tion of a proposal for dissertation work and its defense. The committee may cover additional topics in the oral examination.
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 student's attention on professional practice, accumulated background of curricular components, and recent developments in field. Directed to topics within field of electrical engineering. Level 3 design projects which require laboratory work. Prereq: Linear System Analysis, Electric Energy System Components, Electronic Circuits, Analog Communication Amplitude and Frequency Modulation, Introduction to Logic Design of Digital Systems.

411 **Digital Signal Processing and Filter Design** (3) Discrete-time signal and filter design, recursive and non-recursive filter design, and CAD tools for filter design. Level 1 design projects which require laboratory work. Prereq: Frequency-Domain Analysis of Signals and Noise, Linear System Analysis, Systems and Power Laboratory.

412 **Linear Control System Design** (4) Classical and modern techniques for design and compensation of linear feedback control systems. Basic design, root locus design, state variable pole placement design. Level 2 design projects which require laboratory work. Prereq: 411.

421 **Electric Energy Systems** (3) Structure and operation of electrical energy grid; load flow; economic aspects. Level 1 design projects. Prereq: Senior standing.

422 **Power System Operations and Planning** (3) Dynamic phenomena in power systems. Transient stability assessment and enhancement; direct and indirect methods for stability determination in non-linear systems. Operations planning, unit commitment; economic dispatch; power system design and automatic generation control. Volt-var control, load management, cogeneration and other topics of contemporary concern. Level 2 design projects. Prereq: 421.

423 **Electric Machines** (3) Principles of electromechanical energy conversion and power systems for AC and DC machines. Construction and performance characteristics. Effects of machine parameters on steady state and dynamic performances; the d-q model; reference frames. Level 1 design projects. Prereq: Linear System Analysis, Electric Energy System Components.

431 **Operational Amplifier Circuits** (3) Linear and non-linear active circuits using operational amplifiers. Operational amplifiers, op-amps, operational amplifiers, bridge, rms and logarithmic converters, multiplexers and clocks, rectifiers, reference, active filters, modulation, non-linear circuits, etc. Noise fundamentals and calculations in op-amp circuits. Design for specified pole-zero functions. Applications: Audio and video interfacing. Level 1 design projects which require laboratory work. Prereq: Linear System Analysis, Electronic Circuits, Analog Communication Amplitude and Frequency Modulation.

432 **Electronic Amplifiers** (4) Feedback amplifier principles, wideband design, noise preamplifier design, audio power amplifier design; linear regulations. Power supply and design with switching regulators. Radio frequency amplifier design; oscillator principles, white noise, noise figure, feedback, and circuit design projects. Level 2 design projects which require laboratory work. Prereq: 431.

441 **Digital Communications** (3) Discrete Fourier Transforms. Binary and M-ary Signaling, digital communication in present of noise, matched filtering and equalization, Information theory. Level 1 design projects. Prereq: Analog Communication and Frequency Modulation.

442 **Communication System Design** (4) Application of communication theory to system design. Development of communication system specifications. Computer simulation utilizing programming language, Hardware and software design and simulation. Construction and performance evaluation of complete analog or digital transmitter or receiver or significant subsystems. Level 2 design projects. Prereq: 441.

443 **Antennas and Propagation** (3) Antenna theory: fundamental antenna concepts and parameters, directivity, gain, patterns, etc. and signal propagation. Theory and design of antennas, arrays, and other simple antennas. Level 1 design projects. Prereq: Linear System Analysis, Simulation Field, Analog Communication Frequency and Modulation.

451 **Microprocessors and Microcontrollers in Electronic End-Uses** (3) Use of microcomputer kit to develop and implement a control and display system project which requires laboratory work. Prereq: 451.

452 **Organization and Design of Digital Systems and Computers** (4) Considerations for hardware organization of digital systems, digital and analog systems, ALU and CPU structures, computer organization, storage systems, and I/O channels, microcomputers and control systems. Level 2 design projects which require laboratory work. Prereq: 451.

453 **Introduction to Pattern Recognition** (3) Design of learning and adaptive machines. Elementary decision theory, perceptron algorithm, Bayes classification rule, learning algorithms, element statistics of pattern recognition, Level 1 design projects. Prereq: Senior standing. Non-majors require consent of instructor.

454 **Introduction to Digital Image Processing** (3) Basic methods for digitizing, storing, processing, and displaying images. Computational procedures for image enhancement, restoration, coding, and segmentation. Level 1 design projects. Prereq: Senior standing. Non-majors require consent of instructor.

461 **Power Electronics Circuits** (4) Voltage-fed inverters, PWM techniques, control of inverters, dc-dc converters, motor drives, resonant controllers, transformerless power systems, Level 2 design projects which require laboratory work. Prereq: 461.

462 **Power Electronics** (3) Principles of power semiconductor devices, single-phase and polyphase converters, converter control, ac current controller, voltage-fed inverter and dc-dc converter principles. Level 1 design projects which require laboratory work. Prereq: Frequency-Domain Analysis of Signals and Noise, Linear System Analysis, Electric Energy System Components, Electronic Circuits, Systems and Power Laboratory.

471 **Introduction to Pattern Recognition** (3) Design of learning and adaptive machines. Elementary decision theory, perceptron algorithm, Bayes classification rule, learning algorithms, element statistics of pattern recognition, Level 1 design projects. Prereq: Senior standing. Non-majors require consent of instructor.

472 **Introduction to Digital Image Processing** (3) Basic methods for digitizing, storing, processing, and displaying images. Computational procedures for image enhancement, restoration, coding, and segmentation. Level 1 design projects. Prereq: Senior standing. Non-majors require consent of instructor.

481 **Power Electronics** (3) Principles and characteristics of power semiconductor devices. Single-phase and polyphase converters, converter control, ac current controller, voltage-fed inverter and dc-dc converter principles. Level 1 design projects which require laboratory work. Prereq: Frequency-Domain Analysis of Signals and Noise, Linear System Analysis, Electric Energy System Components, Electronic Circuits, Systems and Power Laboratory.

500 **Thesis (1-15)** P/NP only. E or consent of instructor. S/NC or letter grade.

501 **Project in Lieu of Thesis** (3) Capstone course taken under supervision of student's major professor and with major's committee. Individual project involving literature survey, development of software or hardware, writing a white paper, or presentation of thesis or other suitable project. Prereq: Consent of Graduate Committee. May be repeated. Maximum 6 hrs.


504 **Random Process Theory for Engineers** (3) Probability and random variables as developed by the text. Stability laws and transformations of random variables. Random processes, stationarity, correlation functions, and spectral analysis, power spectrum and spectral analysis as applied to response of systems to random signals.

505 **Digital Signal Processing I** (3) Discrete-time signals and systems, z transform, IIR and FIR filters. Prereq: Linear System Analysis, Electronic Circuits, Analog Communication Frequency and Modulation.

506 **Digital Signal Processing II** (3) Further properties of the Z and Fourier transform domains, structures for digital filters, sampling and reconstruction, hardware implementation of digital filters.

507 **Application of Linear Algebra in Engineering Systems** (3) (Same as Chemical Engineering 507 and Mechanical Engineering 507)

511 **Linear Systems Theory** (3) State space models of linear dynamical systems, state transition map, matrix exponential, controllability, observability, realization theory, and stability theory. Coreq: Coreq: 500.

512 **Multivariable Linear Control System Design** (3) Design of controllers for multivariable systems, which satisfy constraints on robustness to plant uncertainties, disturbance rejection, command following. Prereq: 511.

515 **Adaptive Control System Identification** (3) Adaptive control of large-scale deterministic and stochastic systems, adaptive filtering and prediction, parameter estimation for deterministic and stochastic systems. Prereq: 511-2 or 519.

517 **Control System Design I** (3) Analysis and design of continuous and discrete time control systems, feedback theory, stability, steady-state performance, compensation. Engineering aspects of control systems.

519 **Control System Design II** (3) Digital control, variable structure control, state-space systems. Design of controllers, non-minimal systems, which satisfy constraints on robustness to plant uncertainties, disturbance rejection, command following. Prereq: 517.

521 **PRESSH (3)** Matrix-vector representations of power networks, sequence modelling of power system components, unbalanced short and series faults. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 421 or equivalent.

522 **Power System Analysis II** (3) Operation and control of interconnected power systems, transient and dynamic stability. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 521.

523 **Power Electronics and Drives** (3) Forced commutation, PWM techniques, current-fed inverters, drive systems, vector control, and scalar control of induction machines, parametric variations, control principles of synchronous machines.

524 **High Voltage Systems** (3) Phenomena, generation, transmission, distribution, substations, transformers, high voltage circuits, testing, surge and arc control, shielding, reliability. Prereq: 421.


532 **Advanced Analog Electronics II** (3) Design and analysis of linear wideband and low-noise feedback amplifi-
Visualization Tools used in image synthesis and 3D Methods in Robot Sensing, Vision and image enhancement, restoration, and coding. Segmentation. Prereq: 471 or consent of instructor.


580 Graduate Seminar (1) Topics of interest discussed in weekly seminar. May be repeated. Maximum 6 hrs. S/NC or letter grade.

599 Special Topics (1-3) Advanced topics of current interest to Ph.D. students in Electrical Engineering. May be repeated. Maximum 9 hrs.

Engineering Science

See Mechanical and Aerospace Engineering and Engineering Science

English

(Committee of Arts and Sciences)

MAJOR

DEGREES

English .................................................. M.A., Ph.D.
D. Allen Carroll, Head

Professors:
Independent Study may be applied toward the M.A.; and 6 hours for graduate credit at any level, including the 400 level. In this coursework, students must maintain at least a 3.0 GPA.

Thesis Option: Written under the direction of a faculty member of the department and approved by a committee of two other faculty members. Six semester hours of credit will be given.

Non-Thesis Option: Six hours of additional coursework at the 500-600 level, making a total of 30 hours of required coursework.

Language Requirement: Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:
1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT with a grade of B or better.
3. Passing of the regular Ph.D. foreign language examination as currently administered at UT.

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 from 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 500-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 two 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.

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 8 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 the 300 level, 12 hours 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. All other coursework must be in the English department. In this coursework, students must normally maintain a 3.5 GPA.

Dissertation: Twenty-four semester hours of dissertation. These represent the research for and writing of the dissertation. The research and dissertation will be directed by a faculty member of the department and approved by a doctoral committee of three or four other faculty members.

Language Requirement: A language requirement met in one of the following ways:
1. Two languages approved by the Director of Graduate Studies in English. The requirement for each language may be fulfilled by (a) completion of French 302 or German 332 with a grade of B or better; (b) completion at UT 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) in option 1. for one foreign language; and completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509 History of the English Language (offered in alternate years only). For the other 3 hours, the student may either complete the history of the language sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the comprehensive examination in linguistics.

Examinations: (1) A 4-hour qualifying examination taken before the end of the first year 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.

Residency 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 before 1601. Reading and discussion of selected early comedies and tragedies, 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 1612. 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 1550 and 1640 through readings 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 Genre and Modes (3) Major genres and literary modes: comedy, novel, poetry, non-fiction prose, satire, romance, or epic, written between 1660 and 1800. May be repeated.

414 Romantic Poetry and Prose I (3) Wordsworth, Coleridge, Blake; readings from Lamb, De Quincey, and other prose writers.

415 Romantic Poetry and Prose II (3) Keats, Shelley and Byron; readings from Hazlitt, Peacock, and other prose writers.

416 Early Victorian Literature (3) May include poetry by Tennyson and the Browning; prose by Carlyle, Newman, and Mill.

419 Later Victorian Literature (3) May include poetry by the Pre-Raphaelites, Arnold, Hopkins, and Hardy; prose by Arnold, Ruskin, and Carroll; plays by Gilbert and Wilde.

420 The Nineteenth-Century British Novel (3) Scott to Hardy.

421 Modern British Novel (3) Works from authors such as Joyce and Woolf through contemporary British fiction writers.

422 Women Writers in Britain (3) Literary consciousness and works of women writers in Britain. Topics vary: Marie de France, Margery Kempe, Aemilia Lanyer, Elizabeth Cary, Aphra Behn, Frances Burney, Mary Wollstonecraft, Mary Shelley, George Eliot, Virginia Woolf, and Doris Lessing. May be repeated. Maximum 6 hrs. (Same as Women's Studies 422.)

431 Colonial, Federal, and Early National American Literature (3) From Columbus to Washington Irving.

432 American Romanticism and Transcendentalism (3) Prose and poetry of American Renaissance, from c. 1830 to end of the Civil War: Cooper, Poe, Hawthorne, Melville, Emerson, Thoreau, Stowe, Douglass, Whitman, and Dickinson.

433 American Realism and Naturalism (3) Literature from the time of the Civil War to World War I: Twain, Howells, James, Jewett, Freeman, Crane, and Norris.

434 Modern American Literature (3) World War I to present.

435 American Novel before 1900 (3) From earliest sentinent novels through Brown and Cooper, and major figures to 1900: Hawthorne, Melville, Stowe, Clemens, and James.


437 Southern Literature (3) Southern writing from colonial period into twentieth century: frontier humorists, local color writers, and Southern literary renai.

438 American Humor (3) Early nineteenth century into twentieth century: Mark Twain.

439 Topics in Black Literature (3) Contents vary: particular genres, authors, or theories from 1845 to present: Langston Hughes and Harlem Renaissance, Richard Wright and Gwendolyn Brooks, writing by Black women, international Black literature in English, and Black American autobiography.

451 Modern British and American Poetry (3) From Yeats and Frost to Auden, Stevens, and more recent poets.

452 Modern Drama, 1860-1945 (3) Survey of British, American, and international drama from the advent of modern dramatic to the end of World War II.

453 Contemporary Drama (3) Survey of British, American, and international drama since World War II.

454 Twentieth-Century International Novel (3) Fiction from the turn of the century to the present: the works of Kafka and Camus through contemporary authors.

455 Persuasive Writing (3) Writing and analyzing persuasive texts in private, public, and academic contexts. Prereq: Advanced Expository Writing or consent of instructor.

456 Contemporary/Postmodern Literature (3) Studies in literature written after World War II. Content will vary. May be repeated with consent of instructor. Maximum 6 hrs.

460 Technical Editing (3) Editing technical material for publication. Principles of style, format, graphics, layout, introduction and management. Prereq: Technical and Professional Writing or consent of instructor.

462 Writing for Publication (3) Principles and practices of writing for publication. Dissertations, articles, and reports in science and technology. Prereq: Technical and Professional Writing or consent of instructor.

463 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 363 or consent of instructor.

464 Advanced Fiction Writing (3) Further development of skills acquired in advanced fiction course. Prereq: 365 or consent of instructor.

466 Writing, Layout, and Production of Technical Documents (3) Principles of design for desktop publishing. Production of various documents to be incorporated into professional portfolio. Prereq: Technical and Professional Writing or consent of instructor.

470 Special Topics in Rhetoric (3) Topics vary. Prereq: Advanced Expository Writing or consent of instructor. May be repeated with consent of department for a maximum of 6 hrs.

471 Sociolinguistics (3) Study of language in relation to society. Empirical and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 260 or consent of instructor. (Same as Linguistics 471.)

472 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 260 or consent of instructor. (Same as Linguistics 472.)

474 Teaching English as a Second or Foreign Language I (3) Major issues surrounding teaching ESL/EFL, language acquisition; learner variables; socio-cultural factors; implications for second/foreign language instruction.

475 Teaching English as a Second or Foreign Language II (3) Issues, principles, and techniques in teaching ESL/EFL, including grammar, speaking, pronunciation, reading, and writing in ESL/EFL. Observation and teaching practice in ESL/EFL classes and development of ESL materials and tests. Prereq: 474. (Same as Linguistics 475.)

476 Second Language Acquisition (3) How humans learn second languages. Theoretical models and research: differences between first and second language acquisition, learner variables; socio-cultural factors; and implications for second/foreign language instruction. (Same as Linguistics 476.)
479 Literary Criticism (3) Historical survey of major works of literary criticism.


481 Studies in Folklore (3) Topics vary. May be repeated with different topic. Maximum 8 hrs.

482 Major Authors (3) Content varies. Concentrated study of at least one of the most influential writers in British or American literary history: e.g., Donne, Pope, Austen, Tennyson, Whitman, Faulkner, Lawrence, Baldwin, or Morrison.

483 Special Topics in Literature (3) Topics vary. May be repeated. Maximum 6 hrs.

484 Special Topics in Writing (3) Original writing integrated with reading, usually taught by professional author. Topics may vary and may be repeated. Maximum 6 hrs.

485 Special Topics in Language (3) May be repeated. Maximum 6 hrs. with consent of department. (Same as Linguistics 486.)

486 Special Topics in Criticism (3) Content varies. Theoretical and practical approaches to British and American literature may be repeated with consent of department. Maximum 6 hrs.

489 Special Topics in Film (3) Content varies. Principal directors, film genres, national cinema movements, or other topics. Topics may be repeated with consent of department. Maximum 6 hrs. (Same as Cinema Studies 489.)

490 Language and Law (3) Language in Anglo-American legal process: focus on differences between spoken and written language; lexical and syntactic ambiguity; pragmatic speech act analysis; and language rights of linguistic minorities. Prereq: Foundations of the English Language or The Structure of Modern English or consent of instructor. (Same as Linguistics 480.)

495 Introduction to Rhetoric and Composition (3) Historical, theoretical, and empirical modes of inquiry in rhetoric and composition and implications for teaching of composition. Prereq: Advanced Expository Writing or consent of instructor.

496 Rhetoric of Legal Discourse (3) Application of basic principles of persuasive writing to legal materials. Issues of identification and argument through written position papers, briefs, and memoranda. Critical reading and discussion of introductory research texts. No prior legal knowledge necessary. Prereq: Advanced Expository Writing 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 the student uses University facilities and/or facility use before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E

505 Teaching Freshman Composition (3) Introduction to teaching Freshman English through study of various techniques and philosophies of composition. Required of all first-year teaching associates.

506 Introduction to Literary Research (3) Critical examination of aims of English studies, profession of English teachers, theory of literature, and methods of research: collecting of information, evaluation of material, and transmitting of results of scholarship.

507 Applied Criticism: The Rhetoric of Literary Forms (3) Study and application of ways in which major critics have analyzed form in poetry and prose fiction. May be repeated. Maximum 6 hrs.

508 History of the English Language I (3) Phonological, morphological, and syntactic development of English language. Old and Middle English. F, A

509 History of the English Language II (3) Phonological, morphological, and syntactic development of the English language with concentration on developments after 1500, especially in American English. F, A

519-21 Readings in Selected Areas of Sixteenth- and Seventeenth-Century Prose, Poetry, and Drama (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hrs. each.

520-21 Readings in English Literature of the Restoration and Eighteenth Century (3,3) Topics vary: genre, poetry, prose, fiction, drama, or period; Restoration, eighteenth century, or other. May be repeated. Maximum 9 hrs. each.

530-31 Readings in English Literature of the Nineteenth Century I and II (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hrs. each.

540-41 Readings in English Literature of the Nineteenth Century I and II (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hrs. each.

550-51 Readings in American Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hrs. each.

552 Readings in Black American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hrs. each.

550-51 Readings in Twentieth-Century Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis. May be repeated. Maximum 9 hrs. each.

576 Introduction to Contemporary Criticism (3) Introduction to the survey of twentieth-century literary criticism from New Criticism to deconstruction. May be repeated. Maximum 6 hrs.

580 Fiction Writing (3) Advanced fiction projects under supervision of instructor and time for independent study. Prereq: Extensive background in reading and writing fiction. May be repeated. Maximum 6 hrs.

581 Colloquium in Poetry Writing (3) Major poetic project or continuation of project begun in 485. Individual consultation with instructor supplements class analysis. Readings in contemporary poetry and theory. Prereq: 463 or consent of instructor. May be repeated. Maximum 6 hrs.

582 Special Topics in Writing (1-3) Topics vary. May be repeated. Maximum 6 hrs. Enrollment by consent of director of graduate studies only.

583 Special Topics in Literature (3) Topics vary: genres, modes, and other literary subjects not in standard period divisions. May be repeated. Maximum 6 hrs.

584 Topics in Feminist Studies (3) Topics vary. May be repeated. Maximum 9 hrs.

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

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

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

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

590 Topics in Critical Theory (3) Topics vary. May be repeated. Maximum 9 hrs.

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

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

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

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

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

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

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

620 Studies in Medieval English Literature (3) Seminar in literature and literary genres of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year. May be repeated. Maximum 6 hrs.

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer's works. Prereq: Previous course in Chaucer. May be repeated. Maximum 6 hrs.


640-41 Studies in Restoration and Eighteenth-Century Literature (3,3) Topics vary: Swift, satire, Restoration literature, Johnson and Boswell, Addison and Steele, restoration drama, Dryden. May be repeated. Maximum 9 hrs. each.

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

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

660-61-62 Studies in American Literature (3,3,3) Southern literature before 1830, frontier, regionalism, women's literature, literature of the 1800's, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain. May be repeated. Maximum 9 hrs. each.

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


690-70-72 Studies in Feminist Studies (3,3,3) Seminar content varies: feminist literary figures or genres, themes, or other coherent focus. May be repeated. Maximum 9 hrs. each.

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

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

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


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

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

Entomology and Plant Pathology

(College of Agricultural Sciences and Natural Resources)

MAJOR

DEGREE

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

Edward E. (Gene) Burgess, Acting Head

Professors:

Bernard, Ernest C., Ph.D. .................. Georgia

Bost, Steven C., Ph.D. .................. NC State

Burgess, Edward E., Ph.D. ............ Tennessee
department to assist in designating courses required for the minor.

