccalaureate students in professional year program. Prereq: Admission to Teacher Education program. May be repeated. Maximum 12 hrs. S/NC only. F,Sp
- 576 Practicum in Classroom Teaching (1-8) Teaching and teaching-related experiences in elementary and secondary school settings. Specific hours and school level assignment determined by licensure or certification requirements. May not be used for probationary licensure year. May not be used toward degree requirements. May be repeated. Maximum 12 hrs. S/NC only. E
- 589 Field Experience (1-3) Application of curricular and instructional principles, methods, and materials in schools. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E
- 591 Clinical Studies (4) Group and individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of capstone and portfolio of teaching project. Coreq: 575.
- 601 Trans-College Seminar (1) Introduction to Ph.D. program in Education: research requirements, meaning of scholarship in academe 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.
- 635 Teacher Education in America (3) For students preparing to enter teacher education. Brief historical development, program analysis and evaluation, current issues, and future directions. F

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**Educational Administration and Cultural Studies**

(College of Education)

### MAJORS

**DEGREES**

College Student Personnel .................... M.S.
Education ............................... M.S., Ed.S., Ed.D., Ph.D.
Educational Administration and Policy Studies ............................... M.S., Ph.D.

Joy T. DeSensi, Head

Professors:
- Allison, C. B. (Emeritus), Ph.D. ....... Oklahoma
- Bogue, Grady, Ed.D. ............... Memphis State
- DeSensi, J. T., Ed.D. .............. North Carolina (Greensboro)
- Howard, Robert (Emeritus), Ph.D. .. Ohio State
- Malik, Anand (Emeritus), Ed.D. ....... Columbia
- McInnis, Malcolm, Ph.D............ Florida State
- Mead, B. J. (Emeritus), Ph.D. .. Purdue
The Department of Educational Administration and Cultural Studies participates in graduate programs leading to degrees, majors, and concentrations in:

- **Master of Science**
  - College Student Personnel
  - Education
    - Social foundations
  - Educational Administration and Policy Studies
    - Educational administration and supervision
  - Human Performance and Sport Studies
    - Sport studies
    - Specialist in Education
  - Education
    - Educational administration and supervision
  - Doctor of Education
    - Educational administration and policy studies
  - Doctor of Philosophy
    - Educational studies in education
    - Educational administration and policy studies

**Cultural Studies in Education**

**GRADUATE COURSES**

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

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. Prereq: 532. F

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E


505 History of Olympics: Ancient and Modern (3) Examination of various aspects of ancient and modern Games. Ancient Olympics 776 BC to 393 AD. Panhellenic Games. Modern Olympics, 1896 to date; political, social, class, gender, and economic issues that influence Games. F


514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues. F

515 Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport. Sp

526 Philosophy of Education (3) Description, interpretation, and critique of philosophical/theoretical arguments: truths, knowledge and values in relation to education. S

532 Professional Practice Issues in Sport Psychology (3) Study and critique of various aspects of professional practice in sport psychology. Sp

533 Psychology of Sport (3) Social psychological factors influencing human behavior in sport context. Discussion of contemporary theory, research, and methodology. Prereq: General psychology course or consent of instructor. F

534 Motor Behavior and Skill Acquisition (3) Topical exploration and application of principles of human movement behavior to acquisition and performance of skills; discussion of current research and methodology. F

535 Health and Exercise Psychology (3) Study and cultural critique of various aspects of exercise psychology. F

537 Sport Psychology Seminar (1) Issues and problems in applied sport psychology. Analysis and synthesis of research literature and discussion of sport psychology consultation practices and other topics. May be repeated. Maximum 3 hrs. S/N only. F

539 Development of Education Thought (3) Historic and philosophic approach to lives and writing of influential educators. Platon, Quintilian, Comenius, Rousseau, Pestalozzi, Froebel, Dewey. Prereq: Graduate status and consent of instructor. Sp,Su

540 Foundations of Educational Policy (3) Relationship between policy, theory, and practice, educational policies that arise from philosophical and practical considerations relative to human nature, to educational purpose, to content of curriculum and to methods and techniques for conducting educational enterprise. F,S

541 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated. F

542 Sociological Aspects of Sport (3) Social and cultural factors influencing sport and physical education. Pertinent issues and research applications. Prereq: Consent of instructor. F

544 Survey of Contemporary Philosophies in Education (3) Current debates within various philosophical fields of study related to education. F

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. F

547 Topics in Philosophy of Education (3) May be repeated. F

548 Transforming Critical Thinking: Constructive Thinking and Educational Implications (3) Critique and transformation of critical thinking to more holistic, relational, and aesthetic model of multicultural and gender-sensitive constructive thinking; confronting power and addressing educational implications. F