GRADUATE COURSES

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

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

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

510 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant pathogenic fungi. Isolation and identification of plant pathogenic fungi. Prereq: 313 or consent of instructor. 2 hrs and 1 lab. (Same as Ornamental Horticulture and Landscape Design 510.) F, A

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

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

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

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

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

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

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

530 Integrated Pest Management (3) Principles and application of biological, cultural, genetic, behavioral, and chemical methods of control to manage pest populations below economic threshold levels. Prereq: 321, or consent of instructor. (Same as Plant and Soil Science 320.) F, A

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

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

533 Concentrated Study in Entomology (1-3) Selected subjects in entomology for advanced students, concentrated in time and subject matter. Prereq: 321 or basic entomology course. May be repeated. Maximum 8 hrs. F, Sp

541 Seminar (1) Review of literature and current research in entomology and plant pathology. May be repeated. Maximum 2 hrs. E

Environmental Engineering

See Civil Engineering

Exercise Science and Sport Management

(division of Education)

MAJORS

Degree

DEGREES

Human Performance and Sport Studies

Exercise science (exercise physiology; biomechanics/ sports medicine)

Sport management

Doctor of Philosophy

Education

Exercise science

See Education under Fields of Instruction for full description of all degree requirements. The exercise science concentration promotes and integrates scientific research, education, and practical applications of
exercise science to maintain and enhance health, fitness, performance, and quality of life. The department offers an undergraduate major in Exercise Science that will prepare students for careers in fitness and provide the science-based background needed for application to graduate programs in biomechanics, physical therapy, cardiac rehabilitation, public health, exercise physiology, athletic training, or public school teaching. Graduate students and faculty focus on research dealing with theoretical and applied aspects of exercise and sport.

The sport management concentration provides the opportunity for students to attain knowledge and to develop the essential skills to be successful sport managers. In addition, the department coordinates and provides instruction in many physical activities designed to improve physical fitness and encourage future participation in lifetime sports.

Elective courses are offered in dance. These courses are appropriate for students interested in management of dance studios, teaching dance, or dance performance.

ADMISSION REQUIREMENTS

Applicants are required to complete the departmental application which will be sent to all persons upon their initial inquiry about the program. This is in addition to The Graduate School application. Applications from persons who have less than a 3.0 GPA will not be considered.

The following retention policy applies to all graduate students seeking a degree in the department:

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

GRADUATE ASSISTSHIPS

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

Exercise Science

GRADUATE COURSES

400 Physiology of Exercise (3) Functions of body in muscular work; physiological aspects of fatigue, training, and adaptation to environment. Prereq: Biophysics and Cellular and Molecular Biology 230 Human Physiology or 440. Coreq: Biophysics. (Same as Biochemistry and Cellular and Molecular Biology 480.)

500 Thesis (1-15) E

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. S/NC only.

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

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

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

509 Graduate Seminar in Public Health (1) (Same as Public Health 500, Nutrition 500, Nursing 500 and Social Work 500.)


513 Biomechanics of Orthopedic Rehabilitation (3) Effect of physical activity on musculoskeletal tissue: flexibility development and measurement, surgical implications, and rehabilitation related research.

516 Therapeutic Exercise (3) Current research in therapeutic exercise: role of nervous system, soft tissue healing, proprioception, muscle activation patterns, and strength.

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

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

533 Exercise Physiology (3) Physiology of human performance: acute and chronic effects of exercise on metabolic, cardiovascular, pulmonary, and skeletal systems. Prereq: Human physiology or general physiology, general chemistry, 2 hrs and 1 lab.

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

563 Laboratory Techniques in Exercise Physiology (3) Laboratory course in methodology and instrumentation: respiratory and metabolic measurements, blood chemistry, and gas analysis. Prereq: 480 or 533.

565 Advanced Physiology of Exercise (3) Systematic study of skeletal muscle and metabolism related to acute exercise and physical training: lectures, discussions of major scientific reviews, and appropriate laboratory experiments. Prereq: 480 or 533.


569 Clinical Exercise Physiology (3) Cardiac structure and function, interpretation of 12-lead electrocardiograms, exercise considerations for cardiac and pulmonary patients. Prereq: 480 or 533. May be repeated with written consent of instructor. (Same as Public Health 569.)

570 Cardiovascular Rehabilitation Practicum (1-3) Supervised experience in hospital-based exercise programs for participants with cardiac and/or pulmonary disorders. Prereq: 480 or 533. May be repeated with written consent of instructor. Coreq: 569. May be repeated. Maximum 6 hrs.

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

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

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

601 Research Seminar in Exercise Science (1) Research topics in different aspects of exercise science. May be repeated. S/NC only.

622 Directed Independent Research (3-6) Prereq: Total of 480 or 533 and 567. May be repeated. Coreq: 569. May be repeated. Maximum 6 hrs.

625 Mortality and Survival (3) Life table and other population-based approaches to studying international and sociodemographic patterns and differentials in mortality, morbidity, and disability. Prereq: 2 graduate statistics courses or consent of instructor.

635 Physical Activity and Positive Health (3) Review of clinical, epidemiological, and experimental evidence concerning relationship and effects of exercise on health-related components of fitness. Prereq: Elementary statistics, 480 or 533 and 567 or consent of instructor. (Same as Public Health 635.)

661 Seminar in Exercise and Applied Physiology (1-3) Selected topics in exercise and environmental physiology. Prereq: 480 or 533. May be repeated with consent of instructor.

664 Research Participation in Applied Physiology (1-6) Participation in research with faculty member whose interests coincide with those of student. S/NC only.

681 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.
Sport Management

GRADUATE COURSES

415 Development and Maintenance of Recreation, Tourism and Athletic Facilities (3) (Same as Recreation and Tourism Management 415)

440 Sport Marketing (3) Application of fundamental marketing concepts to sport industry. Marketing research, promotions, fund raising, advertising, and assessment of marketing programs specific to sport. Historical development of sport marketing. Prereq: Marketing or consent of instructor.

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

501 Special Project (3-15) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. Prereq: 532.

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


511 Administration/Supervision in Sport (3) Development of knowledge and analytic skills desirable for managers/administrators in sport business/organization: organizational, administrative, and supervisory strategies related to sport in profit and non-profit settings. F,Sp

512 Application of Legal Concepts to Sport Settings (3) Application of contract law, breach of contract, and monetary damages within sport settings; risk assessment and development of effective risk management strategies, development of contracts in sport; and analysis of cases involving discrimination based upon gender, race, and age as well as protection of rights at amateur and professional levels of sport. Sp

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

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

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

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

532 Commercial and Investment Banking (3) Analysis of management policies of financial institutions and investment banking firms. Legal, economic and regulatory environment and implications for management. Financial institution structure and competition and changing trends in U.S. financial system. Analysis of financing and investment policies of financial institutions. Prereq: Business Administration 504 and 505 or consent of instructor.

Finance

(College of Business Administration)

MAJOR

BUSINESS ADMINISTRATION ........... MBA, Ph.D.

James W. Wansley, Head

Professors:

Black, Harold A. (James F. Smith, Jr., Prof.), Ph.D. ......... Ohio State
Boehm, T. P., Ph.D. ........ Washington (St. Louis)
DeGennaro, R. P. (TN Bankers Assoc. Scholar), Ph.D. ...... Ohio State
Dyer, Howard L. (Emeritus), Ph.D. .......................... Pennsylvania
Ehrhardt, M. C. (Vanderbilt), Ph.D. ............ Georgia Tech
Philipatos, G. C. (Distinguished Prof.), Ph.D. ...... New York
Shrieves, Ronald E. (SunTrust Bank Prof.), Ph.D. ........ UCL A
Wachowiak, J. M., Jr., CPA, Ph.D. ............... Illinois
Wansley, James. W. (Glenview Chair of Excellence) (Liaison), CPA, Ph.D. .......... South Carolina

Associate Professors:

Auxier, A. L., Ph.D. ............................ Iowa
Collins, M. Cary, Ph.D. ............................... Georgia
Daves, Phillip R., Ph.D. ................... North Carolina
Gunthorpe, Deborah L., Ph.D. ............ Florida

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Finance.

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

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

Ph.D. Concentration: Finance.

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

GRADUATE COURSES

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


511 Administration/Supervision in Sport (3) Development of knowledge and analytic skills desirable for managers/administrators in sport business/organization: organizational, administrative, and supervisory strategies related to sport in profit and non-profit settings. F,Sp

512 Application of Legal Concepts to Sport Settings (3) Application of contract law, breach of contract, and monetary damages within sport settings; risk assessment and development of effective risk management strategies, development of contracts in sport; and analysis of cases involving discrimination based upon gender, race, and age as well as protection of rights at amateur and professional levels of sport. Sp

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

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

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

532 Commercial and Investment Banking (3) Analysis of management policies of financial institutions and investment banking firms. Legal, economic and regulatory environment and implications for management. Financial institution structure and competition and changing trends in U.S. financial system. Analysis of financing and investment policies of financial institutions. Prereq: Business Administration 504 and 505 or consent of instructor.

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

581 Real Estate Investment and Finance (3) Financial and market analysis used to make real estate investment decisions. Effects of various financing options on the return of new properties. Effect of various financing options on consumer's decisions to purchase, or sell property. Relationship between primary and secondary mortgage markets and impact of those markets on cost and availability of funds for real estate lending. Effects of government intervention (taxation, subsidization, and regulation) in both real estate and mortgage markets. Prereq: Business Administration 504 and 505 or consent of instructor.

599 Special Topics in Finance (1-3) Topics vary. Prereq: Consent of Instructor. May be repeated. Maximum 6 hrs. S/NC or letter grade.

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

641 Seminar in Finance (1-3) Capital markets, utility theory, asset pricing, theory of the firm, capital structure, dividend policy. Prereq: Consent of instructor. S/NC or letter grade.


653 Seminar in Financial Institutions (1-3) Theoretical and empirical studies of financial institutions. Topics: modeling banking firm, efficiency of banks, bank credit allocation and asymmetric information, international competitiveness and deposit insurance. Prereq: 641 and consent of instructor. May be repeated. Maximum 6 hrs. S/NC or letter grade.

**Food Science and Technology**

*(College of Agricultural Sciences and Natural Resources)*

**MAJOR DEGREES**

Food Science and Technology .... M.S., Ph.D.

Clark J. Brekke, Head

Professors:

Brekke, C. J., Ph.D. ............... Wisconsin
Collins, J. L. (Emeritus), Ph.D. ....... Maryland
Davidson, P. M., Ph.D. .............. Washington State
Draughon, F. A., Ph.D. ............... Georgia
Jaynes, H. O. (Emeritus), Ph.D. ...... Illinois
Melton, C. C., Ph.D. ................. Kansas State
Melton, S. L., Ph.D. ................. Tennessee
Miles, J. T. (Emeritus), Ph.D. ........ Wisconsin
Morris, W. C., Ph.D. ................. Iowa State
Overcast, W. W. (Emeritus), Ph.D. .... Iowa State
Penfield, M. P., Ph.D. ............... Tennessee

Associate Professors:

Golden, D. A. (Liaison), Ph.D. ........ Georgia
Lovejoy, H. D., Ph.D. ............... Kansas State
Mount, J. R., Ph.D. ................... Ohio State

Assistant Professors:

Huibert, G., Ph.D. .................... Illinois
Kelly-Winterberg, Kimberly (Adjunct), Ph.D. ............... Tennessee
van Laack, R. L., Ph.D. ............. Utrecht
Weiss, J., Ph.D. ....................... Massachusetts

The Department of Food Science and Technology offers the Master of Science and Doctor of Philosophy degrees. Students in the doctoral program may choose research in the concentration areas of food processing, food chemistry, food microbiology or sensory evaluation of foods. Commodity interests (meats, dairy, fruits, vegetables, bakery products) can be emphasized in any of the areas by careful selection of courses and the research topic. Minors are available in cognate fields. For detailed information, contact the department head.

Admission requirements of The Graduate School of UT apply. In addition, applicants must submit scores from the general section of the Graduate Record Exam (GRE), a written statement of educational and career goals, and Graduate School rating forms or letters of recommendation from at least three people familiar with the applicant’s scholastic ability and professional potential. Admission to the program is contingent upon faculty evaluation of the applicant’s undergraduate/graduate GPA, GRE scores, rating forms, relevant work experience, and scores from the Test of English as a Foreign Language (TOEFL), if applicable.

**THE MASTER’S PROGRAM**

Applicants must have a B.S. in food technology, food science or a related scientific field.

**Thesis Option**

1. Prior to research for the thesis, the student must develop a detailed written research plan. Registration for 6 hours of 500 Thesis is required.

2. In addition to the thesis requirement, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student’s committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student’s progress or background indicates such need.

3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate in discussions during their master’s program. Completion of 510 or equivalent is also required.

4. An oral, final examination covering the thesis and coursework is required.

**Non-Thesis Option**

1. In lieu of a thesis, students are required to complete a problem in cooperation with their employer (company or governmental agency) and their faculty committee. Students working on a problem must register for 6 hours of 503.

2. In addition to the requirement for 6 hours of 503, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student’s committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student’s progress or background indicates such need.

3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate in discussions during their master’s program. Completion of 510 or equivalent is also required.

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

**THE DOCTORAL PROGRAM**

1. Completion of a master’s degree in the field, or a closely related field, or passing a special qualifying examination is required for admission.

2. A dissertation is required for the Ph.D. degree. Each student must develop a detailed written plan for the dissertation research. A minimum of 72 hours beyond the Bachelor’s degree, excluding credit for the master’s thesis, is required. Of this, 24 semester hours must be 600 Doctoral Research and Dissertation.

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

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

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

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

**GRADUATE COURSES**

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

452 Science of Dairy Foods (3) Science and technology of processing of milk and its products. Prereq: Food Laws and Regulations, Food Chemistry, Food Microbiology, and Lab, and Food Preservation or consent of instructor. 2 hrs and 1 lab. Sp

460 Meat Science (3) Muscle characteristics of meat animals, muscle structure and composition, cut identification, cooking, freezing and cooking. Prereq: Food Industry or consent of instructor. Sp

469 Meat Science Lab (1) Slaughter and processing methods for beef, pork, lamb and poultry. Coreq: 460. Sp

470 Food Crop Products (3) Food products from plants; types, manufacturing systems, quality attributes and utility. Prereq: Food Preservation and 3 hrs biological science or consent of instructor. Sp/A

480 Cereal Science and Bakery Products (3) Chemistry and technology of processing of cereal grains, interactions of ingredients during production and storage of baked products. Prereq: Food Laws and Regulations, Food Chemistry, and Food Preservation or consent of instructor. 2 hrs and 1 lab. Sp/A

490 Food Laws and Regulations (3) Laws and regulations designed to preserve safety, wholesomeness, and nutritional quality of United States food supply; precedent case studies and their impacts on laws and regulations. Prereq: The Food Industry; consent of instructor for non-majors. Recommended prereq: Core courses in Food Science and Technology. F

495 Food Processing System Analysis and Evaluation (3) Design and evaluation of food processing operation to produce safe and stable quality food product. Prereq: Food Chemistry, Food Microbiology, Food Preservation or consent of instructor. Sp

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

501 Seminar (1) Individual reports and discussion on topics from current literature. May be repeated. Maximum 3 hrs. F,Sp

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

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

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

509 Scientific Communication (1) Same as Agriculture and Natural Resources 509, Animal Science 509, Horticulture and Landscape Design 509, and Plant and Soil Sciences 509. F

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

511 Color of Foods (2) Chemical basis, measurement, and reactions involved in color changes in foods. Manufacture and application of materials used to modify color of foods. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. F,A
GRADUATE COURSES

421 Forest and Wildland Resource Economics (3) Production functions, supply-demand and market analysis; non-market programs and projects; economic analysis and decision models; investment and financial analysis; managerial economics; taxes; forest products marketing. Prereq: Forest Resource Analysis or consent of instructor. F

422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; for wildland and wildlife law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing or consent of instructor. F

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, recreation design projects, management strategies, methods of visitor and recreation site management; case application that must be submitted at the time of application to The Graduate School.

Thesis Option
1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. Registration for 6 hours of Thesis (Forestry 500 or Wildlife and Fisheries Science 500) is required.

2. A graduate committee of no fewer than 3 faculty members must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis requirement, a minimum of 24 hours of graduate coursework is required. This work must be approved by the student's committee and no more than 10 hours of the minimum 30 can be below the 500 level. The committee may require additional coursework if the student's progress or background indicates such need.

3. All students are required to include Forestry 512 or Wildlife and Fisheries Science 512, Seminar in their programs. This is required of each graduate student in residence fall semester.

4. An oral examination covering the thesis and coursework is required.

Non-Thesis Option (Forestry only)
1. Thirty-five hours of graduate coursework of which 23 must be at the 500 level or above is required.

2. A graduate committee of no fewer than 3 faculty members will be selected. At least one member shall be from outside the department. The committee will meet and schedule the student's program during the first semester in residence.

3. Three hours of Forestry 511 are required.

4. Nine hours of coursework in the department must be at the 500 level or above, exclusive of Forestry 511.

5. Final comprehensive written and oral examinations shall be taken. The exam must be completed no fewer than 28 hours of approved study.

MINOR IN ENVIRONMENTAL POLICY

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

Forestry

The MASTER'S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor's degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must take the general Graduate Record Examination (GRE) with minimum scores required. Graduate School rating forms or letters of recommendation are required. Three individuals familiar with the applicant's academic ability are required. The department also has an option for the student to complete an interdisciplinary specialization in environmental policy. See Economics for program description. 

Forestry, Wildlife and Fisheries

(Graduate School rating forms or letters of recommendation are required. The department also has an option for the student to complete an interdisciplinary specialization in environmental policy. See Economics for program description. 

Forestry

GRADUATE COURSES

421 Forest and Wildland Resource Economics (3) Production functions, supply-demand and market analysis; non-market programs and projects; economic analysis and decision models; investment and financial analysis; managerial economics; taxes; forest products marketing. Prereq: Forest Resource Analysis or consent of instructor. F

422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; forest and wildlife law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing or consent of instructor. F

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, recreation design projects, management strategies, methods of visitor and recreation site management; case
as results from conflict resolution. Linkage between management and planning as tools and natural resource organizations: night field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. F

434 Wood Processing and Machining (2) Primary log breakdown and secondary processing into major products. Fundamentals of machining technology for major types of cutting operations: limiting, planing, veneer cutting, and laser machining; day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. Sp

435 Wood Drying and Preserving (3) Discussion of wood moisture relationships. Introduction to commercial wood drying equipment and practices. Proper, use, specification, and disposal of preserved treated wood. Day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. F

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

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

511 Problem Analysis in Forest Resources (3) Problem identification and solution in forest resources management. Identify, analyze, and prepare written report. Topic and report must have approval of graduate committee. Available only to students in nonthesis option for M.S. in Forestry. E

512 Seminar (1) Current developments in forestry. Required of all graduate students in residence in fall. May be repeated. Maximum 2 hrs. S/N/C only. F

520 Advanced Forest Ecology (3) Physiological ecology and adaptations of trees: relationships between overstory structure, microclimate, and understory response; regeneration ecology; competition and effects of natural and human disturbance regimes at multiscale; forest succession and stand dynamics. Prereq: Graduate standing in forestry or biological science, or consent of instructor. Sp, A

530 Advanced Forest Resource Management (3) Analysis of forest management problems in public and private organizations, interest regulation, planning and goal programming, as applied to resource management problems; advanced forest investment analysis; decision making for priority forest management activities; and methodologies for incorporating non-timber values in forest management operations. Prereq: Senior-level forest management course or consent of instructor. Sp, A

540 Genetics in Forestry (3) Genotypic improvement of forest trees, selection of superior phenotypes; field testing for genetic variability; tree breeding; development of seed orchards, hybridization; tree coryology and tissue culture; use of biochemical variation; planning and conducting forest genetics research. Prereq: Silvicultural methods and Biology 220 or consent of instructor. F, A

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

570 Management & Policy of Forest Resource Organization (3) Theory and application of management as applied to natural resource organizations: institutional direction and control; strategic planning and management. Development of policy as planning tool and as results from conflict resolution. Linkage between policy development and structured management of organizations. Prereq: Forest administration and policy or consent of instructor. F, A

580 Advanced Silviculture (3) Silvicultural characteristics, silvicultural practices and systems applied to commercially important hardwoods and softwoods. In-depth analyses of silvicultural principles involved and tools used, prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, silvicultural bond strength and glued wood product performance, day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. F

585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory; fixed and variable plot sampling; list sampling; Posses sampling; regression estimators; multiscale and multistage sampling. Growth and yield predictors for even-aged and uneven-aged stands. Prereq: Land Measurement Techniques and Forest Resource Inventory or consent of instructor. F, A

590 Advanced Topics in Forestry (1-3) Recent advances and concepts; research techniques and analysis of current problems. Consent of instructor. May be repeated. Maximum 6 hrs.

593 Independent Study in Forestry (1-4) May be repeated. Maximum 6 hrs. E

Forestry, Wildlife & Fisheries

GRADUATE COURSES

410 Wildlife Habitat Evaluation and Management (3) Ecological relationships between wildlife and habitat. Evaluation, monitoring, and management of wildlife habitat. Effects of land uses, practices, and vegetation on wildlife habitat. Weekend field trips. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 2 labs. Sp, A

416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildlife resource management through developing land management plans and analyzing case studies including conflict resolution. Applicable to majors in Forestry and in Wildlife and Fisheries Science. 2 hrs and 1 lab. F

420 Environmental Impact to Natural Ecosystems (2) Identities and analyses of issues regarding forestry, wildlife, fisheries and wildland park resources beyond U.S. borders. Political, economic, social, and biophysical elements impacting natural resources in different parts of the world: Northern Europe, Latin America, Asia, Africa, and South America. In-depth case study and class presentation required by student teams. Not available for students who have taken 420. F

425 Management of Forestry, Wildlife and Fisheries Resources (2) Current technologies and management strategies concerning use of forestry, wildlife, and fisheries resources necessary for decision making and implementation. Prereq: 6 hrs of biological sciences or consent of instructor. Maximum 2 hrs and 1 lab.

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

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

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

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

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

525 Endangered Species Management and Conservation of Biodiversity (2) Status, ecology, and management of endangered wildlife and plant species. Historic aspects, policy implications, and philosophical issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor. (Same as Comparative and Experimental Medicine-Veterinary Medicine 530) F

530 Wildlife Diseases (3) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. (Same as Comparative and Experimental Medicine-Veterinary Medicine 530) F, A

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

Wildlife and Fisheries Science

GRADUATE COURSES

440 Wildlife Techniques (2) Methods of wildlife and fishery control, forest and wildlife habitat management, identification of wildlife field signs, wildlife capturing techniques and management plans. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

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

443 Fisheries Science (3) Quantification and management of freshwater fisheries: population estimation, age and growth, biological assessment, and stocking. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. Sp, A

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

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

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

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

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

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

525 Endangered Species Management and Conservation of Biodiversity (2) Status, ecology, and management of endangered wildlife and plant species. Historic aspects, policy implications, and philosophical issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor. (Same as Comparative and Experimental Medicine-Veterinary Medicine 530) F

530 Wildlife Diseases (3) Necropsy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. (Same as Comparative and Experimental Medicine-Veterinary Medicine 530) F, A

540 Predator Ecology (2) Dynamics of terrestrial vertebrate predator populations in human-altered and relatively unaltered environments. Prereq: 444 or 445 or consent of instructor. Sp, A
demonstrated proficiency in conducting independent research. The department is particularly well-qualified to direct graduate work in location analysis, transportation geography, urban and rural geography, cultural ecology, and the geography of the natural environment (especially biogeography and geomorphology). The faculty is qualified to direct students from a variety of approaches ranging from historical and humanistic to rigorously analytic and GIS-based.

THE MASTER’S PROGRAM

The department offers the thesis and non-thesis options for the Master of Science. Both options require a minimum of 30 semester hours beyond the completion of a sound undergraduate major program. At least two-thirds of the total hours in the degree program must be at or above the 500 level and must include 501 (at each offering during residency). 504 and 3 semester hours at the 600 level. In the thesis option, 6 hours must be Thesis 500. A final examination is required in both programs.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those who demonstrate proficiency in conducting independent research. Students must have a broad foundation and understanding of the discipline; these should have been achieved in a comprehensive master’s program. Course requirements for the degree shall be determined by the student’s faculty committee in accordance with specific interests and needs. The program must include 504, 515, 599, 9 hours of 600-level seminars, and (at least) 9 hours of 700-level seminars. A minimum of 9 hours must be earned in related fields outside the department. Competence in cartography and quantitative techniques is required. Additional fields, including languages, will be required as appropriate to the student’s area of research specialization.

Examinations required for admission to candidacy include a written comprehensive examination, comprised of two written examinations in which the student will be tested on his/her knowledge of two special fields, and related areas of geography; an oral examination on the student’s program, the special fields and related areas, and the dissertation proposal. All parts of the written comprehensive examination should be taken within the same semester.

MINOR IN ENVIRONMENTAL POLICY

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

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

410 Global Positioning Systems and Geographic Data (3) Theory, field and laboratory use of Global Positioning Systems for capturing geographic data. Prereq: Introduction to Cartography and knowledge of computer language or consent of instructor. 2 hrs and 1 2-hr lab.

412 Advanced Cartography Techniques (3) Cartographic design and data display techniques for reference and theme maps. Required of a major program. 2 hrs and 1 2-hr lab.

413 Remote Sensing: Types and Applications (3) Principles and uses of remote sensing imagery, digital data, and spectral data. Required of a major program. 2 hrs and 1 2-hr lab.

415 Quantitative Methods in Geography (3) Basic statistical techniques, point pattern analysis, and analysis of areal units. Required of a major program. 2 hrs and 1 2-hr lab.

421 Geography of Folk Societies (3) Geographical study of folk culture, traditional material culture, and rural settlement, examples from eastern North America and selected foreign areas. Required of a major program. 2 hrs and 1 2-hr lab.

423 Geography of American Popular Culture (3) Geographies of popular American cultures, youth cultures in United States. Required of a major program. 2 hrs and 1 2-hr lab.

425 Historical Geography of the United States (3) Survey of changing human geography of United States during four centuries of settlement and development. Required of a major program. 2 hrs and 1 2-hr lab.

433 The Land-Surface System (3) Characteristics of surface form, water, vegetation, and surface materials, and their regional interrelationships. Required of a major program. 2 hrs and 1 2-hr lab.

435 Biogeography (3) Changing distribution patterns of plants and animals on a variety of spatial and temporal scales. Required of a major program. 2 hrs and 1 2-hr lab.

436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues from physical and economic perspectives. Required of a major program. 2 hrs and 1 2-hr lab.

439 Plant Geography of North America (3) Characteristics and distribution of major plant communities of North America, the U.S., Mexico, and Central America. Required of a major program. 2 hrs and 1 2-hr lab.
521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography. Prereq: 421 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

532 Topics in Global Change (3) Emerging trends, anticipated problems and methods in global change research and response. Prereq: 434 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

533 Topics in Physical Geography (3) Examination of trends, problems, and methods in geography of land surface system or in modern climatology. Prereq: 433 or 454 and consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

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

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

541 Topics in Urban Geography (3) Analysis of urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 432 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

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

577 Biological Conservation (3) Analytical treatment of politics, policies, and forms of biological conservation as practiced in U.S. and abroad. Prereq: Consent of instructor.

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

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

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

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

600 Doctoral Research and Dissertation (1-15) S/NC only. E

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

610 Seminar in Biogeography (3) Topics vary. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

631 Seminar in Natural Hazards (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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

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

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

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

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

677 Seminar in Biological Conservation (3) Conduct of original research. Prereq: 577 or consent of instructor. May be repeated. Maximum 6 hrs.

Geological Sciences

(College of Arts and Sciences)

MAJOR

DEGREES

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

William M. Dunne, Head

Professors:

Broadhead, Thomas W., Ph.D. ............... Iowa

Dries, Steven G. (Liaison), Ph.D., Wisconsin

Dunne, William M., Ph.D. .................. Bristol

Hatcher, Robert D., Jr. (Director, Department of Geology), Ph.D. ............... Tennessee

Kopp, Otto C., Ph.D. ......................... Pennsylvania State

Labotka, Theodore C., Ph.D. ............... California

McLaughlin, Robert E. (Emeritus), Ph.D. ............... Tennessee

McSween, Harry Y., Ph.D. ............... Harvard

Misra, Kula C., Ph.D. ....................... Western Ontario

Taylor, Lawrence A., Ph.D. ............... Lehigh

Walker, Kenneth R. (Carden Prof.), Ph.D. ............... Yale

Associate Professors:

Byerly, Don W., Ph.D. ....................... Tennessee

Clark, G. Michael, Ph.D. ....................... Penn State

McKay, Larry D. (Jones Prof.), Ph.D. Waterloo

McKinney, Michael L., Ph.D. ....................... Yale

Mora, Claudia L., Ph.D. ............... Wisconsin

Williams, Richard T. II., Ph.D. ............... VPI&SU

Assistant Professor:

Kah, Linda C., Ph.D. .......................... Harvard

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

For admission, an applicant must provide transcripts of previous university work, two rating forms or letters of recommendation, and GRE scores (general). Students are not normally admitted under non-degree status. Prerequisites for both degrees includes coursework in mineralogy, optical mineralogy, petrology, stratigraphy, paleontology, structural geology and field geology. One year each of coursework in calculus and chemistry and one year of coursework in biology, physics, or statistics are also required. Applicants lacking any of these may be admitted, but the deficiencies must be removed within the first year without graduate credit. Substitutions may also be allowed.

THE MASTER'S PROGRAM

The department offers the thesis option in the master's program. Graduation requires successful oral defense of a written thesis.
and a minimum 3.0 GPA in all graduate coursework.

Course requirements are a minimum of 30 semester hours, including:
1. Six hours of Thesis 500.
2. Registration in 595 during the first two years in residence. Two hours may be counted toward the 30-hour minimum. This requirement may be waived in unusual circumstances.
3. Sixteen hours of geology courses, with at least 14 hours at the 500 or 600 level, including at least one course from any three of the following five groups:
   Group 1: 410, 460, 480, 530, 563, 565.
   Group 2: 420, 520, 525, 545, 546, 556.
   Group 3: 470, 570, 571, 575, 576.
   Group 5: Any 400- or 500-level courses with grade credit from related departments (allied sciences, mathematics, and engineering), selected with approval of advisor.
4. Eight hours of additional graduate coursework.

THE DOCTORAL PROGRAM

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

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

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

A minimum of 24 hours of graded coursework beyond the master's degree is required in addition to the 24 hours of Dissertation 600. The coursework includes the sum of 9 hours of 600-level geology courses, 9 hours of 500-level or higher geology courses, and 6 hours of additional graduate courses. Extra-departmental coursework is encouraged.

The student must demonstrate a reading knowledge of a foreign language in which there is a body of geologic literature, as approved by the student's dissertation committee. The foreign language requirement may be waived for Ph.D. students whose native language is not English and who have demonstrated mastery of the English language, as determined by the student's dissertation committee.

GRADUATE COURSES

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

geology and tectonics. Prereq: The Dynamic Earth or Earth, Life, and Time, 2 semesters of Calculus.


411 Optical Mineralogy (2) Laboratory course on principles of optical mineralogy. Use of petrographic microscope to identify rock-forming minerals with applications to geology and environmental mineralogy. Prereq: Minerylology.

412 Elements of X-ray Diffraction (2) Laboratory course on principles and applications of X-ray diffraction. Phase identification, quantitative determination of mineral abundances in mixtures, and crystal structure determination. Prereq: Mineralogy.

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

421 Invertebrate Paleontology (4) Survey of invertebrate animal phyla: skeletal structure and preservation, functional morphology, ecology, and geographic distribution. Prereq: Paleobiology or consent of instructor. 2 hrs and 2-4 hrs lab.

440 Field Geology (5) Summer field course for advanced undergraduate geology majors and first-year graduate students in geology. Includes off-campus field trip and requires full time of student. Synthesis of major aspects of geological sciences in local context. Field techniques demonstrated, practiced, and applied to solution of geologic problems. Prereq: Completion of major core courses and consent of instructor.

450 Process Geomorphology (3) Integrative approach to development of surface of earth based upon case histories, maps, remote sensing imagery, off-campus laboratory, and requires full time of student. Synthesis of major aspects of geological sciences in local context. Field techniques demonstrated, practiced, and applied to solution of geologic problems. Prereq: Completion of major core courses and consent of instructor.

455 Environmental Geology (3) Applications of geological sciences toward comprehension of effects of geological processes on human activities and effects of human activities on earth’s environment. Prereq: The Dynamic Earth. 2 hrs and 1-3 lab or field period.

460 Principles of Geochemistry (3) Application of chemical principles to geologic problems. Crystal chemistry and relation between basic atomic structure and distribution and bonding of elements in earth’s crust. Prereq: Chemistry 120-30. Recommended prerequisite 101-02. (Same as Geography 450.) 2 hrs and 1-2 lab.


471 Fieldwork in Geophysics (2) Geophysical investigations applied to solution of problems in tectonics, hydrogeology, or environment. Summer field course off-campus. Requires full time for 2 or more weeks. Prereq: 470 or consent of instructor.

475 Physical and Chemical Systems of the Earth (3) Development of physical laws used in earth’s interior from study of moon and planets to present. Formation, composition, and evolution of hydrosphere, crust, mantle, and core. Interdependence of the earth, geology, sedimentary basins, and processes of the earth’s surface. Prereq: Minerals & Chemistry 120-30. Recommended prerequisite: 310 or equivalent. 3 hrs and 1 lab.

480 Principles of Economic Geology (4) Ore-forming processes, classification of mineral deposits, survey of different types of mineral deposits with examples, and metallurgical techniques. Prereq: Principles of X-ray Diffraction. 4 hrs and 1 lab.

485 Principles of Hydrogeology (3) Basic principles of flow, flow equations, geologic controls, groundwater flow, pollution, and modern water resources, with applications to transport processes. Prereq: The Dynamic Earth; Calculus; Fundamentals of Physics or equivalent.

486 Hydrogeology Laboratory (1) Application and demonstration of hydrogeological principles in field and laboratory. Prereq: or coreq: 485 or Environmental Engineering 535 or consent of instructor.

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

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

505 Structure of the Southern and Central Appalachians (2) Structural development of Southern and Central Appalachians from extensional Late Proterozoic to early Paleozoic rift-drift-platform margin through processes related to compressional events producing accretionary elements that formed Appalachian orogenic belts. Prereq: Structural Geology.

510 Clay Mineralogy (3) Origin, chemistry, structures, and distribution and behavior of clay minerals: application to environmental problems. Prereq: Principles of Geochemistry, or consent of instructor. 2 hrs and 2 labs.

521 Data Analysis in Geology and Environmental Science (3) Application of statistical and other quantitative techniques using computers to analyze geological data: environmental problems.

530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metamorphic rocks, magmatic and subduction processes, and metamorphic conditions. Laboratory involves petrographic study of crystalline rocks in thin section. Prereq: 410. 3 hrs and 1 lab.

535 Ground Water Hydrology (3) (Same as Environmental Engineering 525.)

540 Seminar in Local Geology (1) Introduction to geology of Southern Appalachian region and environmental problems. Lab: 2 hrs and 2 2-hr labs.

545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of terrigenous and clastic rock types; physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. Prereq: 340 or equivalent. 3 hrs and 1 lab.

546 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonate sediments and diagenesis of rock units; field and laboratory analysis of sample material and preparation of scientific reports. 3 hrs and 1 lab.

550 Regional Geomorphology (3) Integrative approach to study of natural geomorphological regions and landforms and unique characteristics of major divisions, sections, and districts. May be repeated with consent of instructor. Maximum 6 hrs.

556 Ice-Age Environments and Global Climate Change (3) (Same as Ecology and Evolutionary Biology 556.)

557 Quaternary Ecology (3) (Same as Ecology and Evolutionary Biology 557.)

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


560 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, x-ray fluorescence, and atomic absorption spectroscopy techniques. Prereq: 310 or consent of instructor. 2 hrs and 1 lab.

570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts;
recent literature. Prerequisite: 370 or equivalent, or consent of instructor. 3 hrs and 1 lab seminar.

572 Fracture Analysis (3) Field and subsurface characteristics and mechanical developmental of natural fractures; role in groundwater flow. Prerequisite: Structural Geology or equivalent, or consent of instructor. (Same as Civil Engineering 572.)

575 Tectonics (4) Evaluation of Earth's lithosphere in context of plate tectonics theory. Formation of continents through comparative anatomy of mountain belts, including Appalachian, Alps, Urals, Caledonians, Cordillera, Andes, and Himalayas. Prerequisite: Structural Geology or consent of instructor. 3 hrs and 1 seminar.

576 Reflection Seismology (3) Imaging subsurface features using reflected seismic waves. Energy sources, modes of wave propagation, field procedures, computer data processing, and pitfalls. Applications to tectonic and environmental problems. Prerequisite: 470 or consent of instructor.

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

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

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

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

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

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

595 Selected Topics in Geology (1) Presentation of research by faculty and visiting scientists. Registration required each semester for resident full-time graduate students, except in summer and when registered for 595. S/N only.

596 Geology Colloquium (1) Preparation and oral presentation of scientific material. Grade based on content, preparation, presentation, and instructor critique in department, taken only once during residence for each graduate student.

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

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

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

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

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

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

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

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

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

German
See Modern Foreign Languages and Literatures

Health and Safety Sciences

(College of Human Ecology)

MAJORS

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

Charles B. Hamilton, Head

Professors:

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

Associate Professors:

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

Assistant Professors:

Ellison, Jack S. (Liaison), Ed.D..... Tennessee Smith, Susan M. (Liaison), Ed.D..... Tennessee

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

The department fosters development of pre-professional and professional competencies by those interested in the disciplines of health education/promotion, public health, and safety. The Health and Safety Sciences academic programs emphasize health promotion (lifestyle behaviors) and health protection (regulatory, environmental and safety) strategies for improving individual and community well-being, directly relating to two UT thematic areas of strength, health and biomedical sciences and children and families. The faculty are committed to the educational value of community-based service learning, applied research, and community outreach. For more information, http://hss.he.utk.edu.

Health

A graduate program is available leading to the Master of Science with a major in Health Promotion and Health Education (thesis and non-thesis options), requiring completion of 30 semester hours. The program emphasizes research skills development by those already employed in the health professions with each student completing a realistic health-related research proposal as a major developmental activity.

The Doctor of Philosophy with a major in Human Ecology offers a concentration in community health. Perspectives of social, behavioral and biomedical sciences are incorporated with educational models appropriate for addressing community health needs.

THE P.H.D. CONCENTRATION

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

1. Minimum 21 hours of foundation courses: 610, 620, 6 hours of statistics, 3 hours of specialized research methods, and 6 hours of natural or behavioral sciences.

2. Minimum 21 hours in primary specialization: 530, 540, 650, 655, 660 and 6 hours of electives.

3. Minimum 12 hours in supporting specialization in a focused area: public health, safety, gerontology or a program approved by doctoral committee.

4. Minimum 6 hours in a cognate area.


GRADUATE COURSES

400 Consumer Health (3) Survey of major consumer health care providers and health care services; selecting, purchasing, evaluating and financing medical and health care services/products. (Same as Public Health 400.) Sp

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

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

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

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

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

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

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

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

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

520 Sex Education and Human Sexuality (3) Advanced in-depth discussion of educational and health counseling theory, techniques, materials and teaching approaches. SP
Health and Safety Sciences

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

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

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

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

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

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

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

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

620 Advanced Research Techniques in Health (3) Advanced theory and techniques of research design and methodologies in health discipline. Prereq: 590, 610. Sp

650 Health Aspects of Gerontology (3) Knowledge and understanding of biological, psychological and sociological aspects of aging as related to health and wellness of individual. (Same as Public Health 650.) Su

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

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


Public Health

Graduate study with a major in Public Health leads to the Master of Public Health (M.P.H.). Three professional preparation concentrations are available: community health education, gerontology, and health planning/administration. Preparation for professional practice in improving community health emphasizes a population perspective, service-learning and application opportunities through rigorous internships. The M.P.H. program is accredited by the Council on Education for Public Health. A minor in statistics is available to interested M.P.H. students due to public health affiliation with the Intercollegiate Graduate Statistics Programs.

ADMISSION REQUIREMENTS

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

THE MASTER’S PROGRAM

The M.P.H. is a non-thesis program requiring completion of 36 semester hours of coursework including 9 weeks of field practice. The field internship provides a full-time experience with an affiliated health agency or organization offering one or more health programs. Of importance, field practice allows the student to apply academic theories, concepts, and skills in an actual work setting. Students must complete all assigned prerequisite courses and 21 semester hours of the curriculum with a minimum overall GPA of 3.0 prior to placement in the field.

As an alternative to field practice, preparation of a master’s essay may be used to fulfill the professional skills development component of the curriculum. Approval must be received from the Public Health Academic Program Committee and is contingent on consent of major advisor. A formal written proposal by the student, and completion of an additional research methods course. Written guidelines stipulating expectations and eligibility criteria are available.

Requirements include:

1. Public Health Foundation courses (16 hours): 509, 510, 520, 530, 540, 555.
2. Internship (6 hours): 587, 588.
3. Concentration of Study (16 hours). Required and recommended electives will be selected by the student in consultation with the major advisor. A list of courses is available for each concentration: community health education, gerontology, and health planning/administration. For more information, refer to the website: http://hss.he.utk.edu/pubhealth.

DUAL M.S.-M.P.H. PROGRAM

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

The program is designed to meet the needs of students who are interested in the benefits of majors in both nutrition and public health. Therefore, it accommodates the student’s public health concentrations. Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit towards the M.S. or M.P.H. degree for courses taken in the other program, except as such courses qualify for credit without regard to the dual program.

Approved Dual Credit

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

MINOR IN GERONTOLOGY

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

ACADEMIC COMMON MARKET

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

**GRADUATE COURSES**

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

410 Worksite Health Promotion (3) Foundations of health promotion programs delivered in worksite that revolve around issues relative to employee and management theory, program design, implementation and evaluation from perspective of health promotion specialist. Prereq: Health Education, Promotion, and Behavior. Sp

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

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

509 Graduate Seminar in Public Health (1) Discussion of timely topics reflecting scope of public health as discipline and its interrelation with many other academic and professional disciplines. S/NC only. F,Sp


520 Public Health Policy and Administration (3) Administrative considerations of community-based health care programs and public health practice. Public health policy formulation, political environment and governmental involvement in health, legal responsibilities, and managerial concepts/techniques/process. F,Sp

521 Organization Theory and Health Care Delivery (3) Administrative and organization theory related to health facilities; operation and management of community hospital. Case discussions and problem-solving exercises; managerial functions and skills. F

523 Management in Extended Care Settings (3) Managerial concepts and theoretical foundations essential to supervision and administration of domiciliary health care programs. Management and operation of health services programs for patients and clients in settings which provide activities of daily living and special psychosocial environmental needs. Programs for home health services, comprehensive medical rehabilitation, nursing homes, congregate living centers and similar type health programs. Prereq: 521 or consent of instructor. Sp

525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply techniques. Prereq: 520 or consent of instructor. Sp

530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of vital statistics and introductory research methodology preparatory for first course in epidemiology. Prereq: 520 or consent of instructor. F,Sp

540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of health problems. Historical origins of discipline, epidemiological hypothesis formulation, research design, data and error sources, measures of frequency and association, etiological reasoning, disease screening, and injury control. Prereq or coreq: 530. F,Sp


550 Principles and Practices of Community Health Education (3) Theoretical foundations for community health education; opportunities for skill development in various educational processes; and introduction to community health analysis. F

552 Community Health Problem Solving (4) Dynamics of community organization, community needs assessment, educational interventions, and application of program planning and evaluation techniques. Opportunity to practice a systematic setting. Prereq: 550 or consent of instructor. Sp


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

568 Physical Activity and Positive Health (3) (Same as Exercise Science 568.)

569 Clinical Exercise Physiology (3) (Same as Exercise Science 569.)

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

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

587-88-89 Internship (3,3,3) Internship (community research setting under supervision of designated preceptor. Prereq: M.P.H. major, one semester advance notice and consent of major advisor. S: 587: 1 credit required for approved extended placements, S/NC only. E

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

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

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

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

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

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

**SPECIAL TOPICS (1-3)**

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

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

601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, researched and reported in acceptable form. May be repeated. Maximum 6 hrs. (Same as Health 601.) E

**GRADUATE COURSES**

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

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

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

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

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

522 Problems and Research in Accident Prevention (3) Safety problems found in wide variety of accidents that occur in community: freedom from risk in behavioral sciences as related to variation incidence of accidents. F

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

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

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

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

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

601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, researched and reported in acceptable form. May be repeated. Maximum 6 hrs. (Same as Health 601.) E
History

(Atlantic College Arts and Sciences)

MAJOR DEGREES

History M.A., Ph.D.