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

550 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research proposals. Overview of qualitative research methods: ethnography, case study, historiography, biographical and life history. Critical reading and evaluation of qualitative research studies. F,S

551 Qualitative Research in Education Settings (3) Implementing and writing qualitative studies in educational settings. Qualitative data collection, analysis, and report writing. Prereq: 550 or equivalent. Sp

552 Cultural Studies Seminar (1-2) Two semester sequence (Fall and Spring); ongoing discussion about cultural studies; popular cultural, interdisciplinary work, social justice issues, Presentations, videos and readings. May be repeated. Maximum 4 hrs. S/N only. F

553 Issues in Cultural Studies (3) Combination of theoretical readings in cultural studies and service learning for social justice project. Discussion of interdisciplinary, social justice and activism. Links between theory and practice of cultural studies. F

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

555 Independent Study (1-3) May be repeated. S/N or letter grade. E
Educational Administration and Supervision

GRADUATE COURSES

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

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

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

523 Administration of Special Services (3) Legal, programmatic, and ethical responsibilities of educational administrators in design and implementation of special service programs within school settings. Special learner characteristics, program categories, service delivery models, and legal/ethical frameworks. Inclusion and full service delivery. F.

529 Politics and Public Relations in Education (3) School/community relations in political context of modern society. Development and maintenance of political competencies: political, social, ethnic, cultural, and racial environments in which schools operate. Prereq: M.S. introductory core or consent of instructor. F, Su.

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

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

548 Supervision and Personnel Administration (3) Basic supervisory and personnel concepts and related competencies; building (or micro-organizational) level; interpersonal and personal skills. Prereq: M.S. introductory core or consent of instructor, F, Su.

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

554 Policy Issues in Educational Law, K-12 (3) Legal arrangement of case and statutory materials for public school administrators and teachers; problems concerning law and public education. Prereq: M.S. introductory core or consent of instructor. F, Su.

580 Internship in Educational Administration (3) Field experience in appropriate educational setting working with agency administrative staff. Placement by department assignment. May be repeated for credit. Prereq: Consent of instructor. F, Su.

583 Educational Leadership—Principalship (3) Knowledge, skills and relationships for principal to be effective educational leader. Simulation materials and field-based activities. Culminating course with internship at end of planned course of study. Prereq: 21 hrs in educational administration and supervision and 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 or letter grade. E


595 Seminar 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. E


612 Modes of Inquiry (3) Various inquiry approaches to research in education: related philosophical, methodological and ethical considerations in research design and in use of research findings. Prereq: Graduate Psychology 612.

617 Case Study Methods in Educational Research (3) Methods, techniques and strategies consistent with case study approaches to inquiry in educational and related settings. Required background: Prior knowledge and understanding of research design and modes of inquiry in the social sciences.

619 Practicum (1-3) Intern experience in areas of major interest. May be repeated.

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

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

695 Internship 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

696 Internship 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

Educational Administration and Policy Studies

GRADUATE COURSES

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when the student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. P/ NP only. E


514 Leadership Themes in Literature (3) Review and analysis of selected literature works—novels, biographies, poetry, plays, essays, personal letters and speeches, history—for lessons that enhance understanding of management. F

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

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

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

604 Seminar in Educational Administration and Policy Studies (1-4) Directed readings and discussion of current issues, policy, and research in educational administration. May be repeated. Maximum 6 hrs. S/ NC only.

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

612 Modes of Inquiry (3) Various inquiry approaches to research in education: related philosophical, methodological and ethical considerations in research design and in use of research findings. Prereq: Graduate Psychology 612.

617 Case Study Methods in Educational Research (3) Methods, techniques and strategies consistent with case study approaches to inquiry in educational and related settings. Required background: Prior knowledge and understanding of research design and modes of inquiry in the social sciences.

619 Practicum (1-3) Intern experience in areas of major interest. May be repeated.

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

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

695 Internship 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

696 Internship 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

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

698 Supervision and Personnel Administration (3) Basic supervisory and personnel concepts and related competencies; building (or micro-organizational) level; interpersonal and personal skills. Prereq: M.S. introductory core or consent of instructor. F, Su.

699 Internship in Educational Planning (3) Processes for improving decision-making function through use of both quantitative and qualitative planning techniques. Policy analysis, CPF, PERT, Delphi. Prereq: M.S. introductory core or consent of instructor. F, Su.

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

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


706 Advanced Seminar in Administrative Theory (3) Interdisciplinary seminar. Readings selected by faculty for research and scholarly value from early to current classic theoretical studies and current periodical literature on administrative theory. Required of Ph.D. students in education. Prereq: Doctoral student in education.