Head

Professors:

Bergeron, Paul H., Ph.D. ......... Vanderbilt
Chmielewski, Edward V. (Emeritus), Ph.D. ......... Harvard
Cutter, E. Wayne, Ph.D. ........ Texas
Farris, W. Wayne, Ph.D. .......... Harvard
Finger, John R., Ph.D. ............ Washington
Haas, Arthur G., Ph.D. .......... Chicago
Hao, Yen-Ping (Lindsay Young Prof.), Ph.D. ......... Harvard
Haskins, Ralph W. (Emeritus), Ph.D. .......... California
Klein, Milton M. (Emeritus) (Distinguished Prof.), Ph.D. .......... Columbia
Moser, Harold, Ph.D. ............ Wisconsin
Norrell, R. Jeff (Bernadotte Schmitt Prof.), Ph.D. ........ Virginia
Ratner, Lorman A. (Emeritus), Ph.D. .......... Cornell
Utley, Jonathan G. (Emeritus), Ph.D. .......... Illinois
Wheeler, Bruce, Ph.D. .......... Virginia

Associate Professors:

Ash, Stephen V., Ph.D. ........... Tennessee
Bast, Robert J., Ph.D. .......... Arizona
Boehstedt, John, Ph.D. ............ Harvard
Bradley, Owen P., Ph.D. .......... Cornell
Brummett, Pamina R., Ph.D. ....... Chicago
Burman, Thomas E., Ph.D. ......... Toronto
Diacon, Todd A., Ph.D. .......... Virginia
Johnson, Charles W., Ph.D. ........ Michigan
Muldowney, John, Ph.D. .......... Yale
Pinckney, Paul J., Ph.D. .......... Vanderbilt

Assistant Professors:

Appier, Janis, Ph.D. ............ California (Riverside)
Brosnan, Kathleen, Ph.D. .......... Chicago
Desse, J. P., Ph.D. ............... Arizona
Glover, Lorri, Ph.D. .............. Kentucky
Hulevicz, Vajdas, G., Ph.D. ........ Pennsylvania
Piehler, G. Kurt, Ph.D. .......... Rutgers

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

General Requirements

Complete 510 and a 600-level research seminar normally during the fall and spring semesters of the first year in the graduate program. Complete 521 in preparation for the M.A. examination. As many as 9 related hours may be taken outside the department. As many as 9 graduate credits taken elsewhere may be applied toward the M.A. degree. Except by prior approval of the Director of Graduate Studies, a student's coursework must be at the 500 level or above.

Thesis Option

Twenty-four hours of coursework and 6 hours of Thesis 500 for a total of 30 hours are required. Thesis students are required to select one M.A. field and write a thesis. At the end of the program the thesis student will stand for a two-hour oral examination on both the thesis and the field.

Non-Thesis Option

A total of 30 hours of coursework is required. At least 6 hours must be completed in each of two M.A. fields. The primary field is examined by a two-hour written followed within one week by a one-hour oral examination with the single grade of pass/fail given at the conclusion of the oral examination. No examination is given on the secondary field.

M.A. Fields

United States (colonial to present)
Premodern Europe
Modern Europe
Asia

Retention and Termination

A 3.0 overall grade-point average is required to remain in good standing. M.A. students must take the M.A. examination no later than the semester following the completion of 30 hours. A student who fails the M.A. examination must repeat the examination no later than the following semester. A student who fails the examination a second time or does not take the examination when required will be dropped from the graduate program.

Admission Requirements

1. Successful completion of the M.A. degree from an accredited institution.
2. Acceptable scores on the Graduate Record Examination (general).
3. Fulfill the foreign language requirement.
4. Complete two 600-level research seminars. (One must be completed at UT.) Students who have completed a master's thesis in the area identified under major II must be taken at UT, and History 621.
5. Maintain a 3.0 overall grade-point average in graduate work attempted.
6. Complete 24 hours of graduate coursework (21 hours graded A-F) at UT beyond that required for the M.A.

Language Requirements

Students must demonstrate competence in one foreign language through coursework or examination. Professors of the student's foreign language must be approved by the Director of Graduate Studies. Foreign language proficiency must be fulfilled before taking the comprehensive examination.

Group III (Teaching Field) Examination

This is a one-hour oral exam which must be completed at any time before the comprehensive examination is taken. If a student fails this, he or she may retake the exam one time only and must do so the following semester.

The Doctoral Program

Admission Requirements

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

Residence and Coursework

Before being admitted to doctoral candidacy, a student must:
1. Complete History 510 at UT (may be waived for comparable experience elsewhere).
2. Complete a minimum 6 related hours outside the department.
3. Spend two consecutive semesters in residence.
4. Complete 9 hours in one Group I doctoral field. There is no minimum hours requirement for a Group II field. Complete 9 hours in one Group III field, including the appropriate 511, 512, or 513 course and two additional courses at the 500 level. The Group III field need be in a different geo-

graphic area from the Group II field. Courses taken to fulfill M.A. degrees may be counted toward all field requirements.

Language Requirements

Students must demonstrate competence in one foreign language through coursework or examination. The student's foreign language must be approved by the Director of Graduate Studies. The foreign language requirement must be fulfilled before taking the comprehensive examination.

Group III (Teaching Field) Examination

This is a one-hour oral exam which must be completed at any time before the comprehensive examination is taken. If a student fails this, he or she may retake the exam one time only and must do so the following semester.

The Doctoral Program

Admission Requirements

1. Successful completion of the M.A. degree from an accredited institution.
2. Acceptable scores on the Graduate Record Examination (general).
3. Fulfill the foreign language requirement.
4. Complete two 600-level research seminars. (One must be completed at UT.) Students who have completed a master's thesis must complete one research seminar (must be taken at UT), and History 621.
5. Maintain a 3.0 overall grade-point average in graduate work attempted.
6. Complete 24 hours of graduate coursework (21 hours graded A-F) at UT beyond that required for the M.A.

Language Requirements

Students must demonstrate competence in one foreign language through coursework or examination. The student's foreign language must be approved by the Director of Graduate Studies. The foreign language requirement must be fulfilled before taking the comprehensive examination.

Group III (Teaching Field) Examination

This is a one-hour oral exam which must be completed at any time before the comprehensive examination is taken. If a student fails this, he or she may retake the exam one time only and must do so the following semester.

The Doctoral Program

Admission Requirements

1. Successful completion of the M.A. degree from an accredited institution.
2. Acceptable scores on the Graduate Record Examination (general).
3. Fulfill the foreign language requirement.
4. Complete two 600-level research seminars. (One must be completed at UT.) Students who have completed a master's thesis must complete one research seminar (must be taken at UT), and History 621.
5. Maintain a 3.0 overall grade-point average in graduate work attempted.
6. Complete 24 hours of graduate coursework (21 hours graded A-F) at UT beyond that required for the M.A.

Language Requirements

Students must demonstrate competence in one foreign language through coursework or examination. The student's foreign language must be approved by the Director of Graduate Studies. The foreign language requirement must be fulfilled before taking the comprehensive examination.

Group III (Teaching Field) Examination

This is a one-hour oral exam which must be completed at any time before the comprehensive examination is taken. If a student fails this, he or she may retake the exam one time only and must do so the following semester.

The Doctoral Program
532 Topics in Modern Europe (3) Reading seminar: secondary sources on movements and trends that are multinational in focus. Focus varies. May be repeated. Maximum 15 hrs.

533 Topics in European National History (3) Reading seminar: secondary sources on intra-national topics, usually British, Russian, German or French. Focus varies. May be repeated. Maximum 15 hrs.

541 Topics in Early American History (3) Reading seminar: secondary sources on early North American history. Focus varies. May be repeated. Maximum 15 hrs.

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

543 Topics in 20th-Century United States (3) Reading seminar: secondary sources on 20th-century United States. Focus varies. May be repeated. Maximum 15 hrs.

544 Topics in U.S. Environmental History (3) Reading seminar: secondary sources on U.S. environmental history. Focus varies. May be repeated. Maximum 15 hrs.

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

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

555 Topics in United States Social and Economic History (3) Reading seminar: secondary sources on U.S. social and economic history. Focus varies. May be repeated. Maximum 15 hrs.

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

557 Topics in Cultural and Intellectual History (3) Reading seminar: secondary sources on cultural and intellectual history. Focus varies. May be repeated. Maximum 15 hrs.

558 Topics in United States Regional and Local History (3) Reading seminar: secondary sources on regions, states and cities of the U.S. Focus varies. May be repeated. Maximum 15 hrs.

559 Topics in Jewish History (3) Reading seminar: secondary sources on Jewish history. Focus varies. May be repeated. Maximum 15 hrs.

561 Topics in Latin American History (3) Reading seminar: secondary sources in Latin America. Focus varies. May be repeated. Maximum 15 hrs.

562 Topics in Asian History (3) Reading seminar: secondary sources on Asian history. East Asia and Middle East. Focus varies. May be repeated. Maximum 15 hrs.

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

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

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

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

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

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

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


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

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

Human Ecology

(College of Human Ecology)

MAJOR DEGREE

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

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

ADMISSION REQUIREMENTS

A completed file for review includes the Graduate School application file, departmental application, Graduate Record Examination (GRE) scores for the general section, and three Graduate School Rating Forms completed by individuals who can attest to the potential for graduate education. Forms may be obtained from the Dean's Office, College of Human Ecology.

THE DOCTORAL PROGRAM

Graduate study leading to the Doctor of Philosophy degree with a major in Human Ecology is available in the Departments of Child and Family Studies; Consumer and Industry Services Management; Health and Safety Sciences; Human Resource Development; Nutrition. Concentration areas are child and family studies, community health, human resource development, nutrition science, textile science, and retail and consumer sciences. A major challenge of the doctoral program in Human Ecology is to draw upon basic research generated from the natural sciences, social sciences, humanities, and the arts, and to provide a holistic perspective that contributes to the improvement of individual and family well being. Within the College of Human Ecology, research from one discipline is enhanced by encompassing and utilizing the findings of research from other disciplines.

The Ph.D. is a research degree granted only to individuals who demonstrate proficiency in conducting original research. Course requirements for the degree are determined by the student's faculty committee, based upon college and departmental requirements and student needs and interests. The Graduate School sets minimum requirements for the doctoral degree.
Human Resource Development

(College of Human Ecology)

MAJORS

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

Gregory C. Petty, Head

PROFESSIONAL ROLES

1. Coursework .9 hours required. A minor in Human Resource Development provides a flexible graduate program for professionals wishing to pursue in-depth study within and across subject areas of Human Resource Development; those who work with individuals to help them enter the workforce; those who train individuals already in the workforce; and those who help individuals in the workforce advance their potential.

2. Applied practicum. 2 hours required. Students must also register under the practicum experience in the "home" department of the supervising faculty.


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

Graduate Committee

At least one faculty member from the College of Human Ecology must accept the candidate for the program of study which will be used in the graduate program. All faculty members must be graduates of the University of Kentucky.

Admission to Candidacy

When application is made for admission to candidacy, the material must be acted upon by the Admissions Committee. The candidate must have a master's degree in a related field or an equivalent of 60 semester hours beyond the bachelor's degree.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at U of L on an in-state tuition basis. The Ph.D. program in Human Ecology is available to residents of Alabama, Kentucky, Mississippi, or West Virginia. Additional information may be obtained from the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

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

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

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

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

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

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 (1-6) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to post bacalaureate students in professional year program. Prereq: Admission to Teacher Education program. May be repeated. Maximum 12 hrs. S/N only. F, Sp

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

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

585 Seminar in Gerontology (1) Scope of gerontology as discipline and as related to other academic and professional disciplines. Speakers both internal and external to UT. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. (Same as Counseling Education and Counseling Psychology 585, Exercise Science 585, Nursing 585, Public Health 585, Psychology 585, Social Work 585, and Sociology 585.) S/N only.

591 Clinical Studies (1-4) Group and individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.

630 College Teaching and Professional Roles in Human Ecology (3) Instructional effectiveness, techniques, organization and evaluation in college teaching. Systems and ecological theoretical framework. Professional roles and responsibilities related to higher education programs in human ecology. Sp
familiar with their potential for success in academic work, and a statement describing personal career objectives directly to the Department of Human Resource Development. Applicants must hold a bachelor's degree from an accredited institution and present evidence of ability to do graduate work, including a GPA of 2.7 on a 4.0 scale for the last two years of undergraduate work. Any student below this level of academic quality must justify admission via other exceptional credentials. If the applicant has prior work experience in human resource development, a reference letter should also be provided by the work supervisor. Recent Graduate Record Examination or Miller's Analogies Test scores are required of all applicants except those applying for the teacher licensure concentration. All applicants are required to be interviewed by the department admissions board.

Teacher Licensure Concentration applicants are to submit an application for admission to The Graduate School and are to be admitted to the Teacher Education Program in order to progress in the Professional Education coursework. Admission to the teacher licensure program requires a minimum 2.75 GPA in Technology Education, Business and Marketing Education, Family and Consumer Sciences Education. In addition, applicants are to have a satisfactory student conduct record; a satisfactory speech and hearing evaluation; passing scores on the Pre-Professional Skills Test or an ACT composite score of 21 or an Enhanced ACT composite score of 22 or a SAT combined score of 990; and a satisfactory Admissions Board interview.

Degree Requirements

Training and Development Concentration is a 38-hour thesis program that includes 3 hours of research methodology and 3 hours of statistics. All students must take the departmental core of eighteen hours consisting of 504, 510, 511, 512, 557 and 559. The thesis requires six hours of Thesis (591) (1 hour). The internship experience (509) (3 hours) is an original research project. The department offers an alternative to the Ph.D. degree. An alternative residence involves, among other requirements, a two-year, continuous enrollment in 604, Research Forum in Human Resource Development. Detailed information regarding the Ph.D. concentration program of study may be obtained from the departmental liaison for graduate studies.

ACADEMIC COMMON MARKET

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

Departmental Core (27 hours): Must include 510, 511, 512, 557, 559 or equivalents and 12 hours of 604.

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

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

Research and Statistics (15 hours): Statistics must include advanced statistics such as multivariate analysis and computer application, 6 hours minimum; research methodology must include 504 and 610 or equivalents, 6 hours minimum.

Internship (0-6 hours): Required for those changing career path.

Dissertation (24 hours): Must be original research.

The department offers an alternative to residence for the Ph.D. degree. This alternative residence involves, among other requirements, a two-year, continuous enrollment in 604, Research Forum in Human Resource Development. Detailed information regarding the Ph.D. concentration program of study may be obtained from the departmental liaison for graduate studies.

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

Human Resource Development

GRADUATE COURSES

415 Coordination Techniques (3) Necessary procedures, duties and responsibilities to implement, maintain and evaluate cooperative education programs.

430 Principles and Organization of Business and Marketing Education (3) Historical background and development needs. Principles of educational education in business and marketing, curriculum development, establishing, evaluating, and improving programs.

455 Learner and Program Evaluation (3) Assessing effectiveness of training programs; developing performance-based measures; evaluating job performance; and measuring learner progress.

476 Supervised Occupational Experience (3) Practical field experience in business/industry/community-based settings related to area of study.

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

501 Survey of Human Resource Development (3) Training and development as practiced in organizations: needs assessment, transfer of workplace skills, evaluation, development of training program materials, assessment of personal competencies, values, goals, and training program design and administration.

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


505 Selection, Placement, and Follow-up Procedures in Human Resource Development (3) Methods and procedures utilized in establishing criteria for trainee selection and placement in instructional programs and jobs. Collecting and analyzing and reporting follow-up data appropriate for making program improvements.

506 Developing Organizational Resources (3) Strategies for developing both human and organizational resources through research partnerships and learning. Effective utilization of human resources through active learning programs.

509 Internship in Human Resource Development (3) Practical field experience in selected settings under supervision of practitioner and departments representative.


512 Human Resource Management (3) Processes for human resource management: independent interdependent human resource activities (planning, work design, staff development, training and development, compensation, etc.) and organizational goals.

513 Special Topics in Human Resource Development (1-3) Specific training or activities. Prerequisite: Consent of instructor. May be repeated. Maximum 9 hrs.

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

516 Microcomputer Software Development (3) Advanced software design in BASIC: random access and binary file search, graphics, and program control. Prereq: 515 or consent of instructor.

521 Design and Development of Instruction (3) Curriculum development and program planning: design of instruction; development of teaching materials for classroom and educational purposes. Intended for students in family and consumer sciences, business, marketing, technology and/or industrial education, F.


531 Organization and Supervision of Business and Marketing Education Programs (3) Developing business and marketing programs: Trends in business and marketing education, physical facilities, state plans, instructor qualifications, and advisory committees. Prereq: Consent of instructor. F.

550 Administration of Industrial Education Programs (3) Developing, staffing, and operating technical education programs in secondary and post-secondary school settings. Prereq: Consent of instructor. Sp.

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

554 Program Planning (3) Instructional systems attending to analysis, design, development, implementation, and evaluation of technical, computer-related training. Prereq: Curriculum development course and consent of instructor. Sp.


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

557 Methods of Teaching Conceptual Content (3) Proper selection and effective application of methods for teaching and learning conceptual content. Communication strategies for conceptual content comprehension, retention, and application.

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

559 Program Evaluation (3) Concepts, principles, practices, theories, and trends related to program evaluation. Planning and conducting a comprehensive program evaluation in a variety of settings. Fundamentals of design, measurement, return-on-investment (ROI), and presentation and dissemination of results to stakeholders.

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

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

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

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

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

604 Research Forum in Human Resource Development (2) Development of theoretical framework, research design, evaluation techniques and qualitative and quantitative strategies for investigations of problems and issues in human resource development. Initial enrollment Fall only. Continuous enrollment required for MA. May be repeated. Maximum 12 hrs. Sp/SNC only. E.

610 Research Development in Human Resource Development (3) Proposal development, theoretical base, research design, sampling, application of statistics, and evaluation of research in human resource development. Prereq: 8 hrs of advanced statistics courses and consent of instructor.

611 Internship in Human Resource Development (3) Field experience in relevant organizations. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E.

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

Industrial and Organizational Psychology
(Thesis School Administration)

MAJOR

Industrial and Organizational Psychology ......................... Ph.D.

Robert T. Ladd (Liaison), Director

Committee:

Fowler, Oscar S., Management
James, Lawrence R., Management
Larsen, John M., Jr. (Emeritus), Management
Rentsch, Joan R., Management
Rush, Michael C., Management
Schumann, David W., Marketing, Logistics & Transportation
Wehr, David J., Management

The doctoral program is designed to prepare students for personnel, managerial, and organizational research; for university teaching; and for consulting relationships with industry. The program emphasizes scientific/practitioner model in applying and conducting research based on accepted theory, organizational behavior, psychology, management, and statistics. The degree program is administered by a committee appointed by the Dean of The Graduate School on recommendations from the Management Department head and the program director. It is intended that students entering the I/O program will represent widely different undergraduate and graduate backgrounds including psychology, business administration, engineering, sciences, and liberal arts. The first-year program provides the opportunity to take courses that will assist the students in attaining a reasonable level of sophistication in areas of deficiency.

ADMISSION REQUIREMENTS

Applicants for admission should request information and application forms from both the Office of Graduate Admissions and the College of Education, Office of Graduate Admissions, 305 Educational Sciences Building, University of Tennessee, Knoxville, TN 37996-0545.

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

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

General Requirements

At least one year of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade-point average of 3.7 or above is required with no evidence of special weakness in mathematics and physical sciences.

Test scores on each section of the general portion (verbal and quantitative) of the Graduate Record Examination (GRE) are required. Customarily, those students admitted to the program have performed at or above the 68-79th percentile on the general tests. (This corresponds to a raw score of approximately 600 on each of the tests.)

THE DOCTORAL PROGRAM

The Ph.D. degree with a major in Industrial and Organizational Psychology can be completed with a minimum of 30 semester hours in the major. Students must be in residence full time for one year; must maintain an overall 3.0 grade-point average with no more than one grade below B in the I/O Psychology, General Psychology, and Statistics core; must complete an applied research project prior to beginning dissertation work; must pass a comprehensive examination; and must pass a final oral examination on their dissertation research.
Course Requirements:  
<table>
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<th>Hours</th>
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| I/O Psychology Core | 567, 568, & 569  
| Research Core | 9  
| Statistical Principles (Statistics 537 & 538 or equivalents) |  
| Multivariate Statistics (Statistics 579, 679 or equivalent) |  
| Advanced Research Methods (605 or equivalent) |  
| General Psychology Core |  
| One course in each of the following areas: biological bases of behavior, cognitive bases of behavior, history and systems of psychology. |  
| I/O Psychology Seminars | 9  
| 600 level IOPSY courses, from a program committee approved list. |  
| Approved Electives |  
| Courses supporting the student’s course of study. |  
| Supervised practicum, internship, or field training (690) |  
| Ethics (935 or equivalent) | 3  
| Dissertation (600) | 24  
| Total | 90  

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 is available to residents of Alabama, Kentucky, Louisiana, Mississippi, South Carolina, Tennessee, West Virginia, and Wyoming. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

525 Research in Industrial/Organizational Psychology (1-3) Available only to students admitted to a program in industrial psychology; or by arrangement with program director. May be repeated. Maximum 9 hrs. S/NC or letter grade.

567-68 Proseminar in Industrial/Organizational Psychology (3, 3) Basic thoughts, concepts, and issues required for advanced graduate study in industrial and organizational psychology. Must be taken during first year of study in program. Consent of instructor required for non-proposed students.

569 Applied Measurement for Industrial/Organizational Psychology (3) Basic techniques for collection and evaluation of individual and organizational data using both classical and modern psychometric techniques. Relevant statistical models: reliability analysis, and exploratory and confirmatory factor analyses.

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

605 Advanced Research Methods in Psychology (3) Critical analysis of new and evolving techniques for psychological research; new statistical and psychometric methods.

610 Individuals in Organizations Seminar (3) Bridging principles and processes which link individual attributes with organizational outcomes. Focus: culture, climate, and group decision-making.

611 Seminar in Organizational Leadership (3) Current theories, concepts, and issues related to the psychology of organizational leadership. Prereq: 567-58 or consent of instructor.

612 Seminar in Work Motivation (3) Current theories, concepts, and issues associated with work motivation. Prereq: 567-58 or consent of instructor.

613 Seminar in Performance Appraisal (3) Current issues, problems, and research in performance appraisal and criterion development; applications in compensation. Prereq: 567-68 or consent of instructor.

614 Seminar in Employee Selection (3) Current issues, concerns, and methods used in employee selection. Prereq: 567-68 or consent of instructor.

615 Seminar in Organizational Training and Development (3) Current issues, problems, and research in training and development. Prereq: 567-68 or consent of instructor.

625 Topics in Organizational Psychology (3) Topics vary. May be repeated. Maximum 9 hrs.

626 Topics in Industrial Psychology (3) Topics vary. May be repeated. Maximum 9 hrs.

627 Structural Equation Models in Organizational Research (2) Issues related to the analysis of organizational data using structural equation and related techniques.

628 Personality Assessment (3) Review of key domains of social cognition: measurement systems which use individual differences in social-cognitive biases as basis for measuring personality.

635 Ethical and Professional Issues in Industrial/Organizational Psychology (3) Issues involved with ethical practice in research, academic, organizational, and consulting situations.

690 Supervised Practicum, Internship or Field Training in Industrial/Organizational Psychology (1-3-15) One credit hour per 30 hours of practice. S/NC or letter grade.

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Industrial Engineering

(College of Engineering)

MAJOR DEGREES

Industrial Engineering............ M.S., M.S.-MBA

T. E. Shannon, Acting Head

Professors:

- Bontadelli, J. A. (Emeritus), Ph.D., Ohio State University
- Claycombe, W. W., Ph.D., VPI
- Devine, Michael D., Ph.D., Texas A&M University
- Garrison, G. W., Ph.D., NC State University
- Loveless, Howard L. (Emeritus), Ph.D., NC State University
- Shannon, T. E., Ph.D., Ph.D., Tennessee

Associate Professors:

- Aikens, C. H., Ph.D., Tennessee
- Halley, M. L. (UTSI), PE, Ph.D., Texas Tech University
- Hungerford, J. C., Ph.D., Ohio State University
- Jackson, D. F. (Liaison), PE, Ph.D., Tennessee
- Kirby, K. E., Ph.D., Tennessee
- Liggert, H. R., Ph.D., NC State University
- Sawhney, Rupi S., Ph.D., Tennessee

Assistant Professors:

- Coleman, G. D. (UTSI), PE, Ph.D., VPI
- Ford, E. R., Ph.D., Tennessee
- Kress, T. A., Ph.D., Tennessee

The Department of Industrial Engineering offers a graduate program leading to the Master of Science degree with a major in Industrial Engineering, concentrations in traditional industrial engineering, engineering management, and manufacturing systems engineering. The Ph.D. with a major in Engineering Science is available through the Department of Mechanical and Aerospace Engineering and Industrial Engineering Science with a concentration in industrial engineering.

THE MASTER'S PROGRAM

Students who enroll in the Master of Science degree may select a concentration in industrial engineering, engineering management or manufacturing systems engineering. Admission is open to graduates of ABET-accredited undergraduate curricula in engineering, or to graduates of other technical curricula who satisfy prerequisites depending on their academic backgrounds. Policies concerning prerequisite requirements will be determined by the Industrial Engineering faculty.

Industrial Engineering

Under the industrial engineering concentration, students may select either the thesis or non-thesis option. The thesis option requires 27 hours of coursework and 6 hours of thesis. The non-thesis option requires 30 hours of coursework plus a 3-hour design project.

Depending upon a student's background and career objectives, graduate work in industrial engineering enables the student to select an area of specialization from operations research, human factors engineering, information systems engineering, maintenance and reliability engineering, or general industrial engineering.

Engineering Management

The engineering management concentration has an additional admission requirement of two years' U.S. industrial experience as a practicing engineer or scientist, or current full-time employment in an appropriate engineering or applied science position. The program is non-thesis and requires 33 hours of coursework plus a 3-hour design project. This concentration is fully supported on-campus utilizing electronic media for video taping and interactive distance teaching methods.

Manufacturing Systems Engineering

Under the manufacturing systems engineering concentration, students may select either the thesis or non-thesis option when taking the M.S. degree program, or the non-thesis option only when taking the dual M.S.-MBA program. The thesis option requires 27 hours of coursework and 6 hours of thesis. The non-thesis option requires 30 hours of coursework plus a 3-hour design/or industrial problem project (36 hours in the dual M.S.-MBA program).

DUAL M.S.-MBA PROGRAM

The College of Engineering and the College of Business Administration offer a coordinated program leading to the concurrent Master of Science degree with a major in Industrial Engineering (concentration in manufacturing systems engineering) and the Master of Business Administration degree (concentration in manufacturing management). The dual program saves the student
Admission Requirements

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

Students will initially apply for the MBA program, indicating on that application the intent to pursue the dual M.S.-MBA program in manufacturing (refer to the MBA program for separate instructions). Students accepted for both degree programs will be assigned by the Dual Program Committee advisors who will be responsible for supervision of the student's progress through the dual program.

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

Curriculum

The curriculum in the first academic year of the dual M.S.-MBA program is the two-semester core of the MBA program (two 15-hour courses per semester). In addition to the MBA core, three credit hours of a survey course in manufacturing systems engineering (IE 503) will also be taken during the first year (1 hour Fall semester and 2 hours Spring semester). A summer internship in industry will be accomplished between the two academic years.

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

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

Approved Dual Credit

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

Note: Any 400-level course required in the Bachelor of Science in Industrial Engineering program at UT may not be used for graduate credit in the M.S. degree program.

Industrial Engineering

GRADUATE COURSES


407 Process Improvement Through Planned Experimentation (3) Fundamentals of continuous improvement systems. Objectives of continuous improvement systems, facilities design and material handling, production planning and scheduling, and other related topics. Prereq: 403 or consent of instructor.

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

501 Design Project (1-3) Enrollment limited to industrial engineering students in non-thesis program. May be repeated. Maximum 6 hrs. S/NC only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities or for faculty time during the summer semester. May not be used toward degree requirements. May be repeated. Maximum 3 hrs.

513 Facilities Planning and Design (3) Modern materials handling techniques, computer-aided layout techniques, application of operation research models, and use of these to design manufacturing systems. Prereq: 502 Production Facilities Design and Material Handling or consent of instructor.

514 Advanced Information Systems Analysis and Design (3) Systems analysis and systems control concepts applied to systems of information. Role of IE in office and factory of future. Management support systems, decision support systems, and integrated support systems.

515 Advanced Production and Inventory Systems (3) Advanced topics in production planning and inventory systems. Material requirements planning: production planning and master scheduling, just-in-time concepts, production requirements planning; and other related topics. Prereq: 407 or consent of instructor.

516 Statistical Methods in Industrial Engineering (3) Application of classical statistical techniques to industrial engineering problems. Statistical and statistical thinking in managerial context of organizational improvement; descriptive statistics and distribution theory; relationship between statistical process control techniques and classical statistical tools; parameter estimation and hypothesis testing; goodness-of-fit testing; linear regression and correlation; analysis of variance. Prereq: 502 or consent of instructor.


518 Advanced Engineering Economic Analysis (3) Application of engineering economic analysis to complex decision situations. Inflation and price changes, uncertainty evaluation using nonprobabilistic techniques. Time value of money and discounted cash flow analysis, profitability analysis, and evaluation of equipment replacement, into- owned utilities, and public works projects; probabilistic risk analysis. Includes computer simulation and decision trees: multi-attribute analysis; and other advanced topics. Prereq: 405 and Probability and Statistics for Scientists and Engineers, or equivalent.
519 Human Factors Engineering and Ergonomics
(3) Application of human factor and ergonomic concepts and principles to the design and analysis of man-machine systems and products. Study of human behavior with respect to equipment design, accident causation, and management of human error; anthropology; anatomy and physiology; psychological and environmental factors; human factors engineering; design; layout; and control; work organization; work measurement; and work load. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

520 Human Factors and Product Safety Engineering
(3) Application of human factors and ergonomics to the design and analysis of man-machine systems and products. Study of human behavior with respect to equipment design, accident causation, and management of human error; anthropology; anatomy and physiology; psychological and environmental factors; human factors engineering; design; layout; and control; work organization; work measurement; and work load. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

521 Advanced Human Factors Engineering Methodology
(3) Advanced methodologies used in human factors engineering. Observational methods; function task analysis; computerized human factors design methods; human reliability and human error prediction; evaluation of human-machine systems; human factors engineering; design; layout; and control; work organization; work measurement; and work load. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

522 Optimization Methods in Industrial Engineering
(3) Classical optimization applied to constrained and unconstrained, non-linear, multi-variable functions; function evaluation; function optimization; decision making under uncertainty; game theory; and applied optimization programming. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

523 Mathematical Programming
(3) (Same as Management Science 523.)

524 Advanced Integrated Manufacturing Systems
(3) Different types of manufacturing systems. Integration of human factors design methods; human reliability and human error prediction; evaluation of human-machine systems; human factors engineering; design; layout; and control; work organization; work measurement; and work load. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

525 Systems Modeling and Simulation
(3) (Same as Management Science 525.)

526 Lean Production Systems
(3) Characteristics and performance of mass and lean production systems. Lean production concepts and principles; planning, designing, and implementing lean production systems; line balancing, set-up time reduction, cost management, maintenance support and other related topics. Application at enterprise level to achieve strategic competitive goals. Prereq: Consent of instructor.

591-92-93 Special Topics in Industrial Engineering
(1-3, 1-3, 1-3) Individual or group research projects. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

601 Operations Research Models in Engineering Economy
(3) Mathematical formulations; linear programming; Markov processes; decision-making under uncertainty; network analysis; inventory control; queuing theory; and simulation. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

602 Nonlinear Optimization
(3) (Same as Management Science 602.)

605 Probabilistic Methods in Engineering Systems
(3) Application of probabilistic methods to selected problems in engineering systems. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

606 Advanced Topics in Human Factors, Safety and Biomechanical Engineering
(3) Application of advanced engineering analysis and design methods to the study of human factors in safety and in the design of man-machine systems. Injury models, development of injury prevention strategies, and risk reduction techniques. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

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

### Engineering Management

#### GRADUATE COURSES

501 Capstone Project (3-6) Application-oriented project to show competence in major academic area. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

502 Registration for Use of Facilities (1-5) Required for the student not otherwise registered during any semester when student uses University facilities for non-curricular time. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

511 Motivation and Culture in Engineering Management
(3) Motivation theories and their application to human resources management. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

512 Productivity and Quality Engineering
(3) Productivity and quality measures defined and used to analyze current competitive environments. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

513 Theory and Practice of Engineering Management
(3) Manager's perspective; business definition; strategic planning and management; marketing and competition in global economy. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

514 Financial Management for Engineering Managers
(3) Financial and managerial accounting in engineering and technology management. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

515 Management of Technology
(3) Creativity and innovation; incorporation of advanced technology into engineering; decision-making; and project management. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

516 Project Management
(3) Development and management of engineering and technology projects. Project proposal preparation; resource and cost estimation; project planning; scheduling; and control; network diagrams and other techniques. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

517 Analytical Methods for Engineering Managers
(3) Survey of management analysis and control systems through IE techniques; quality assurance and improvement; quantitative methods; and management of information systems. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

531 Total Quality Management and Beyond
(3) Continuous improvement in capabilities, competitiveness, and productivity of organizations. Principles of total quality management; systems theory and analysis; simulation; quality measurement; and application of statistical techniques to continuous improvement. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

532 Productivity and Quality Engineering
(3) Productivity and quality measures defined and used to analyze current competitive environments. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

533 Theory and Practice of Engineering Management
(3) Manager's perspective; business definition; strategic planning and management; marketing and competition in global economy. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

534 Financial Management for Engineering Managers
(3) Financial and managerial accounting in engineering and technology management. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

535 Management of Technology
(3) Creativity and innovation; incorporation of advanced technology into engineering; decision-making; and project management. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

536 Project Management
(3) Development and management of engineering and technology projects. Project proposal preparation; resource and cost estimation; project planning; scheduling; and control; network diagrams and other techniques. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

537 Analytical Methods for Engineering Managers
(3) Survey of management analysis and control systems through IE techniques; quality assurance and improvement; quantitative methods; and management of information systems. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

538 New Venture Formation
(3) Factors other than technical qualifications which enter into successful establishment of manufacturing or service enterprise. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

539 Strategic Management in Technical Organizations
(3) Strategic planning process and strategy formulation in technical organizations; corporate vision and mission; product, market, organizational and financial strategies; external factors; commercialization of new technologies; and competition and beyond. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

540 Labor Relations
(3) Negotiation and administration of labor agreements. Survey of historical, legal, and structural environments that influence collective bargaining process. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

541 Total Quality Management and Beyond
(3) Continuous improvement in capabilities, competitiveness, and productivity of organizations. Principles of total quality management; systems theory and analysis; simulation; quality measurement; and application of statistical techniques to continuous improvement. Team building and leadership issues, and case studies. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

542 Design of Experiments for Engineering Managers
(3) Methodology for experiments in product, service, and process improvements. Factorial experiments, screening designs, variance reduction, and other selected topics for engineering managers. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

543 Legal and Ethical Aspects of Engineering Management
(3) Legal aspects imposed by government and ethical considerations in engineering practice. Case studies and student presentations. Prereq: Consent of instructor. May be repeated for credit with consent of instructor.

### Information Sciences

(Office of the Provost)

#### MAJOR

<table>
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<tr>
<th>DEGREE</th>
<th>INFORMATION SCIENCES</th>
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<tbody>
<tr>
<td>M.S.</td>
<td>Information Sciences</td>
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<tr>
<td></td>
<td>Elizabeth Aversa, Director</td>
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</tbody>
</table>

**Professors:**
- Aversa, Elizabeth, Ph.D. 
- Tenopir, Carol, Ph.D. 
- Wilson, P. (Emeritus), Ph.D. 
- Pollard, Richard, Ph.D. 
- Robinson, William C., Ph.D. 
- Bean, Carol, Ph.D. 
- Bilal, Dania, Ph.D. 
- Raber, Douglas, Ph.D. 
- Wang, Pailing, Ph.D. 
- Watson, Jinx, Ed.D. 
- Whitney, Gretchen, Ph.D. 

**Associate Professors:**
- Fisher, Patricia L., Ph.D. 
- Pemberton, J. Michael, Ph.D. 
- Tenopir, Carol, Ph.D. 

**Assistant Professors:**
- Bean, Carol, Ph.D. 
- Bilal, Dania, Ph.D. 
- Raber, Douglas, Ph.D. 
- Wang, Pailing, Ph.D. 
- Watson, Jinx, Ed.D. 
- Whitney, Gretchen, Ph.D. 

The School of Information Sciences provides a program leading to the preparation of librarians and information professionals for work in all types of libraries and information centers. The program includes a graduate curriculum leading to the Master of Science degree. The program is accredited by the American Library Association. A Ph.D. degree program may also be pursued with a major in Communications, concentration in information sciences.
A personal data sheet and three recommendations (obtained from the School of Information Sciences) should be returned to the admissions office of the school. Foreign applicants are required to take the Test of English as a Foreign Language.

THE MASTER'S DEGREE

The program leading to the Master of Science involves a total of 42 semester hours of graduate courses, 15 hours of which form a core curriculum required of all students. Either a thesis or a non-thesis option is available, with 6 hours required for thesis credit. At least 36 hours must be taken in the School of Information Sciences, allowing up to 6 hours outside the school with a maximum of 6 from outside the University.

Core Curriculum

The core curriculum is a 15 semester hour sequence of five courses required of all students: 490, 520, 530, 560, 580. These courses address the evolving information environment; foundations of information sciences and information resources selection, acquisition and evaluation; information content representation; information access and retrieval. The 15-hour core is prerequisite to all elective courses for students enrolled in the MS degree program. Elective courses may begin in the final semester of core course work with permission of the advisor and the instructor of each elective course selected.

Individualized Curriculum Approach

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

Whatever individualized curriculum is chosen, all students who complete the program receive an M.S. degree accredited by the American Library Association (ALA). For those pursuing Tennessee Department of Education licensure as a school library information specialist, stipulated requirements apply. See following section.

Tennessee State Department of Education School Library Information Specialist Requirements

The Tennessee State Department of Education requires School Library Information Specialists to hold the master's degree. The School of Information Sciences offers four tracks for School Library Information specialist endorsement.

Initial Endorsement for Non-Licensed Teachers with a Master's Degree in Library or Information Sciences: For those students who do not hold the master's degree, the requirements for initial endorsement include the 15-hour core plus 551, 567, 571, 572, 573, 585, and 595. In addition, students must complete two corequisite courses from the College of Education (5 credit hours) which do not count toward the master's degree requirements. Students pursuing the initial endorsement must follow the non-thesis option. Upon completion of the requirements, students will earn a master's degree in Information Sciences and a Tennessee State Department of Education license as a School Library Information Specialist.

Additional Endorsement for Licensed Teachers with a Master's Degree: The requirements include the 15-hour core plus 551, 567, 571, 572, 585 and 596 (which must be taken twice). Upon completion of the requirements, students will earn a Tennessee State Department of Education additional endorsement as a School Library Information Specialist.

Additional Endorsement for Licensed Teachers without a Master's Degree: The requirements include the 15-hour core plus 551, 567, 571, 572, 585 and 596 (which must be taken twice) plus 3 electives (upon approval of the faculty advisor). Upon completion of the requirements, students will earn a master's degree in Information Sciences and a Tennessee State Department of Education additional endorsement as a School Library Information Specialist.

Additional Program Requirements

Thesis Option: Students electing the thesis option will write a master's thesis under close supervision of a thesis committee. Six hours of Thesis (IS 500) must be taken within the 42 hours required for graduation. (Students may register for more than 6 hours of 500, but only 6 hours will count toward graduation.) Students must be registered for IS 500 in the semester they complete and defend their thesis. The oral defense of the thesis (final comprehensive examination) substitutes for the written examination that is taken by non-thesis students. The writing of the master's thesis serves as the culminating experience.