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


729 Seminar in Policy Issues in Education (3) Legal, programmatic, and ethical responsibilities of educational administrators in design and implementation of special service programs within school settings. Special learner characteristics, program categories, service delivery models, and legal/ethical frameworks. Inclusion and full service delivery. F.

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

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

748 Supervision and Personnel Administration (3) Basic supervisory and personnel concepts and related competencies; building (or micro-organizational) level; interpersonal and personal skills. Prereq: M.S. introductory core or consent of instructor. F, Su.

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

754 Policy Issues in Educational Law, K-12 (3) Legal arrangement of case and statutory materials for public school administrators and teachers; problems concerning law and public education. Prereq: M.S. introductory core or consent of instructor. F, Su.

780 Internship in Educational Administration (3) Field experience in appropriate educational setting working with agency administrative staff. Placement by department assignment. May be repeated for credit. Prereq: Consent of instructor. F, Su.

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

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

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


796 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.

799 Seminar in Policy Issues in Education (3) Legal, programmatic, and ethical responsibilities of educational administrators in design and implementation of special service programs within school settings. Special learner characteristics, program categories, service delivery models, and legal/ethical frameworks. Inclusion and full service delivery. F.
645 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Prereq: 548 or consent of instructor. F

655 Legal Issues in Education (3) School law: constitutional foundations as they relate to public education at state and local levels. F,Su

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

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

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

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

**Higher Education**

**GRADUATE COURSES**

<table>
<thead>
<tr>
<th>#</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>530</td>
<td>Special Topics (1-3)</td>
<td>May be repeated. E</td>
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<tr>
<td>534</td>
<td>Program Evaluation in Education (3)</td>
<td>Same as Instructional Technology, Curriculum and Evaluation 535S</td>
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<tr>
<td>536</td>
<td>Policy Issues in Higher Education Quality Assurance (3)</td>
<td>Exploration of historic and contemporary approaches to definition and demonstration of quality in higher education and examination of contemporary policy issues related to quality assurance in colleges and universities.</td>
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<td>537</td>
<td>Student Assessment in Higher Education (3)</td>
<td>Outcome assessment in American higher education: origins of assessment, accountability, criteria, rationales for assessment policy and practice, constructs and outcomes typically assessed, methods for conducting assessment, and uses of assessment data. Philosophies, priorities, and values, recent assessment efforts in higher education.</td>
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<tr>
<td>542</td>
<td>The College Student and the Court (3)</td>
<td>Legal precedent affecting student personnel services in public higher education. Student discipline, housing, dress, organizations, activities fees, tuition and related federal regulations.</td>
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<td>543</td>
<td>American Higher Education in Transition (3)</td>
<td>History, philosophy, purposes, functions, organizations and programs in American higher education.</td>
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<td>570</td>
<td>Student Affairs Administration in Higher Education: Theory &amp; Practice (3)</td>
<td>Historical, philosophical, and organizational perspective. Functional areas comprising field and major issues.</td>
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<td>572</td>
<td>Student Development Theory and Practice in Higher Education (3)</td>
<td>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.</td>
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<td>574</td>
<td>The College Student (3)</td>
<td>Today's college student beginning with transition into college, through critical first year and beyond, culminating in senior year and another period of transition.</td>
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<td>599</td>
<td>Internship in College Student Personnel (1-6)</td>
<td>Prereq: Consent of instructor. May be repeated.</td>
<td>S/NC only.</td>
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<tr>
<td>619</td>
<td>Administration and Governance of Higher Education (3)</td>
<td>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</td>
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**Doctor of Philosophy**

**Education**

**Educational psychology**

**School psychology**

See Education under Fields of Instruction for full description of all degree requirements. The department brings together four areas of graduate study related to teaching and learning across the lifespan. The department is committed to the creation and study of environments that enhance learning potential and promote lifelong learning for people of all ages, abilities, and backgrounds within our programs and the professional practices that we address. Assistantships and fellowships are available for qualified applicants. For more detailed information about the department, see website at http://web.utk.edu/~edpsych.

The adult education area is designed for individuals who seek to provide professional leadership in the education of adults. It offers two degree programs: Master of Science with a major in Educational Psychology, concentration in individual and collaborative learning, and Doctor of Philosophy with a major in Educational Psychology, concentration in educational psychology, specialization in adult education. For details, see website at http://web.utk.edu/~appedps.

The collaborative learning area is designed for professional practitioners who seek to increase their understanding of the collaborative learning process and its facilitation in their interaction with learners of any age in a variety of educational situations. It offers the Doctor of Education degree program with a major in Education, concentration in educational psychology, specialization in collaborative learning. For details, see website at http://web.utk.edu/~collab.

The school psychology area offers advanced training in psychological, educational, and professional foundations leading to licensure as a school psychologist. It offers two degree programs: Educational Specialist with a major in Education, concentration in school psychology, and Doctor of Philosophy with a major in Education, concentration in school psychology. The school psychology programs are accredited by the relevant bodies, including the National Association of School Psychologists (NASP), the American Psychological Association (APA), and the National Council for Accreditation of Teacher Education (NCATE). For details, see website at http://web.utk.edu/~schpsyc.

**Admission Requirements**

Admission requirements include completion of all items in the department's admissions packet and three letters of recommendation (i.e., rating forms). Up-to-date GRE scores are required for application to all degree programs except the master's.

**Educational Psychology**

(Majors of Education)**

**MAJORS**

**DEGREES**

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

* R. S. McCallum, Head

Professors:

Bellon, Jerry J. (Emeritus), Ed.D. | UC Berkeley
Brockett, Ralph G., Ph.D. | Syracuse
Dickinson, Donald J. (Emeritus)
Greenberg, Katherine H., Ph.D. | Oklahoma State
George, Thomas W., Ed.D. | Tennessee
Greer, L. M., Ph.D. | Georgia
McCallum, R. S., Ph.D. | NC State
Sortino, Christopher H., Ph.D. | Lehigh
Williams, R. L. (Liaison), Ph.D. | George Peabody

Associate Professors:

Bain, Sherry K., Ph.D. | Southern Mississippi
Kindall, Luther M., Ed.D. | Tennessee
Ziegler, Mary F., Ed.D. | Columbia

The Department of Educational Psychology offers graduate programs leading to degrees, majors, and concentrations in:

Master of Science

Educational Psychology

Adult education
Individual and collaborative learning

Educational Specialist

Education
School psychology
Doctor of Education

Educational psychology
GRADUATE COURSES

432 The Disadvantaged Student: Psychoeducational Perspectives (3) Theory and research regarding ethnicity, psychosocial behavior and appropriate interventions. F

460 Self-Management in the Helping Professions (3) Applications of self-management strategies to career, social, emotional, and health domains for both helping professionals and their clients. Prereq: Introductory course in psychology or consent of instructor. S/NC or letter grade. F,Su

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

502 Registration for Use of Facilities (1-15) Required of student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used for degree requirements. May be repeated. S/NC only. E


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

505 Quasi-Experimental and Single-Subject Design Research (3) History, theory and research design techniques used to examine cause and effect relationships during applied psychoeducational research. Focus on controlling threats to internal validity through research design. Su

509 Internship in Adult Education (3) Practical field experiences in selected settings under supervision of practitioner and departmental representative. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

510 Psychological Theories of Human Development Applied to Education (3) Theory and research on emotional, social, and intellectual development over life span with applications to educational and therapeutic settings. F,Su

513 Reflective Practice in Education and Psychology (3) Concepts, theories and processes of reflective practice applied to educational settings. E

514 Individual Study in Adult Education (3) Prereq: Consent of supervisor and instructor. Approval form must be completed in office of unit head. May be repeated. Maximum 6 hrs. E

515 Educational Applications of Behavioral Theories of Learning (3) Behavioral theories and research, conditioning, observational learning, and ethological learning as systems apply to student motivation, discipline and learning. Su

516 Educational Applications of Cognitive Learning Theories (3) Cognitive theory and research, social learning, attribution, and information processing as applied to education. Su

517 Direct Assessment and Interventions for Academic Skills Deficits (3) Theory, techniques and procedures shown to prevent and remedy academic skills deficits; curriculum-based assessment and direct intervention procedures. Su

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

520 Survey of Adult Education (3) Historical development, philosophies of adult education agencies, associations, programs, issues, and literature illustrating process of adult education and diversity of continuing education. Prereq: Consent of instructor. F

521 Program Development and Operation in Adult Education (3) Theories and methods from research to practice in planning and directing adult education programs. Prereq: Consent of instructor. Sp

522 Adult Development (3) Theory and research in adult development and change over lifespan and its implications for adult learning in formal and informal contexts. F

523 Post-Secondary Education for Adults (3) History, evolution, philosophy, structure and functions of post-secondary, sub-university institutions, their programs and clientele. Prereq: Consent of instructor. Su

524 Continuing Professional Education (3) Theories, concepts and management of continuing professional education programs for adults in professions. Prereq: 520 or equivalent.