Non-Thesis Option: Upon completion of the program, all students will elect the non-thesis option must take either a written comprehensive examination. A culminating experience is also required which must be completed in one of the student's last two terms with a grade of B or better (except as noted) selected from the following and approved by the student's advisor: 530 Problems in Information Science, 591 Supervised Readings in Information Sciences, 592 Seminar in Information Sciences, 593 Independent Study, 594 Graduate...
### 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 Information Sciences is available to residents of the states of Arkansas, Georgia, Virginia, or West Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

### GRADUATE COURSES

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>History of the Book (3)</td>
<td>History of writing and various methods of bookmaking</td>
</tr>
<tr>
<td>450</td>
<td>Writing About Science, Technology and Medicine (3)</td>
<td>Same as Journalism 450.</td>
</tr>
<tr>
<td>485</td>
<td>Introduction to Electronic Communications and Information Resources on the Internet (3)</td>
<td>Exploration of worldwide information and communication resources: email, newsgroups, and world-wide web. Discussion of information issues: copyright, censorship, privacy, and access.</td>
</tr>
<tr>
<td>496</td>
<td>Advanced Electronic Communications and Information Resources on the Internet (3)</td>
<td>Exploration of advanced information and communication issues, resources, tools, forms, scripting, and search engines. Prereq: 495 or consent of instructor.</td>
</tr>
<tr>
<td>490</td>
<td>Information Environment (3)</td>
<td>Generation, production, management, dissemination, and use of information. Roles of information in society, information seeking and information industry, economics of information products and services, technological and organizational change, information professions, and issues. E.A.</td>
</tr>
<tr>
<td>500</td>
<td>Thesis (1-15)</td>
<td>P/NP only. E</td>
</tr>
<tr>
<td>502</td>
<td>Registration and Use of Facilities (3-15)</td>
<td>Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E</td>
</tr>
<tr>
<td>520</td>
<td>Organization and Representation of Information (3)</td>
<td>Principles of distinguishing, describing, and information resources and current approaches: citation systems, descriptive classification, authority control, and subject indexing, pre- and post-coordinate subject indexing, classification and categorical, authority control of index terms; standards. E.A.</td>
</tr>
<tr>
<td>521</td>
<td>Cataloging and Classification (3)</td>
<td>Basic library-oriented cataloging and classification techniques, tools, and supporting operations. Descriptive cataloging, choice and form of non-subject entries, subject heading, and classification: guides, order, authority control, bibliographic utilities, online library catalogs.</td>
</tr>
<tr>
<td>522</td>
<td>Organization and Representation of Multimedia Information Resources (3)</td>
<td>Principles and practices of description and access to information resources in nonprint materials: nonbook, visual, auditory, and electronic (including Internet) resources.</td>
</tr>
<tr>
<td>523</td>
<td>Abstracting and Indexing (3)</td>
<td>Philosophies, standards, and procedures for manual and automatic document indexing. Vocabulary control, thesaurus construction, and abstracting.</td>
</tr>
<tr>
<td>530</td>
<td>Information Access and Retrieval (3)</td>
<td>Media for information storage, retrieval, and distribution: structure, query, logic, interfaces, search strategies, and user interfaces. Discussion of retrieval system performance. Search techniques for various types of databases including multimedia, full-text, numeric, bibliographic, E.A.</td>
</tr>
<tr>
<td>531</td>
<td>Sources and Services for the Social Sciences (3)</td>
<td>Information sources in political science, sociology, philosophy, geography, history, anthropology, business, and education.</td>
</tr>
<tr>
<td>532</td>
<td>Sources and Services for Science and Engineering (3)</td>
<td>Information sources in engineering, physical, and life sciences.</td>
</tr>
<tr>
<td>533</td>
<td>Sources and Services for the Humanities (3)</td>
<td>Information sources in philosophy, religion, fine arts, performing arts, literature and language. Organization and management of regional collections.</td>
</tr>
<tr>
<td>534</td>
<td>Government Information Sources (3)</td>
<td>Selection, acquisition, organization, and utilization of government information in formats from legislative, judicial, executive, and state, local, and international government and intergovernmental agencies.</td>
</tr>
<tr>
<td>535</td>
<td>Advanced Information Retrieval (3)</td>
<td>Bibliographic, non-bibliographic, full-text databases, e.g., non-bibliographic formula and structured databases, contents-page/full-text databases, patents; document delivery alternatives, evaluation, and testing.</td>
</tr>
<tr>
<td>537</td>
<td>Information Industry (3)</td>
<td>Issues and trends concerning information industry: products and services, enabling technologies, choice of distribution media, entrepreneurial opportunities. Legal, ethical, and quality concerns.</td>
</tr>
<tr>
<td>538</td>
<td>Economics of Information (3)</td>
<td>Costing and pricing of information; value of information and value added services; cost-benefit analysis and tradeoffs; policy issues related to economic aspects of information exchange and transfer.</td>
</tr>
<tr>
<td>539</td>
<td>Information Policy (3)</td>
<td>Role of government in creation, exchange of information; review of key national and international policy areas related to information creation, production, and distribution; development of information policy for organizations.</td>
</tr>
<tr>
<td>540</td>
<td>Research Methods (3)</td>
<td>Research methods in variety of information environments; primary and secondary research; research project design; research results interpretation; analysis of published research; techniques supporting research process.</td>
</tr>
<tr>
<td>550</td>
<td>Management of Information Organizations (3)</td>
<td>Survey and analysis of information organizations, structures, functions, and techniques applicable to information professional working in libraries, archives, records management, and other information organizations.</td>
</tr>
<tr>
<td>551</td>
<td>School Library Media Centers (3)</td>
<td>Planning, implementation, and evaluation of school library media centers. Application of library science and other professional knowledge in the planning, design, and implementation of learning environments. Application of technology, site-based management, relationships with district and state services.</td>
</tr>
<tr>
<td>552</td>
<td>Academic Libraries (3)</td>
<td>Mission, status, and history of academic libraries and academic librarianship in community colleges, universities, school districts, information technology, and government's impact on public, technical, and administrative services.</td>
</tr>
<tr>
<td>553</td>
<td>Corporate Information Services (3)</td>
<td>Development and present status, scope and objectives. Information resources external to organization.</td>
</tr>
<tr>
<td>554</td>
<td>Public Library Management and Services (3)</td>
<td>Development, roles, functions, professional ethics, organizational structures, information technology, and management of public libraries. Includes practical experience.</td>
</tr>
<tr>
<td>555</td>
<td>Scientific and Technical Communications (3)</td>
<td>Fundamentals of technical and scientific communication; current trends; role of formal and informal communications; major STI organizations and their roles.</td>
</tr>
<tr>
<td>557</td>
<td>User Instruction (3)</td>
<td>Theory, design, and practice in providing instructional services and technology for end users of information and information systems. Includes practical experience.</td>
</tr>
<tr>
<td>560</td>
<td>Development and Management of Collections (3)</td>
<td>Selecting and preserving items, franchises to need particular needs; copyright, moral rights, library use and management.</td>
</tr>
<tr>
<td>561</td>
<td>Contemporary Book Publishing (3)</td>
<td>Creation, design, production, marketing, and distribution; various publishers.</td>
</tr>
<tr>
<td>562</td>
<td>Graphic Design and Media (3)</td>
<td>Principles and practice in visual aspects of communication. Design, layout, typography, production techniques, and publishing design, as they apply to electronic information delivery systems.</td>
</tr>
<tr>
<td>563</td>
<td>Information Systems (3)</td>
<td>Objectives and functions of records systems, access to files, management systems, and techniques within various types of organizations. Management of information internal to organizations.</td>
</tr>
<tr>
<td>566</td>
<td>Business Intelligence for Information Professionals (3)</td>
<td>Principles and practice of data mining and synthesizing business intelligence: competitive intelligence, information network management; information evaluation and synthesis; role of strategic information in modern organizations.</td>
</tr>
<tr>
<td>567</td>
<td>Information Network Applications (3)</td>
<td>Scholarly and community-based electronic communications. Network programming, distributed file systems, identification, analysis, evaluation, and management of tools and resources; construction of local technologies as developed and applicable.</td>
</tr>
<tr>
<td>569</td>
<td>Advanced Production of Audiovisual Software (3)</td>
<td>Sound, video, and graphic production, and uses, and applications of audiovisual software.</td>
</tr>
<tr>
<td>572</td>
<td>Resources for Young Adults (3)</td>
<td>Critical survey of books and related materials for young adults, personal, vocational, and recreational needs and interests. Evaluation, selection, and utilization for school and public libraries.</td>
</tr>
<tr>
<td>573</td>
<td>Programming for Children and Young Adults (3)</td>
<td>Philosophy and objectives of public and school library services for children and young adults. Reading, viewing, and leisure reading for individuals and groups. Program planning, implementation, and evaluation.</td>
</tr>
<tr>
<td>574</td>
<td>Adult Materials and Services (3)</td>
<td>Popular information and recreational materials and services to meet adult interest in various formats. Development of specialized collections.</td>
</tr>
</tbody>
</table>
| 580           | Foundations of Information Sciences and Technologies (3) | Definitions of information, informa-

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

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

521 Computer Applications in Classroom (3) Computer applications and peripheries in school and classroom. Appropriate for all grades and subjects as well as non-school institutional situations. Prereq: Microcomputer and Instructional Design. Applications of Instructional Technology in Elementary and Middle School, Teaching, or Introduction to Instructional Computing. E

532 Instructional Research: Analysis and Application (3) Analysis of research on instruction. Translation and application of research findings into instructional performance.

533 Program Evaluation in Education (3) Issues and practices in planning and conducting program and curriculum evaluation in a variety of settings. Fundamentals of evaluation, methodology, and underlying values; proper role and use of evaluation in educational organizations. Prereq: Consent of Instructor. (Same as Higher Education 534.) Sp,Su

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

552 School Law for Educators (3) Case and statutory material for school public educators; problems concerning law and public education.

557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Characteristics of students, curriculum designs, instructional patterns, and organization and structure of junior high and middle school.

558 Curriculum Planning and Development (3) Foundations and principles of curriculum planning and development. Historical analysis of curriculum theory, principles of planning and development, and classroom applications for improved learning. E

560 Student Assessment (3) Processes for assessing and reporting student progress; interpretation and use of available assessment data. Methods and metrics other than tests and measurements: portfolios, performance tasks, exhibitions. F

561 Educational Statistics (3) Applications of descriptive and inferential statistics to educational and institutional problems. Use of electronic calculators in educational research. Prereq: One year of college mathematics, an elementary course in statistics, or consent of instructor. E

566 Administering Instructional Media Programs (3) Leadership roles and responsibilities of professional media administrator in a variety of organizational settings.

569 Advanced Production of Audiovisual Software (3) Hand and mechanical lettering, flat picture mounting, overhead projection, audio production, TV studio orientation, sync-taping, multi-screen presentations, and printing techniques. (Same as Information Sciences 569).

571 Desktop Publishing for Educators (3) Use of computer-based desktop publishing and graphics software and related hardware in designing and producing instructional and informational products.

573 Designing and Producing Interactive Multimedia (3) Selected multimedia authoring tools to design and produce interactive instructional materials based on specified learner characteristics and objectives: internet and stand-alone applications.

575 The Internet: Implications for Teaching and Learning (3) Projects and survey theories for using Internet as information, research, and instructional tool. Variety of browsers, search engines, and web page construction software.

577 Introduction To Data Processing in Curriculum and Instruction (4) Analysis of current activities in educational computing and data processing. Curricular, instructional, research, and classroom manage-
ment applications from microcomputers to supercomputers. Prereq: Consent of instructor.

580 Techniques for Research in Curriculum and Instruction (3) Fundamentals of research methodology applicable to curriculum, instruction, and current areas of educational inquiry. Critical reading of research and development of skills needed for proposal development. E

588 Instructional Theory and Design (3) Relationship of curriculum to instruction. Examination of instructional and related learning theories. Instructional models and teaching styles. F, Su

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

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

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

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

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


631 Application of Assessment/Evaluation (3) Systems design, instrumentation, personnel, and application of S/NC or letter grade. E

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

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

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

674 Designing and Implementing Personnel (3) Models and methods for performance assessment of professionals. Critique of systems currently in use and development of evaluation systems.


677 Instructional Programs Design (3) Educational theory and research concerning design, development and evaluation of instructional programs based on specified goals, objectives, and audience characteristics.

678 Seminar in Instructional Technology (1-3) Readings and discussions based on current literature, research, theories, and practices in instructional technology.

679 Trends and Issues in Instructional Technology (3) Theory and practice concerning design, development and evaluation of instructional programs based on specified goals, objectives, and audience characteristics.

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

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

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

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

Interdisciplinary Programs

(Chair of Arts and Sciences)

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

African and African-American Studies

GRADUATE COURSES


450 Issues and Topics in African-American Studies (3) Problems, topics, issues, and individuals. May be repeated. Maximum 6 hrs.

452 Black African Politics (3) Same as Political Science 452.


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

American Studies

GRADUATE COURSES

423 Geography of American Popular Culture (3) Same as Geography 423.

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

Ancient Mediterranean Civilizations

GRADUATE COURSES

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

Asian Studies

GRADUATE COURSES

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

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

Cinema Studies

GRADUATE COURSES

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

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

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

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

469 Sexuality and Cinema (4) (Same as Women's Studies 469.)

499 Special Topics in Film (3) (Same as English 499.)

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

Comparative Literature

GRADUATE COURSES

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

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

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

Judaic Studies

GRADUATE COURSES

405 Modern Jewish Thought (3) (Same as Religious Studies 405.)

425 Early Christian and Byzantine Art, to 1350 (3) (Same as Art History 425.)

431 Medieval Art of the West, 800-1400 (3) (Same as Art History 431.)

Latin American Studies

GRADUATE COURSES

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

GRADUATE COURSES

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

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

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

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

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

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

435 Structure of the German Language (3) (Same as German 435)

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

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

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

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

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

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

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

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

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

Medieval Studies

GRADUATE COURSES

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

Urban Studies

GRADUATE COURSES

401 The City in the U.S. (3) (Same as Planning 401)

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

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

Women's Studies

GRADUATE COURSES

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

410 Gender Role Development: Implications for Education and Counseling (3) (Same as Counselor Education and Counseling Psychology 410)

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

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

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

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

469 Sexuality and Cinema (4) Exploration of issues surrounding sexuality, gender, and cinema from points of view of feminist film criticism. (Same as Cinema Studies 469)

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

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

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

593 Independent Study (1-6) Prereq: Consent of Chair of Women's Studies.

Journalism

(College of Communications)

MAJOR

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

James A. Crock, Director

Professors:

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

Ashdown, Paul G., Ph.D. ......................... Bowling Green

Bowles, Dorothy, Ph.D. ........................... Wisconsin

Cade, Dozier C. (Emeritus), Ph.D. .......... Iowa

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

Crook, James, Iowa State

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

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

Leiter, B. Kelly (Emeritus)

Ph.D. ............................................ Southern Illinois

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

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

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

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

Associate Professors:

Dimmock, Susan L., Ph.D. ................... Tennessee

Foley, Daniel, M.S.J. .............................. Northwestern

Heller, Robert B., M.A. ....................... Syracuse

Morrow, Jerry L., Ph.D. ............................ Toledo

Assistant Professors:

Riechert, Bonnie P., Ph.D. .................... Tennessee

White, Candace L., Ph.D. ........................ Georgia

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

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

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

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

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

451 Environmental Reporting (3) Writing for news media on such environmental issues as strip-mining, acid rain, air pollution, allergens, nuclear power, fossil fuel power, and solid wastes. Presentations from and interviews of experts in environmental science and reporting. Exemplary popular literature in environmental reporting. Prereq: Editing for majors; consent of instructor for non-majors.

455 Issues in Science Communications (3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

456 Science Writing as Literature (3) Survey of important science writing for general public across spectrum of science, engineering, and medical works by authors such as Arthur C. Clarke, Stephen J. Gould, and Richard Selzer. Analysis of literary qualities in quest to understand why some science writing succeeds. Prereq: Consent of instructor.


465 Women and Mass Media (3) Media effects on women. Media coverage and portrayal of women. Historical and current status of women in mass communications industries.

466 Advanced Photojournalism (3) Advanced principles and methods of black-and-white photography. Introduction to color photography. News and feature photographs and photo essays. Prereq: Photojournalism or consent of instructor. Sp

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

525 Public Opinion (3) Role of press in developing and influencing public consensus. Social theories of public opinion and analysis of mass media's response. (Same as Public Relations 525)
Law
(Office of Law)

MAJOR

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

Professors:

Anisley, Frances Lee, LL.M........Harvard
Best, Reba, M.L.S....................Florida
Blaze, Douglas A., J.D..........Georgetown
Cohen, Neil P., LL.M........Harvard
Cook, Joseph G., LL.M...............Yale
Galligan, Jr., Thomas C., LL.M.......Columbia
Hardin, Patrick J., J.D........Chicago
Hees, Amy M., J.D...............Virginia
Jared, Durward S. (Emeritus), J.D.

S.D.J. ..............................................Michigan
Le Clercq, Frederic S. (Emeritus), LL.B., Duke
Lloyd, Robert M., J.D..........Michigan
Overton, Elvin E. (Emeritus), S.D.J.. Harvard
Phillips, Jerry J., J.D........Yale
Picquet, Cheryn, M.S.L.S........Tennessee
Reynolds, Glenn H., J.D..........Yale
Rivkin, Dean H., J.D........Vanderbilt
Sewell, Toxey H. (Emeritus), LL.M...George Washington
Sobieski, John L., J.D........Vanderbilt
Starck, Barbara J., J.D........New York
Wirtz, Richard S., J.D........Stanford
Zwier, Paul J., LL.M........Temple

Associate Professors:

Aarons, Dwight, J.D........UCLA
Anderson, Gary L., LL.M........Harvard
Beintema, William J., J.D..Miami
Black, Jerry P., Jr., J.D., Vanderbilt
Carnett, Judy M., J.D........Tennessee
Davies, Thomas Y., J.D., Northwestern
Gray, Graysford B., J.D........Vanderbilt
Hamm, Joan M., J.D........New York
Kennedy, Deseree A., LL.M........Temple
Leifer, Don A., J.D........New York
McAlpine, Janice E., LL.M........Illinois
Mcdill, Colleen E., J.D........Kansa
Parker, Carol M., J.D., Illinois
Pearce, Carl A., J.D........Vanderbilt
Plank, Thomas E., J.D........Maryland
Stein, Gregory M., J.D., Columbia
Thorp, Steven R., J.D........Mercer
White, Penny J., LL.M........Georgetown
Williams, Paulette J., J.D........New York

Assistant Professors:

Cochran, Cathleen R., M.S........Tennessee
Davis, Melinda D., M.S.L.S........North Carolina
Marshall, Sibyl D., J.D........Loyola
Price, Loretta, M.S.L.S........Tennessee

The College of Law offers the Doctor of Jurisprudence degree program; a dual degree program with the College of Business Administration leading to the J.D. and the Master of Business Administration degree; and a dual degree program with the Department of Political Science, College of Arts and Sciences, leading to the J.D. and

Master of Public Administration. In addition graduate students may be eligible to take a limited number of law courses to court toward a graduate degree.

Current information regarding admission, financial aid, course requirements, academic policies, extracurricular activities, and student services is available from the Admissions Office, The University of Tennessee, College of Law, 1505 W. Cumberland Ave., Knoxville, Tennessee 37996-1910. Completed application should be received before February 1 of the year of requested admission.

DEGREE OF DOCTOR OF JURISPRUDENCE

The degree of Doctor of Jurisprudence will be conferred upon candidates who complete, with the required average, six semesters of resident law study and who have 90 semester hours of credit, including all required courses. The required average is 2.0 and that average must be maintained on the work of all six semesters. Also, the combined work of the grading periods in which the last 28 credit hours taken in residence were earned. Averages are computed on weighted grades. Grades are on an alphabetical scale from A+ to F. No credit toward the J.D. degree is awarded for grades of D- or F.

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

Concentration in Business Transactions

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

818 Fundamental Concepts of Income Taxation
826 Introduction to Business Transactions*
827 Business Associations
972 Income Taxation of Business Organizations
940 Land Finance Law
840 Commercial Law
842 Contract Drafting Seminar
633 Representing Enterprises

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

*This course is not required for students who have an undergraduate major in accounting, finance, or business administration, who hold the MBA degree, or who are enrolled in the dual J.D.-M.B.A. program. Waivers may also be granted to students who have acquired the requisite business knowledge through other coursework or through practical experience.
Concentration in Advocacy and Dispute Resolution

Students interested in a concentration in advocacy and dispute resolution must complete all of the following courses:

- 813 Evidence
- 815 Introduction to Advocacy and Professional Responsibility
- 905 Advocacy Clinic
- 920 Trial Practice
- 921 Pretrial Litigation
- 922 Advanced Trial Advocacy
- 928 Case Development and Resolution

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

DUAL J.D.-MBA DEGREE PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual degree program leading to the conferral of both the Doctor of Jurisprudence and the Master of Business Administration degrees. A student pursuing the dual program is required to take fewer hours of coursework than would be required if the two degrees were to be earned separately.

Admissions

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

Curriculum

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

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

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

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

Awarding of Grades

For grade recording purposes in the College of Law for graduate business courses and in the College of Business Administration for law school courses, grades awarded will be converted to either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college where such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a College of Law course in which the student has earned a C+ grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

Non-Law Elective Course Credit

Students enrolled in the J.D.-MBA degree program may not receive credit towards the J.D. degree for courses taken in other departments of the University except for those taken in conjunction with the dual program.

Note: Students are advised to consult The Graduate School's degree requirements as stated in the front section of this catalog as well as the requirements for this college.

DUAL J.D.-M.P.A. PROGRAM

The College of Law and the Department of Political Science in the College of Arts and Sciences offer a coordinated dual degree program leading to the conferral of both the Doctor of Jurisprudence and Master of Public Administration degrees. In this program, a student may earn the M.P.A. and J.D. degrees in about four years rather than the five years that otherwise would be required. Students pursuing the dual degree program should plan to be enrolled in coursework or an internship for one summer term in addition to taking normal course loads for four academic years.

Admission

Applicants for the J.D.-M.P.A. program must make separate application to, and be independently accepted by, the College of Law for the J.D. degree and the Department of Political Science in the College of Arts and Sciences for the M.P.A. degree. Applicants must also be accepted by the Dual Degree Committee. All applicants must submit a Law School Admission Test (LSAT) score. An applicant's LSAT score may be substituted for the Graduate Record Examination (GRE) score, which is normally required for admission to the M.P.A. program. Application may be made prior to or after matriculation in either the J.D. or the M.P.A. program, but application to the dual program must be made prior to entry into the last 29 semester hours required for the J.D. degree and prior to entry into the last 15 hours required for the M.P.A. degree.

Curriculum

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

During the first two years in the dual program, students will spend one academic year completing the required first year of the College of Law curriculum and one academic year taking courses solely in the M.P.A. program. During those first two years, students may not take courses in the opposite area without the approval of the J.D.-M.P.A. coordinators in both academic units. In the third and fourth years, students are strongly encouraged to take both law and political science courses each semester. Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit toward either the J.D. or the M.P.A. degree for courses taken in the other program except as such courses qualify for credit without regard to the dual program.

Awarding of Grades

For grade recording purposes in the College of Law and the Department of Political Science, grades awarded in courses in the other unit will be converted to either Satisfactory or No Credit and will not be computed in determining a student's GPA or class standing. The College of Law will award a grade of Satisfactory for an approved M.P.A. course in which the student earns a grade of B or higher and a grade of No Credit for any lower grade. The Political Science Department will award a grade of Satisfactory for an approved law course in which the student earns a grade of C+ or higher and a grade of No Credit for any lower grade. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

POLICY FOR GRADUATE STUDENTS TAKING LAW COURSES

Students pursuing a graduate degree in another college may, upon approval of the College of Law and the major chairperson, take up to 6 semester hours of law courses and receive credit toward the graduate degree. The graduate student must register for the law course during regular registration at the College of Law requesting an S/NC
Life Sciences

(College of Arts and Sciences)

MAJOR DEGREES

Life Sciences M.S., Ph.D.

W.F. Harris, Chair

The program leading to the M.S. and Ph.D. degrees in Life Sciences is interdepartmental and intercollegiate and is designed to augment offerings of individual departments in two concentrations: genome science and technology, and plant physiology and genetics. Students interested in these areas should contact either the Life Sciences chairperson or the director of the area of interest. Each concentration is administered separately and has unique admission requirements.