525 Characteristics of Adult Learners (3) Key characteristics of adult learners, current theory and research on adult learning, and implications for teaching and learning concepts. Sp

526 Informal Methods of Assessment (3) Development and use of rating scales, check-lists, observation, test scores and case reports in assessment and counseling of youth and adults. Prereq: Counselor Education and Counseling Psychology 525, A

527 Controversies in Adult Education (3) Controversies confronting field of adult education; development of critical analysis skills by looking at controversies from different perspectives. Sp

528 Psychology of Aging (3) Theory and research of aging and gerontology related issues: psychological and related physiological changes that occur in later life stages of human development. Implications for treatment programs and policies. May be repeated. S,Sp

529 Facilitating Adult Learning (3) Theory, research, and practice related to working with adults in teaching-learning situations. Su

530 Methods of Collaborative Inquiry (3) Philosophical and theoretical frameworks for designing and conducting collaborative inquiry projects. Practice in conducting research. Sp

540 Seminar in School Psychology (3) Essentials of theory and practice of school psychology as professional specialty. Consideration of history and current issues in school psychology. F

541 Psychoeducational Assessment (3) Direct, psychological and educational assessment methods in learning environments. Prereq: Admission to school psychology program or consent of instructor, and Education 621, Educational Psychology 525 or equivalent. May be repeated. Maximum 6 hrs. 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

545 Psychoeducational Consultation (3) Use of two and three-person models of consultation in educational and therapeutic settings based on behavioral, ecological, social learning and cognitive-behavioral theories. F

546 Practicum in Consultation (3) Application of consulting skills to educational settings. Prereq: 545, Sp

549 Internship in School Psychology (1-6) Supervised field work in public and private school psychology internship sites. Prereq: Enrollment in school psychology program and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

560 Discipline and Conflict Resolution (3) Applications of major theories of discipline and conflict resolution strategies in development of constructive atmosphere for classroom learning. Sp

572 Cognitive Education: Models and Approaches (3) Models and approaches in field of cognitive education: research, and theoretical support for various program components, critical variables of organizational learning that affect success of implementation. Sp

573 Meeting Needs of Nontraditional and Underachieving Learners (3) Exploration of students’ needs at any age and level of functioning who are not progressing up to their fullest potential. Causes of academic and motivational problems, and approaches to overcome them. Learning to learn, cultural alienation, and personal world view and interaction with effective teaching and learning. Su

574 Facilitating Group Change (3) Practical issues of group change. Analyses of group and individual experiences in all types of educational settings in relation to systems theory and collaborative learning. Need for use of theory. Needs of individuals and groups involved in change and roles of inside and outside change agents. F,Su


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

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

602 Directed Research (1-3) Instructor- or student-initiated group 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 courses offered at convenience of unit on topics of interest. May be repeated. Maximum 15 hrs. S/NC or letter grade. F,Su

609 Advanced Seminar in Curriculum and Learning (3) Team-taught interdisciplinary seminar on trends, themes, and issues in curriculum and learning. Reading and discussions based on significant research and scholarly publications. Sp

612 Modes of Inquiry (3) (Same as Educational Administration and Policy Studies 621) F

620 Seminar in Adult Education (3) Issues in adult education, theories and concepts, philosophical positions, research trends and methodologies. Prereq: 520 or equivalent. Sp

621 Advanced Seminar in Program Planning (3) Concepts, principles, and processes related to program planning in adult education. Prereq: 521 or equivalent. A

622 Advanced Seminar in Adult Development and Learning (3) Adult development and adult learning theory and research. Prereq: 522, 525, or equivalent. A


635 Ethical, Legal, and Professional Issues in Psychology (3) (Same as Psychology 635 and Counselor Education and Counseling Psychology 635.) F

640 Seminar in Applied Educational Psychology (2) Issues, theories, concepts and research in applied educational psychology. Prereq: Admission to Ph.D. in Education. May be repeated. Maximum 12 hrs. S/NC only. E

649 Advanced Internship in School Psychology (1-9) Supervised experience as school psychologist in unit-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

650 Professional Practice in School Psychology (1) Field setting to facilitate academic, social, and emotional development of children and adults. School and mental health settings for intervention, consultation, prevention, and assessment services. May be repeated. Maximum 9 hrs. S/NC only. F,Sp
Electrical and Computer Engineering

*MAJOR DEGREES*

**Electrical Engineering**

William T. Snyder, *Interim Head*

Professors:
- Abadi, Mongi A., Ph.D. 
  Tennessee
- Alexoff, Igor (Emeritus), PE, Ph.D. 
  Wisconsin
- Bailey, Jackson, M. (Emeritus), Ph.D. 
  Clemson
- Bodenheimer, Robert E. (Emeritus), Ph.D. 
  Northwestern
- Bose, Bimal K. (Condra Chair of Excellence), Ph.D. 
  Calcutta
- Bouldin, Donald W., PE, Ph.D. 
  Vanderbilt
- Gonzalez, R. C. (Emeritus), Ph.D. 
  Florida
- Gooe, Joseph M. (Emeritus), PE, Ph.D. 
  Georgia Tech

Hwang, James C. (Emeritus), PE, Ph.D. 
New York
Kennedy, Eldredge J. (Emeritus), PE, Ph.D. 
Tennessee
Lawler, J. S., Ph.D. 
Michigan State
Pace, Marshall O. (Liaison), PE, Ph.D. 
Georgia Tech
Pierce, J. Frank (Emeritus), PE, Ph.D. 
Pittsburgh
Pujol, Alfonso Jr. (UTSI), Ph.D. 
Vanderbilt
Roth, J. Reece, Ph.D. 
Connecticut
Sims, Syed, Ph.D. 
Tennessee
Smith, Philip W. 
Virginia Tech
Tolbert, Leon, Ph.D. 
Georgia Tech

**THE MASTER’S PROGRAM**

Graduate work leading to the Master of Science with a major in Electrical Engineering may be completed during one academic year of full-time study, or two to three years of part-time study.

**Admission Requirements**

Applicants for admission to the M.S. degree program are expected to have completed a bachelor's degree in Electrical Engineering with an average of at least 3.0 out of 4.0 both overall and in the senior year. All applicants whose native language is not English, including those who have earned degrees at U.S. institutions, must score at least 550 on the TOEFL exam to be considered for admission to the program.

Students who hold the bachelor's degree in a field other than electrical engineering are also expected to have a minimum cumulative grade-point average of 3.0 and a minimum senior year average of 3.0 in that field. The department will require that selected undergraduate courses be taken to make the background of these students comparable to that of students who hold a bachelor's degree in Electrical Engineering. These undergraduate courses may include electrical engineering courses from the sophomore and junior years and one senior electrical engineering sequence of the student's choice. The specific set of undergraduate courses required will be chosen in view of the applicant's prior education and experience. The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a 3.0 average.

**Master’s Degree Requirements**

Students may choose between a thesis option and a project (non-thesis) option M.S. program. All students must file a Master’s Program Plan with the departmental graduate committee specifying which option they have selected, a semester-by-semester schedule of the courses they intend to take, and the members of the student’s master's committee. Students may choose between the thesis and project options, one time, by filing an amended Master’s Program Plan.

**Thesis Option**

Specific requirements of the thesis option are a minimum of 30 semester hours including:

1. Electrical Engineering 503 and 504.
2. Six semester hours of mathematics at the 400 level or above selected from a list approved by the graduate committee, or 6 semester hours of EE courses at the 500 level or above, or 6 semester hours of non-EE courses approved by the student's master's committee and the graduate committee.
3. An additional 12 semester hours of 500-level work in electrical engineering including 8 semester hours in the student's major area of electrical engineering and 4 semester hours in a second area of electrical engineering approved by the student’s master’s committee.
5. A final oral examination covering the thesis and related coursework.
Non-Thesis Option: Specific requirements of the project (non-thesis) option are a minimum of 33 semester hours including:
1. Electrical Engineering 503 and 504.
2. Six semester hours of mathematics at the 400 level or above selected from a list approved by the graduate committee, or 6 semester hours of EE courses at the 500 level or above, or 6 semester hours of non-EE courses approved by the student’s master’s committee and the graduate committee.
3. At least 18 semester hours of 500-level work in electrical engineering courses, with at least 6 hours of 500-level work in each of two areas of electrical engineering.
4. Electrical Engineering 501 (project in lieu of thesis) with a minimum grade of B. This course will be administered by the student’s master’s committee. A written project proposal describing what the student will do in the course must be submitted in advance for the graduate committee’s approval. A written final report and oral presentation is required and one copy of the final draft must be submitted to the graduate committee.
5. A final written and oral examination covering the project and related coursework.

THE DOCTORAL PROGRAM

The Ph.D. degree program with a major in Electrical Engineering may be pursued in the concentration areas of circuit theory, computers, electro-optics, communication theory, electromagnetic theory, plasma engineering, power systems, solid-state electronics, power electronics, and control systems.