CONCENTRATIONS

Genome Science and Technology

The University of Tennessee–Oak Ridge National Laboratory Graduate Program in Genome Science and Technology (GST) is a unique and multidisciplinary program for full

985 Social Legislation (3) Systems other than traditional tort remedies for compensating victims of work-related accidents and diseases, and for compensating disabled persons. Workers' compensation requirements for covered employer-employee relationships. Occupational injuries or occupational diseases arising out of and in the course of employment; nature of medical, disability, and death benefits; exclusivity of compensation remedy against employer and co-workers; rights and liabilities of non-employees; administration and procedural aspects of Workers' Compensation practice; and various law reform measures. Brief introduction to and sampling of cases involving Social Security disability claims.

990 Issues in the Law (3) Selected topics. May be repeated.

991 Issues in the Law Seminar (2) Selected topics. May be repeated.

993 Directed Research (1-2) Independent research and writing under direct supervision of faculty member. Proposals must be approved by supervising faculty member and by the Dean or the Dean's designee. Maximum of once each semester during last two years of study. Prereq: Second-year standing.

994 Independent Study (1-4) Independent study under direct supervision of faculty member. Proposals must be approved by supervising faculty member and by the Dean or the Dean's designee. Maximum of once each semester during last three semesters of study.

996 Law Review (1) Performance of duties as staff member in the publication of the Tennessee Law Review. Responsibilities vary each semester as specified in the Tennessee Law Review Policy Manual: writing of cases, note, or article, and/or performance of other assigned duties related to operations of Tennessee Law Review. Completion of potentially publishable comment or article for Tennessee Law Review satisfies course requirement. May be repeated. S/NC only. (Does not count toward total number of elective upper division courses taken S/NC.)

997 Moot Court (1) Participation as member of faculty-supervised interscholastic moot court competition. May be repeated. S/NC only. (Will not count toward total number of elective upper division courses taken S/NC.)

998 Planning and Drafting Project (1) Preparation and completion of planning and drafting project under faculty supervision in conjunction with substantive courses when such planning and drafting option is provided by course instructor. May be repeated.

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

502 Registration for Use of Facilities (3-18) Required for the student not otherwise registered during any semester when student uses University facilities for faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

503 Graduate Research Participation (3-12) Special advanced course project not related to dissertation research. Topics chosen with consent of instructor. May be repeated. Maximum 3 hrs.

505 Research Rotation (2) Laboratory rotations with faculty member on clearly defined projects. Written proposal and oral report. May be repeated. Maximum 6 hrs.

506 Computational Biology and Genome Informatics (3) Computational basis of nucleotide and protein sequence analysis; pairwise sequence comparison, multiple sequence alignments; gene and species trees. Computation annotation and feature finding; Computational protein structure analysis; threading homology modeling, ab initio methods. Prereq: Computer Science 140 Data Structures or consent of instructor.

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

510 Special Topics in Life Sciences (1-3) Specializations in biotechnology, cellular, molecular, and development biology; environmental toxicology; ethology; plant, physiology and genetics; and physiology. May be repeated. Maximum 6 hrs.

514-16 Introduction to Genome Science and Technology I, II (1, 1) S—156—Introduction to research in genome science & technology concentration, S—516—Science and ethics of practice of science. S/NC only.

520-21 Genome Science and Technology I, II (3.3) S—520—Overview of genomics, advanced genetics principles, computational biology and bioinformatics; S—521—Computational biology and informatics, analytical technologies, and special techniques.


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

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

593 Independent Study (1-15) See College of Arts and Sciences.
595-96 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in variety of special topics to be chosen by instructor. May be repeated. Maximum 6 hrs.

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

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

695-96 Advanced Topics in Genome Science and Technology (1-3) Tutorials or lectures on variety of advanced topics to be chosen by instructor. May be repeated. Maximum 4 hrs.

**Logistics**

See Marketing, Logistics and Transportation

**Management**

(College of Business Administration)

**MAJOR DEGREES**

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

Oscar Fowler, Head

Professors:


Associate Professors:


**BUSINESS ADMINISTRATION CONCENTRATIONS**

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

MBA Concentrations: Management, Forest Industries Management, Environmental Management, Manufacturing Management. Minimum course requirements for management—Three courses from the following: 511, 521, 522, 531, 541, 542, 551, 571, 581, 593, Business Administration 510, 515. Selection must be approved by the Management Department MBA advisor. For forest industries management—511; For forestry 560, 565. For environmental management—561 plus two approved courses from the following list: Ecology and Evolutionary Biology 520, 555; Environmental Engineering 510, 553, 556; Chemical Engineering 581; Economics 677, 678; Agricultural Economics 570; Sociology 560, 665; Law 866, 887; Geography 577. For manufacturing management—541, 542, Management Science 526, and an Industrial Engineering/Management Science course approved by designated faculty. Industrial Engineering 554 or Management Science 541 are recommended. Additional courses may be accepted subject to approval by Management Department Chairperson or designated faculty.

**MINOR IN ENVIRONMENTAL POLICY**

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

**GRADUATE COURSES**

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses 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 Organizational Theory: Integrated Structure and Behavior (3) Cases, group projects, discussion; organizational theories, organizational behavior, contextual factors of organizations: environment, size, technology, organizational structure configurations, organization design, work behaviors; influences on organizational effectiveness: motivation, leadership, group behavior, intergroup relations, organization change and development.

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

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

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

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

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

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

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

593 Directed Independent Study (1-3) Topic of mutual interest. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 8 hrs. S/NC or letter grade.

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

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

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

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

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

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

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

**Management Science**

(College of Business Administration)

**MAJORS DEGREES**

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

Chanaka Edirisinghe, Chairperson

Committee:

Bowers, Melissa R., Management; Bozdogan, Hamparsum, Statistics; Edirisinghe, Chanaka P., Management; Fowler, Oscar S., Management; Gilbert, Kenneth C., Management; Leitnaker, Mary G., Statistics; Noon, Charles E., Management; Ralston, Bruce A., Geography.

**THE MASTER'S PROGRAM**

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

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

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

The master's program requires three applicant recommendation forms and the GRE or GMAT. Applications are encouraged from all majors, but a mathematics background equivalent to the completion of at least two years of college calculus and proficiency in a computer language is required. The program is designed to be completed in four semesters by full-time students. However, students may start the program in any semester and may pursue an M.S. degree program in Management Science on a part-time basis.

Course Requirements

<table>
<thead>
<tr>
<th>Core Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Science 531, 532, 533, 534, and 691 or 692</td>
<td>16</td>
</tr>
<tr>
<td>Statistics 563</td>
<td></td>
</tr>
<tr>
<td>Applied specialization area (approved by advisor)</td>
<td></td>
</tr>
</tbody>
</table>

Technical elective:

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

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

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

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

THE DOCTORAL PROGRAM

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

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

Admission Requirements

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

Coursework

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

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

Qualifying Examinations

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

Mastery of 12 to 14 semester hours in mathematics coursework must be demonstrated by passing a written qualifying examination. Topics normally include numerical analysis, either Mathematics 471, 472, 453, and 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty will consider waiving the mathematics and/or statistics qualifying examinations. These requirements generally are completed by the end of the first year of the program.

There is no foreign language requirement.

Comprehensive Examination

Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written comprehensive examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis.

Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.

Research and Dissertation

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

ACADEMIC STANDARDS

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

PREREQUISITES FOR MANAGEMENT SCIENCE COURSES

The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose prior coursework does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

GRADUATE COURSES

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

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

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

531 Mathematical Programming (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis, linear programming, piecewise-linear, separable and integer programming, transportation linear programs, Prereq: Fundamentals of matrix algebra. (Same as Industrial Engineering 522.)

532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queueing theory. Prereq: Statistics 553 and Mathematical Analysis or consent of instructor. Sp

533 Computational Mathematical Programming (3) Computational aspects of mathematical programming models, in particular for large systems. Prereq: S31 and proficiency in computer language.

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

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

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

621 Network Flows (3) Treatment of network optimization algorithms, transportation and transshipment models and primal and dual and primal-dual basis tree methods. Prereq: S31 or equivalent.

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

651 Nonlinear Optimization (3) Kuhn-Tucker theory in nonlinear programming, necessary conditions for constrained and unconstrained nonlinear programs, search techniques, quadratic programming, duality and sensitivity analysis. Prereq: 531 or equivalent, proficiency in computer language. (Same as Industrial Engineering 602.)

681 Special Topics (3) Prereq: 531, 532 and consent of instructor. May be repeated. Maximum 9 hrs.

691-92 Management Science Seminar (1,1) Subjects selected from current literature. S/NC only.
Marketing, Logistics and Transportation

(College of Business Administration)

MAJOR

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

Richard C. Reizenstein, Acting Head

Professors:

Barnaby, D. J., Ph.D. .................. Purdue
Cadotte, E. R., Ph.D. .................. Ohio State
Davis, F. W., Jr., Ph.D. ............... Michigan State
Dier, G. N., DBA ....................... Indiana
Langley, C. J. (Dove Prof.), Jr., Ph.D. Pennsylvania State
Munday, R. A. (Taylor Prof.), Ph.D. Penn State
Schumann, D. W., Ph.D. ............. Missouri
Woodruff, R. B. (Poffit's Prof.), DBA Indiana

Associate Professors:

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

Assistant Professors:

Moon, M. A., Ph.D. .................... North Carolina
Norek, C. D., Ph.D. ................... Ohio State

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Logistics and Transportation, Marketing.

Minimum course requirements for logistics and transportation-501, 508, and one course from the following: 504, 506, 507, 509, and 509. For marketing-510 and 512.

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

Minimum course requirements for logistics and transportation--12 hours to include 612, 614, 615. For marketing-12 hours from among the following courses: 601, 612, 614, 615, 617.

Logistics and Transportation

GRADUATE COURSES

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

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

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

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

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

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

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

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

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

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

611 Seminar in Theoretical Foundations (3) Same as Marketing 611.

612 Research Methods I (3) Research process: philosophical foundations, problem formulation, gathered theory, qualitative methods and analysis, measurement, sources of error, experimental design and analysis, and survey design and analysis. (Same as Logistics and Transportation 612.)

613 Research Methods II (3) Practical application of data analysis techniques. Experience with sophisticated statistical techniques, using real marketing databases.

614 Contemporary Marketing Thought (3) Representative topics comprising content of marketing knowledge: macro-marketing, marketing, channels, and competitor behavior; marketing strategy; marketing mix tools; pricing issues in marketing; examination of research for contributions to advancing knowledge and opportunities for new research.

615 Seminar in Buyer Behavior Research (3) Theoretical perspective and research processes describing in people in their roles as buyers, users, and evaluators of goods and services. Important research issues and practical applications related to buyer behavior.

616 Measurement (3) Measurement and measurement process: design and development of tools, process of testing, and determination of reliability and validity.

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

693 Independent Study (1-6) Direct research on subject of mutual interest to student and faculty. May be repeated. Prereq: Consent of instructor.

Marketing

GRADUATE COURSES

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

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

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

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

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

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

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

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

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

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612 Research Methods I (3) Research process: philosophical foundations, problem formulation, gathered theory, qualitative methods and analysis, measurement, sources of error, experimental design and analysis, and survey design and analysis. (Same as Logistics and Transportation 612.)

613 Research Methods II (3) Practical application of data analysis techniques. Experience with sophisticated statistical techniques, using real marketing databases.

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

693 Independent Study (1-6) Direct research on subject of mutual interest to student and staff member. May be repeated.

Materials Science and Engineering

(College of Engineering)

MAJORS

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

Joseph E. Spruill, Head

Professors:

Benson, R. S., Ph.D. .................. Florida State
Brooks, C. R., Ph.D. ............... Tennessee
Buchanan, Raymond A., Ph.D. .... Vanderbilt
Clark, Edward S. (Emeritus), Ph.D. California
Fellers, J. F., Ph.D. .................. Akron
Liang, P. K. (Racheff Chair of Excellence), Ph.D.

Lowndes, Douglas H., Ph.D. ........ Colorado
Lundin, Carl D., Ph.D. ............. Pennsylvania State
McHargue, Carl J., Ph.D. ........... Kentuck
Oliver, Ben F., Ph.D. ............... Penn State
Graduate programs are offered leading to the degrees of Master of Science and Doctor of Philosophy in Metallurgical Engineering or Polymer Engineering. Both the metallurgical and polymer programs are flexible and interdisciplinary in nature. Students may be admitted from a wide range of disciplines; these include physics, chemistry, chemical engineering, mechanical engineering, electrical engineering, materials engineering, and engineering science programs. Prospective students should consult materials science and engineering faculty concerning development of individual concentrations or special programs compatible with their backgrounds and goals.

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

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

**THE MASTER'S PROGRAM**

### Thesis Option

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

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

2. Additional courses up to 12 hours total in related areas.


4. Satisfactory performance on a comprehensive oral examination administered by the faculty committee.

All resident students are required to register for and participate in the graduate seminar in metallurgical engineering or polymer engineering, as appropriate, during each semester in which it is offered. Three hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements.

### Non-Thesis Option

Any candidate may apply for a non-thesis option. Upon acceptance, a supervisory committee of three will be appointed. At least two members of the committee will be from the faculty in the major area, either metallurgical engineering or polymer engineering. The requirements for completion of the non-thesis option are as follows:

1. Completion of a total of 30 hours of graduate coursework. At least 18 of those hours must be in the department, and up to 12 hours may be in related areas. Three hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements. The polymer engineering major must include the same courses required for the thesis option. The candidate's degree program must be approved by the faculty committee.

2. Satisfactory completion of a culminating experience such as MSE 580 (Critical Review).

3. Satisfactory performance on a comprehensive examination administered by the faculty committee.

### THE DOCTORAL PROGRAM

After one year in residence and with the approval of the doctoral committee, a student may proceed directly to the doctoral program without completion of a master's degree.

Departmental requirements for completion of the doctoral degree are:

1. a. For students proceeding directly to the Ph.D. from the B.S.E. degree: 48 graduate course credit hours with at least six hours of 600-level courses. Six hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements. At least 36 credit hours must be counted toward the degree.

b. For students having a master's degree in Metallurgical Engineering, Polymer Engineering, or Materials Science and Engineering: 18 additional graduate course credits with at least six hours of 600-level courses. Three hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements. At least 12 credit hours must be courses in the department.

2. Students must complete at least 24 hours of dissertation credits.

3. Satisfactory performance on a comprehensive examination, usually given in two parts, and covering such topics as materials science and engineering, metallurgical or polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.

4. Active participation in graduate seminars conducted by the department. Resident students must register for the appropriate 503 or 504 every semester offered.

### GRADUATE COURSES

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

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


429 Introduction to Ceramic Matrix Composites (3) Characteristics of composites: ceramic matrix composites; morphology and materials design; overview of fabrication techniques; microstructural characterization; and mechanical and physical properties of ceramic matrix composites. Prereq: Introduction to Materials Science and Engineering and Mechanics of Materials or equivalent and consent of instructor.

443 Polymer Processing (3) Rheological measurements of polymers as they flow through ducts and dies, and effects and extrudate characteristics such as shape, uniformity, size, and quality. Injection molding: synthetic fiber spinning, structure development, properties.

444 Plastics Fabrication and Design (3) Lectures, laboratories, and field trips; unit operations of plastics fabrication; plastics classifications; design and selection criteria; processing techniques; characterization laboratory. 5p.


472 Fundamental Principles of Composite Materials (3) Establishment of physical principles basic to design, manufacture, and application of fiber reinforced polymers, metals and ceramics. Prereq: 305 or equivalent. (Same as Engineering Science 426.)

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

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

484 Introduction to Maintenance Engineering (3) (Same as Nuclear Engineering 484, Industrial Engineering 484, and Mechanical Engineering 484.)

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

502 Registration for Use of Facilities (3-15) Required of 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 Graduate Seminar in Metallurgical Engineering (1) Prereq: Admission to graduate program. May be repeated. S/N only. E.

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

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

522 Defects in Crystals (3) Analytical and experimental analysis of defects interactions in solids. Prereq: 421 or consent of instructor.

523 Plastic Deformation of Metals (3) Geometry and mechanisms of single crystal plastic deformation; slip, twinning, and dislocation theory; effect of temperature, loading rate effects, effect of ordering and solute solution alloying; polycrystalline behavior in terms of crystal plastic deformation mechanisms; texture formation. Prereq: 201, 301 or consent of instructor.

524 Metallurgical Thermodynamics (3) Applications of chemical thermodynamics to metallurgical problems: refining, oxidation, surface treatments, alloying. Prereq: 570 or equivalent.
528-26 Welding Metallurgy (3,3) Welding processes; physical metallurgy of welding; phase transformations; heat flow; residual stresses; theories of hot cracking; cold cracking and porosity formation; applications to process utilization.

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

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

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

531 Advanced Corrosion (3) Analyses of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to pitting, crevice, fretting, wear, fatigue and stress corrosion. Prereq: 470 or consent of instructor.


540 Basic Polymer Chemistry (3) Synthesis, reactions and degradation of polymers. Molecular characterization: solution methods and spectroscopy. Prereq: Semester of organic chemistry and thermodynamics or equivalent.

541 Fluid Mechanics and Polymer Processing (3) Navier-Stokes equations and illustrative problems; applications to chemical engineering and polymer engineering, packed and fluidized beds, multiphase systems. Basic concepts in rheology; applications in polymer processing: screw extrusion, fiber spinning, injection molding. (Same as Chemical Engineering 541.)

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

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


546 Mechanical Properties of Solids (3) Types of mechanical behavior; Hookean and rubber elasticity, plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss tangent; experimental methods. Introduction to mechanical properties of polymeric composites.

549-50 Laboratory Methods in Polymer Engineering (1.2) Basic experimental techniques and instrumentation associated with characterization, X-ray and light scattering, calorimetry, rheometry, mechanical properties of solid polymers in processing operations. Coreq: 540 or consent of instructor. 549-S/NC only.

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

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

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

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

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


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

621-22 Theoretical Metallurgy (3,3) Equations of state; entropy of disorder, function of temperature; specific heats, electron theory of solids, electrical and thermal conductivity, magnetic properties, theories of alloy formation. Prereq: Consent of Instructor.

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

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

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

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

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

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

Mathematics

(Mathematics (College of Arts and Sciences))

MAJOR

DEGREES

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

John B. Conway, Head

Professors:

Alexiades, V., Ph.D. .......... Delaware
Anderson, D., Ph.D. .......... Iowa
Baker, G. A., Ph.D. .......... Cornell
Bradley, J. S. (Emeritus), Ph.D. .......... Iowa
Carruth, J. H. (Emeritus), Ph.D. .......... Louisiana State
Clark, C. E. (Emeritus), Ph.D. .......... Louisiana State

Conway, J. B., Ph.D. .......... Louisiana State
Daverman, Robert J., Ph.D. .......... Wisconsin
Dobbins, D. E., Ph.D. .......... Cornell
Dwyer, J., Ph.D. .......... Illinois
Frandsen, Henry (Emeritus), Ph.D. .......... Illinois
Gross, L. J., Ph.D. .......... Cornell
Hinton, D. B., Ph.D. .......... Tennessee
Husch, L. S., Ph.D. .......... Florida State
Johannson, K., Ph.D. .......... Bielefeld
Jordan, G., Samuel, Ph.D. .......... Wisconsin
Karakashian, O., Ph.D. .......... Harvard
Kupershmidt, R. A. (UTSI), Ph.D. .......... MT
Lantart, S., Ph.D. .......... Kentucky
McConnel, R. M., Ph.D. .......... Duke
Mathews, H. T. (Emeritus), Ph.D. .......... Tulane
Miller, D. D. (Emeritus), Ph.D. .......... Michigan
Mulay, S., Ph.D. .......... Purdue
Rajput, B. S., Ph.D. .......... Illinois
Reddy, K. G. (UTSI), Ph.D. .......... Indian IT
Richter, Stefan, Ph.D. .......... Michigan
Richter, J., Ph.D. .......... Wroclaw
Schafer, P. W., Ph.D. .......... Maryland
Serbin, Steve, Ph.D. .......... Cornell
Simpson, H., Ph.D. .......... Cal Tech
Son. K., Ph.D. .......... Oregon State
Son. R. P., Ph.D. .......... Oregon State
Stallman, F. W. (Emeritus), Ph.D. .......... Giessen
Stephenson, K. R., Ph.D. .......... Wisconsin
Sundberg, C. P., Ph.D. .......... Wisconsin
Thistlewhite, M. B., Ph.D. .......... Manchester
Wade, W. R., Ph.D. .......... California (Riverside)
Wagner, C. G., Ph.D. .......... Duke

Associate Professors:

Collins, Charles R., Ph.D. .......... Minnesota
Feng, Xiaobing, Ph.D. .......... Purdue
Freire, A., Ph.D. .......... Princeton
Gavrillets, Sergey, Ph.D. .......... Moscow State
Guan, Bo, Ph.D. .......... Massachusetts
Kimble, K. R. (UTSI), Ph.D. .......... Ohio State
Kuo, Y., Ph.D. .......... Cincinnati
Plaut, Conrad, Ph.D. .......... Maryland
Smith, J., Ph.D. .......... California
Warne, Debra Polignone, Ph.D. .......... Virginia
Xiong, Jie, Ph.D. .......... North Carolina

Assistant Professors:

Matthews, Gretchen, Ph.D. .......... Louisiana State
Schulze, Timothy, Ph.D. .......... Northwestern

The Mathematics Department has three graduate degrees: (1) the Master of Mathematics degree, intended primarily for teachers, (2) the Master of Science degree, designed to prepare students for industrial employment and for teaching, and (3) the Doctor of Philosophy degree, designed to prepare students for industrial employment and for graduate and university teaching and research. Contact the department office for additional information.

A student offering mathematics as a minor for the master's degree is required to obtain at least 6 hours of resident graduate credit in courses numbered above 400 and approved by both the major department and the Department of Mathematics.