Applicants are required to submit scores on the Graduate Record Examinations. A TOEFL score of 550 is required for non-native speakers of English, including those who have earned degrees at U.S. institutions. Specific departmental requirements for the Ph.D. include the following:
1. A Master of Science or Master of Engineering degree.
2. A minimum of 24 semester hours of coursework beyond the Master’s, excluding research and dissertation credit. These hours must include:
   a. A minimum of 12 semester hours in electrical engineering at the 500 and 600 levels.
   b. A minimum of 9 semester hours of 600-level coursework. At least 3 hours of this work must be in an area other than the student’s major area.
   c. A minimum of 6 hours of mathematics courses at the 500 level or above and approved by the electrical engineering graduate committee.
3. One foreign language if the student’s academic background does not cover the knowledge of a foreign language.
4. Satisfactory performance on a qualifying examination and on a comprehensive examination. The qualifying examination is prepared by the Electrical Engineering faculty and consists of two 4-hour written examinations. Successful performance in the graduate electrical engineering curriculum through the junior level. The qualifying examination is offered twice each year (January and August) and is to be taken the first time it is offered after the student enrolls in the program. A student who fails the qualifying examination must take and pass the examination the next time it is offered to remain in the program. A minimum of 18 hours of coursework must be completed after the student has taken the qualifying examination the first time.
   A comprehensive examination is required by the Graduate Council. In this department the comprehensive exam is administered by the student’s committee; the exam results are reported to the graduate committee for approval; and the exam is filed in the department. The comprehensive exam is given when the student is ready to apply for admission to candidacy. The comprehensive exam consists of both written and oral parts. The written part consists of 400-level course sections: a complete review of the literature in the student’s dissertation topic, and a review of the major tools to be used in the dissertation work. The student’s committee may require additional written sections. The student must demonstrate a mastery of the dissertation area, ability to think analytically and creatively, skill in using academic resources, and ability to complete the dissertation satisfactorily. The oral part consists primarily of a professional presentation of a proposal for dissertation work and its defense. The committee may cover additional topics in the oral part.
5. Participation in departmental seminars.

GRADUATE COURSES

Note: Courses required in the Electrical Engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. programs. No 400-level course may be used toward a graduate degree in Electrical Engineering except when required by the program.

400 Senior Design (5) Major design project focusing on professional practice, accumulated background, and current components and trends in the developments in field. Directed to topics within field of electrical engineering. Level 3 design projects which require laboratory work. Prereq: 316 Signals and Systems II, 325 Electric Machinery, 325 Electronic Circuits, 342 Communications, 355 Computing System Fundamentals.


423 Electric Machines (3) Principles of electromechanical energy conversion. Design procedures for AC and DC machine windings; construction and performance characteristics. Electrical machine parameters or steady state and dynamic performances; the d-q model; reference frames. Level 1 design projects. Prereq: 316 Signals and Systems II, 325 Electric Energy System Components.

431 Operational Amplifier Circuits (3) Linear and non-linear active circuits using commercial operational amplifiers. Operational, instrumentation, isolation, bridge, rms and logarithm meters, multipliers and function generators, rectifiers, references, active filters, modulation and demodulation, sinusoidal generation, and fundamental calculations in op-amp circuits. Design for specified pole-zero functions. Applications: transducer interfacing. Level 1 design projects which require laboratory work. Prereq: 316 Signals and Systems II, 325 Electronic Circuits, 342 Communications.

432 Electronic Amplifiers (4) Feedback amplifier principles; wideband linear amplifier design; low-noise preamplifier design; audio power amplifier design; linear regulated power supply design and switching regulator principles. Radio frequency amplifier design; oscillator principles. Laboratory experiments and design projects. Level 2 design projects which require laboratory work. Prereq: 431.

441 Digital Communication (3) Quantization and pulse code modulation. Binary and M-ary signaling, spectra of line codes, link budget analysis, binary communication in presence of noise; matched filtering and equalization, bandpass digital transmission, introduction to multiple access techniques. Level 1 design projects. Prereq: 342 Communications.

442 Communication System Design (4) Application of communication theory to system design, development of communication system specifications. System simulation utilizing graphical programming language, hardware and software simulation. Construction and performance evaluation of complete analog or digital transmitter and receiver or significant subsystems. Level 2 design projects. Prereq: 441.

443 Antennas and Propagation (3) Introduction to antenna theory; fundamental antenna concepts and parameters (directivity, gain, patterns, etc.) and signal propagation. Theory and design of linear and loop antennas, arrays, and other planar antennas. Level 1 design projects. Prereq: 316 Signals and Systems II, 341 Fields, 342 Communications.

446 Electromagnetic Compatibility (3) Principles and practices to avoid interference among and within electronic devices, devices, and systems. Fundamentals of coupling and shielding, crosstalk, susceptibility, and emissions and susceptibility. Crosstalk, shielding, electrostatic discharge, and EMC regulations. Level 1 design projects that require laboratory work. Prereq: 316 Signals and Systems II, 341 Fields, 342 Communications.

451 Computer Systems Architecture (3) Architecture and design of microcomputer systems with microprocessors or microcontrollers. Instruction set architectures, software interfaces, processor structures, memory hierarchy, instruction set design, and level 1 design projects that require laboratory work. Prereq: 355 Computing System Fundamentals.


471 Introduction to Pattern Recognition (3) Statistical decision theory, adaptive classifiers, and supervised and unsupervised learning. Application of techniques in areas of current interest: face recognition, speech processing, remote sensing, data mining and bioinformatics. Level 1 design projects. Prereq: 316...
systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 617.

623 Advanced Power Electronics and Drives (3) Phase-controlled cycloconverters, cycloconverters-fed drives, resonant converters, vector and scalar control of synchronous machines, static Kramer drives, static Scherbius drives, VSCF generation, modern control theory in ac drives.

624 Electrical Insulation (3) Principles, testing, and case studies. Basic principles of aging, losses, charging, conduction, and breakdown in vacuum, gas, liquid, solid, and composite insulation systems. Testing with low-noise instrumentation, pulse height analysis, optics, acoustics, and bridges; associated statistics and distributed parameter effects. Case studies drawn from active research, power systems, electronic circuits and devices, shielding, and stress grading. Prereq: 503, 504, and consent of instructor.

631 Advanced Topics in Electronic Instrumentation I (3) Based on particular interests of students. Fundamental physical processes in instrumentation transducers: thermoelectric, magnetoelectric, electro-mechanical and quantum-mechanical devices. Prereq: 531-32 and consent of instructor.


643 Detection and Estimation Theory (3) Detection theory; coding theory; system identification. Signals with unknown parameters; optimal filter synthesis; adaptive systems; sequential detection; suboptimal detection. Prereq: 504 or consent of instructor.

644 Coding and Information Theory (3) Structure of algebraic and probabilistic codes; linear codes, convolutional codes, error-correcting codes, decoding methods. Identification schemes; deterministic, stochastic, and hierarchical methods. Prereq: 643.

651 Computer-Aided Design of VLSI Systems I (3) Fabrication of microelectronic devices; computer architecture design; algorithmic state machines; partitioning; structured design methodology. Prereq: 551-2 or consent of instructor.

652 Computer-Aided Design of VLSI Systems II (3) Computer-aided design tools; design and implementation of fully custom very large scale integrated (VLSI) circuits; design for testability; testing of fabricated chips. Prereq: 651.

663 Advanced Plasma Physics I (3) Basic concepts of high temperature plasma physics. Magnetohydrodynamics, kinetic descriptions of plasma, plasma transport, plasma waves, equilibrium, and stability. Prereq: Physics 541-2, 461-2 or 563-4, or consent of instructor.

664 Advanced Plasma Physics II (3) Plasma heating and radiation phenomena. Advanced topics of current interest. Must be taken in sequence. Prereq: 663.

671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, multisensor systems. Prereq: 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereo- view, shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-varying imagery, pathplanning and navigation. Prereq: 672.

691 Advanced Graduate Seminar (1) Research in department. May be repeated. 5/N or letter grade.

692 Special Topics (1-3) Advanced topics of current interest to Ph.D. students in Electrical Engineering. May be repeated. Maximum 9 hrs.

The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. Thesis and non-thesis options are available for the M.A. as well as a special concentration in writing. The Department also offers a creative writing dissertation option in the doctoral program.

For detailed information about the master's and doctoral programs, and about individual graduate courses, visit the graduate descriptions of programs and departments on the Website of the College of Arts and Sciences homepage at www.artssci.utk.edu.

The Department of English does not accept students in non-degree or provisional status. A student who wishes to enter the department must contact the department to receive the proper information and forms with which to apply. For additional information, please visit the graduate website through the College of Arts and Sciences.
Capstone Experience Requirement: An integral part of all options in the master’s degree program in English is a capstone experience which allows the student to synthesize and apply the knowledge and skills gained through the completion of the program in a substantial way. Examples of capstone experiences include, but are not limited to, the completion of a thesis or the formal public presentation of a paper at a professional meeting or departmental colloquium. All capstone experiences normally occur after the completion of 24 hours of coursework and must be approved by the Director of Graduate Studies.

Final Examination: A candidate presenting a thesis must pass a one-hour oral examination; a candidate presenting a creative project must pass a ninety-minute oral examination. The examination consists 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 freelance 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 short novel, a play, or a creative work of non-fiction prose.
3. 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 54 semester hours beyond the B.A. (of which at least 24 semester hours must be beyond the M.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 3-hour course in teaching composition; and 15 additional hours at any level approved for graduate credit (including a maximum of 12 hours at the 400 level if approved by the Director of Graduate Studies).

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, 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 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.
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 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) 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., and anyone electing this language option may not take the comprehensive examination in linguistics.

Examinations: (1) An oral qualifying examination taken before the end of the first year of Ph.D. coursework; this 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 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/or 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

Note: Students enrolling in English graduate courses must first register in the office of the Director of Graduate Studies in 306 McClung Tower.

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 between 1601 and 1613. 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 Literature of Restoration and Early Eighteenth Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1745.

412 Literature of Later Eighteenth Century: Johnson to Burns (3) Survey of English literature and culture from 1745 to 1800.

413 Restoration and Eighteenth-Century Genres and Modes (3) A major genre or literary mode: drama,