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

By both the major department and the two major departments of the mathematics program for college and university teaching and research. Contact the department office for additional information.

For additional information, please visit the graduate website on the Department of Mathematics' homepage at www.math.utk.edu.
THE MASTER OF MATHEMATICS PROGRAM

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

The following requirements must be met:
1. Complete 30 hours of coursework of which 21 must be at the 500 level. The coursework must include 504, 505, 506, 507, and 6 hours in 509. At most, 6 hours may be taken outside the Department of Mathematics (selected in consultation with the advisor).
2. Pass a final examination upon completion of all coursework.

In exceptional circumstances, part of admission requirement (b) might be satisfied concurrently with coursework. Normally Master of Mathematics degree students will start the program by taking 504 during the summer.

THE MASTER OF SCIENCE PROGRAM

The department offers two options for the Master of Science degree. The first option requires a thesis for which 6 hours must be earned along with 24 additional hours of work in acceptable coursework numbered above 400. Of the additional hours, 6 may be in an area outside the department and 15 must be in courses in mathematics numbered above 500.

After one semester of graduate study, a student whose advisory committee gives its approval may choose the other option concurrently with coursework. Normally Master of Mathematics degree students will start the program by taking 504 during the summer.

Concentration in Applied Mathematics

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

The DOCTORAL PROGRAM

For the Ph.D. program in Mathematics, the student must meet the following four requirements in addition to those of the Graduate School:
1. Satisfy either the standard program or the interdisciplinary mathematical ecology concentration. A student intending to work in mathematical ecology may complete either but is encouraged to complete the interdisciplinary mathematical ecology concentration. A student may elect to switch from one to the other provided the constraints of the latter option have not been violated.
2. Demonstrate proficiency in one foreign language, normally French, German or Russian. This requirement must be met prior to the examination in the area of specialization. A student's doctoral committee may require the student to pass a second language examination.
3. Pass an examination in the field of specialization. After the requirements in 1. and 2. have been met, this examination will be given by a committee appointed by the department head. A student may take this specialty examination only twice.
4. Pass a 600-level sequence in mathematics outside the student's area of specialization. The sequences selected to fulfill this requirement must be approved by the department head and the student's doctoral committee. (Such approval may occur after completion of the sequence.)

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

Mathematical Ecology Concentration

The student must pass written examinations in three subjects:
2. A subject from Groups I, II, and III of the standard program.
3. A subject represented by a year-long graduate-level sequence from outside the Department of Mathematics. The sequence must be approved in advance by the mathematical ecology faculty and by the departmental Graduate Committee. At least one member of the mathematical ecology faculty must be involved in the grading of the examination. The examination in this subject may be taken only twice.
The student also must earn grades of B+ or better each semester in the courses associated with two additional subjects from the groups listed in the standard program. This requirement may not be satisfied with courses from outside the department. At least one of the two subjects used to meet this requirement or the written examination as subject 2 must be from Groups I and II.

Except for the privilege of utilizing as a Group IV course a course from outside the department, this concentration is subject to the constraints and privileges specified in the standard program, including the requirement that when a student takes a written examination in lieu of earning a grade of B+ or better each semester in a sequence from Group I, II, or III.

GRADUATE COURSES

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

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

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

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


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

423 Probability I (3) Axiomatic probability, multivariate distributions, conditional probability and expectation, theorems, method of generating functions. Prereq: Calculus I or Matrix Algebra I, and either Computer Literacy or consent of instructor. Recommended prereq: 422. May not be applied toward M.S. degree in mathematics.

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

425 Statistics (3) Derivation of standard mathematical distributions: Binomial, Poisson, normal, chi-square, t, F, the distributions of functionals of independent normal random variables, Neyman-Pearson theorem. Probability theory and other parametric and non-parametric tests; sufficient statistics. Prereq: Probability I or consent of instructor.


435 Partial Differential Equations (3) Separation of variables, Fourier series, solution of Laplace, wave, and heat equations. Prereq: Differential Equations, Calculus III.

443 Complex Variables I (3) Theory of functions of complex variables: residue theory and contour integrals.

Prereq: Calculus III. Recommended prereq: 300- or 400-level mathematics course.

445-46 Advanced Calculus I, II (3,3) Theory of sequences, series, differentiability, convergence, and Riemann integrations of functions of one or more variables. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.

447-48 Honors Advanced Calculus I, II (3,3) Honors version of 445-46. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.

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

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


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

460 Geometry (3) Axiomatic and historical development of neutral, Euclidean, and hyperbolic geometry. Prereq: Calculus III.

462 Differential Geometry (3) Curvature and its applications to curves and surfaces. Prereq: Calculus III.

475 Industrial Mathematics (3) Modeling, analysis, and computation applied to scientific/technical/industrial problems. Prereq: Differential Equations I and either Computer Literacy or Numerical Algorithms. Prereq: 472. (Same as Computer Science 475.)

476 Perturbation Theory (3) Perturbation methods and applications to physical problems. Prereq: Calculus III, Numerical Methods, or consent of instructor.

505 Analysis for Teachers (3) Development of differential and integral calculus. Prereq: Calculus I and Introduction to Abstract Mathematics, or consent of instructor.

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to integers and polynomials. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics.


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

521-22 Enumerative Combinatorics (3,3) Sieve methods, generating functions, and permutation groups applied to enumeration of discrete structures. Induction theorems and combinatorics of partially ordered sets. Prereq: 425.

524-26 Probability (3,3) Pertinent facts from measure theory, definition of probability, random variables, Kolmogorov's existence theorem, series of independent random variables and laws of large numbers; general theory of distributions and their characteristic functions; weak convergence concepts, weak compactness and Levy's convergence theorem in Euclidean spaces; infinite divisible distributions and central limit problem; general concept and properties of conditional expectation, martingales, Doob's martingale and optional sampling theorems. Prereq: 425, 426. Recommended prereq: 422.


534 Calculus of Variations (3) Necessary conditions for extrema, Euler’s equation, broken extremals, Weierstrass-Erdmann sufficient conditions for extrema-Legendre’s and Jacobi’s conjugate point theorems. Prereq: 431.

535-36 Partial Differential Equations (3,3) First order equations, classification of equations and properties of elliptic, hyperbolic, and parabolic equations in several variables. Prereq: 445-46 and 531 or consent of instructor.

537-38 Mathematical Principles of Continuum Mechanics (3,3) Conservation principles, equations of equilibrium, stress, strain, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory. Prereq: 431, 435, 446 or 443, or consent of instructor.

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

541-42 Mathematical Principles of Continuum Mechanics (3,3) Conservation principles, equations of equilibrium, stress, strain, constitutive relations and stress, convexity properties, bifurcation phenomena, existence theory. Prereq: 431, 435, 446 or 443, or consent of instructor.

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


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

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

553 Economic Applications of Algebra (3,3) Mathematical economics, optimization, control, engineering, and operations research. Prereq: 445-46.

555-56 Number Theory (3,3) Introduction to number theory, including congruences, diophantine equations, and number theory of finite fields. Prereq: 455-56 or consent of instructor.

557 Seminar in Number Theory (1-3) May be repeated. Maximum 12 hrs.

561-62 Topology (3,3) Topological spaces; complete metric spaces; compact spaces. Prereq: 431, 435, 446 or 443, or consent of instructor.

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

568-69 Topology (3,3) Introduction to topology, general topology, and point-set topology. Prereq: 431, 435, 446 or 443, or consent of instructor.

570-71 Algebraic Topology (3,3) Homotopy theory, homology of CW complexes, homology of spaces, simplicial complexes, and singular homology. Prereq: 431, 435, 446 or 443, or consent of instructor.

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

575-76 Algebraic Topology (3,3) Introduction to algebraic topology, including homotopy and homology. Prereq: 431, 435, 446 or 443, or consent of instructor.

577 Seminar in Algebra (1-3) May be repeated. Maximum 12 hrs.

578-79 Topology (3,3) Introduction to topology, general topology, and point-set topology. Prereq: 431, 435, 446 or 443, or consent of instructor.

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

581-82 Advanced Mathematical Analysis (3,3) Advanced topics in analysis, including complex analysis, functional analysis, and measure theory. Prereq: 431, 435, 446 or 443, or consent of instructor.

583 Seminar in Advanced Mathematical Analysis (1-3) May be repeated. Maximum 12 hrs.

584-85 Advanced Mathematical Analysis (3,3) Introduction to advanced mathematical analysis, including complex analysis, functional analysis, and measure theory. Prereq: 431, 435, 446 or 443, or consent of instructor.

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

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

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

Each student must satisfactorily complete a program of study that has been approved by his/her advisory committee and complies with the requirements of the Graduate School in Engineering Science, the student's major professor may be selected from a department other than the Department of Mechanical and Aerospace Engineering and Engineering Science; however, at least one member of the student's graduate advisory committee must be on the faculty of the Department of Mechanical and Aerospace Engineering and Engineering Science.

THE MASTER'S PROGRAM

In Mechanical Engineering, Aerospace Engineering, and Engineering Science, two M.S. options are offered. Option I requires a thesis and is the normal program for graduate students. Option II does not require a thesis and provides graduate students, including co-op and off-campus students, the opportunity to focus their programs in special areas through extended coursework.

Credit requirements for these two options in Mechanical Engineering and Aerospace Engineering are:

<table>
<thead>
<tr>
<th>Course Areas</th>
<th>Hours Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option I</td>
<td>1</td>
</tr>
<tr>
<td>Thesis credit</td>
<td>6</td>
</tr>
<tr>
<td>Coursework</td>
<td>24</td>
</tr>
<tr>
<td>Courses in program (500-level or above) (min.)</td>
<td>12</td>
</tr>
<tr>
<td>Mathematics (400-level or above)</td>
<td>6</td>
</tr>
<tr>
<td>590 Selected Engineering Problems (max.)</td>
<td>n/a</td>
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<tr>
<td>Total</td>
<td>30</td>
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</tbody>
</table>
Credit requirements for these two options in Engineering Science are:

<table>
<thead>
<tr>
<th>Course Areas</th>
<th>Hours Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option I</td>
<td>1</td>
</tr>
<tr>
<td>Option II</td>
<td>1</td>
</tr>
</tbody>
</table>

2. Meet all departmental examination requirements, which include passing a written and oral comprehensive examination.

3. Presentation of a dissertation proposal to the student's advisory committee and approval of that proposal by that committee.


ACADEMIC COMMON MARKET

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

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Students majoring in Mechanical Engineering or Aerospace Engineering may not normally use more than one 400-level engineering course to meet their advanced degree requirements. For students majoring in Engineering Science, four hundred-level courses in engineering may be used for graduate credit at the discretion of the advising committee. Furthermore, at least two-thirds of minimum required credit hours in a master's degree program must be at or above the 600 level. With the approval of the student's major department, a student whose major is outside the Department of Mechanical and Aerospace Engineering or Engineering Science may only take senior (400-level) courses in the department for graduate credit. Such students should consult with their advisor for prerequisites for undergraduate courses.

Aerospace Engineering

NOTE: Not all the courses listed below are available at both the UT and the UTSA campuses.

GRADUATE COURSES


424 Astronautics (3) Special mechanics, propulsion, atmospheric reentry of space vehicles; reentry thermal protection materials, human factors in space flight, space environment and current topics. Prereq: 351 Compressible Flow, 370: Mechanical Engineering 344 Heat Transfer. F

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

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

429 Aerospace System Design (4) Synthesis and design of complete space system, economic and technical aspects. Participation in team design effort for formal presentations and design report. Prereq: 422, 425, 426. Sp


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

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

511 Inviscid Flow (3) Kinematics and dynamics of inviscid flows; potential flow in both body, conformal mapping. Prereq: 422 or 541, Mathematics 425 or equivalent.

512 Viscous Flow (3) Derivation of fundamental equations of compressible viscous flows; boundary conditions for viscous heat-conducting flows; exact solutions for Navier-Stokes equations for special cases; similarity solutions. Thermal boundary layers, stability of laminar flows, transition to turbulence, 2-D turbulent boundary layer equations. Incompressible-turbulent mean flow, and compressible boundary layer flow. Prereq: Consent of Instructor.

513 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory reports; representative experiments: hot wire anemometry and turbulence measurements, laser visualization, wind tunnel tests, water table experiments, supersonic flow experiments, boundary layer measurements, laser-optical measurements. Prereq: 423 Viscous Flow or 541.

515-16 Air Vehicle Aerodynamics and Performance (3, 3) Application of aerodynamic principles to air vehicles to provide estimates of performance, stability, and control characteristics for subsonic to hypersonic speeds. Relationship among thrust, drag, lift and altitude, propulsion system design, performance characteristics, and trajectory optimization. Prereq: 422 for 515; 521 for 516.

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

525 Hypersonic Flow (3) Slender body flow; altitude; Newtonian theory; blunt body flow; viscous interactions; free molecule and rarified gas flow. Prereq: 512.

527-28 Aerospace Ground Test Facilities (3, 3) Atmospheric models and similarity considerations; aerodynamic test facilities: continuous and intermittent wind tunnels and ballistic ranges; propulsion test facilities or air breathing and rocket engines; space environment and space vehicle test facilities. Prereq: 521, 541, and Mechanical Engineering 522.

529 Rarefied Gases Dynamics (3) Binary elastic collisions; kinetic theory; flow regimes; Boltzmann and model equations. Transfer equation, gas-surface interactions; slip boundary conditions, free molecule, slip and transition flow; Monte Carlo simulation, experimental techniques; introduction to hypersonic real gas flows. Prereq: 522, Mechanical Engineering 522.

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

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

533 Dynamics (3) (Same as Mechanical Engineering 533) Design and Engineering Science 533.)

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

535 Mechanical Vibrations (3) (Same as Mechanical Engineering 534 and Engineering Science 534.)

539 Continuum Mechanics (3) (Same as Engineering Science 539 and Mechanical Engineering 539.)
541 Fluid Mechanics I (3) (Same as Mechanical Engineering 541 and Aerospace Engineering 541.)
542 Fluid Mechanics II (3) (Same as Mechanical Engineering 542 and Aerospace Engineering 542.)
544 Transonic Flow (3) Nature of flow at transonic speeds; small disturbance theory; shock wave properties; shock wave behavior in gases; strong viscous interaction phenomena; solution techniques. Prereq: 522.
552-53 Advanced Strength of Materials (3,3) (Same as Mechanical Engineering 553-36 and Engineering Science 521-22.)
554 Aerospace Vehicle Stability and Control (3) Static and dynamic longitudinal and lateral stability and control. Coupled modes. Motion with free and fixed flight control surfaces. Automatic control systems. Prereq: 423, 551.
556 Vertical or Short Take Off and Landing Aircraft (3) Performance, stability, control of rotary wing, tilt wing, vectored lift and jet vertical take off type aircraft. Vertical and transition flight modes. High lift aircrafts. Automatic controls. Simulation facility types and flight testing. Prereq: 556.
561 Fundamentals of Aeronautics (3) Generation, propagation and absorption of sound in static and moving media. Prereq: Consent of instructor.
562 Spacecraft Attitude Dynamics and Control (3) Satellites and rockets (orbit, launch vehicles and landing). Attitude control, satellite control, orbit control, attitude stabilization. Prereq: 551, Mathematics 471.
571 Finite Elements for Engineering Applications (3) (Same as Engineering Science 561 and Mechanical Engineering 561.)
571 Aerospace Vehicle Stability and Control (3) Static and dynamic longitudinal and lateral stability and control. Coupled modes. Motion with free and fixed flight control surfaces. Automatic control systems. Prereq: 423, 551.
573 Computational Fluid Dynamics (3) (Same as Engineering Science 573 and Mechanical Engineering 562.)
575 Finite Elements for Engineering Applications (3) (Same as Engineering Science 573 and Mechanical Engineering 562.)
576 Finite Elements for Engineering Applications (3) (Same as Engineering Science 573 and Mechanical Engineering 562.)
577 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science 577 and Mechanical Engineering 577.)
578 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science 578 and Mechanical Engineering 578.)
579 Advanced Topics in Aerospace Engineering (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

Biomedical Engineering

Graduate Courses

590 Selected Engineering Problems (2-6) Enrollment limited to students in problems program. Prereq: Consent of advisor. May be repeated. Maximum 6 hrs. S/NC only.
595 Seminar (1) All phases of aerospace engineering, reports on current research at UT and UTSI. May be repeated. S/NC only.
599 Special Topics in Aerospace Engineering (1-3) May be repeated. Maximum 6 hrs.
600 Doctoral Research and Dissertation (3-15) P/Ed only. E
632 Magnetohydrodynamics II (3) Alfven and shock waves, exact solution for magnetohydrodynamic channel flow, one-dimensional model of channel flow, engineering applications of magnetohydrodynamics, propulsion and power generation. Prereq: 631 and Mathematics 562.
641-42 Physical Gas Dynamics (3,3) High-speed, high temperature gas flow from molecular point of view. Kinetic theory, statistical equilibrium, shock wave properties, strong shock wave behavior, phase transitions. Prereq: Consent of instructor.
645 Theory of Turbulence (3) (Same as Aerospace Science 645.)
661-62 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science 661-62 and Mechanical Engineering 661-62.)
663-64 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science 663-64 and Mechanical Engineering 663-64.)
690 Advanced Topics in Aerospace Engineering (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

Engineering Science

Graduate Courses

423 Fracture-Safe Design (3) Critical review of variables controlling fracture toughness: part and flaw geometry, temperature, loading rate, size of part, material, characterization of fracture toughness by stress intensity factors, strain energy release rates, fracture mechanics, and fatigue. Prereq: 310, 321 and Materials Science and Engineering 201. 3 hrs or 2 hrs and 1 lab.
426 Fundamental Principles of Composite Materials (3) (Same as Materials Science and Engineering 426.)
429 Introduction to Ceramic Matrix Composites (3) (Same as Materials Science and Engineering 429.)
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or for temporary use before degree is completed. May not exceed number of degree requirements. Prereq: Consent of instructor. May be repeated. S/NC only.
521-22 Advanced Strength of Materials (3,3) (Same as Mechanical Engineering 521-22 and Aerospace Engineering 521-22.)
525 Theory of Plates (3) Classical bending theory of thin plates; thick plate; buckling and large deflection problems. Prereq: 553.
527 Fracture Mechanics (3) Mechanisms of fracture and fatigue, stress analyses of thin plate, crack propagation, stress intensity factors, fatigue crack initiation and propagation, fracture mechanics and fracture mechanics. Prereq: Consent of instructor. (Same as Materials Science and Engineering 527.)
528 Ceramic Matrix Composites: Material and Mechanical Behavior (3) Fabrication of ceramic matrix composites, interfacial characterization and mechanics, ceramic microstructure, static and dynamic properties of concrete, composite materials, fiber reinforced composites, fatigue, and fracture mechanics. Prereq: Consent of instructor.
533 Dynamics (3) (Same as Mechanical Engineering 533 and Aerospace Engineering 533.)
534 Mechanical Vibrations (3) (Same as Mechanical Engineering 534 and Aerospace Engineering 534.)
536 Advanced Engineering Acoustics (3) Introduction to theory and application of acoustic analysis; vibration of continuous systems, plate and spherical waves, transmission phenomena, radiation and scatter-
539 Continuum Mechanics (3) Cartesian tensors, transformations, basic continuum mechanics concepts: stress, strain, strain energy, constitutive equations. Conservation laws for mass, momentum, energy. Applications in solid and fluid mechanics. (Same as Aerospace Engineering 539 and Mechanical Engineering 539.)

541 Fluid Mechanics I (3) (Same as Mechanical Engineering 541 and Aerospace Engineering 541.)

542 Fluid Mechanics II (3) (Same as Mechanical Engineering 542 and Aerospace Engineering 542.)

551 Elements for Engineering Applications (3) Computational procedures for differential equation statements and in solvers. Approximations, boundary conditions, error estimation, finite element implementations; comparison to legacy finite difference methods. Applications in 1, 2, and 3 dimensions, non-linearity, unsteady problems, coupled equation systems. Examples from diverse technical fields; fluid mechanics, heat mass transfer, elasticity, electromagnetic, flow/heat transfer systems; Computer projects. Prereq: Bachelor's degree in engineering or natural science. (Same as Aerospace Engineering 551 and Mechanical Engineering 571.)


553 Computational Solid Mechanics (3) Finite element techniques for nonlinear mechanics and linear elasticity. Two and three-dimensional formulations; isoparametric elements, numerical quadrature, equation solving, matrix iteration techniques. Applications in beams, plates and shells; use of representative computer programs in PC and networked Unix/CAD-solids models. Prereq: 321 Mechanics of Materials I or equivalent. (Same as Aerospace Engineering 553 and Mechanical Engineering 573.)


556 Optical Engineering I (4) Wave optics; scalar diffraction theory; introduction to Fourier optics; ray or geometric optics; lenses, mirrors, gratings; paraxial design methods; introduction to aberrations.

558 Optical Engineering II (4) Statistical optics; spontaneous and induced emission; black and graybody radiation; incoherent, partially coherent, and totally coherent radiation; proptional and nonproportional damping. Modal analysis, frequency domain, and residues. Structural properties from test data. Structural modifications. Prereq: 554.

560 Mechanical and Aerospace Engineering and Engineering Science

479 Thermal Engineering Design (4) Design of complete thermal-fluid systems, economic, technical and optimization aspects. Participation in team design.

475 Thermal Engineering (3) Thermal systems, turbomachinery, heat exchangers, combustion and system analysis and design, second law analysis. Prereq: 332, 344, 345. Coreq: 473. 3 lbs. Sp, Su.

471 Refrigeration and Air Conditioning (3) Vapor compression cycle, heat exchanger components and characteristics; psychrometric processes; air handling systems; solar collectors; cooling towers; solar radiation; building heat transmission. Prereq: 331, 342. F, Sp.

475 Thermal Engineering (3) Thermal systems, turbomachinery, heat exchangers, combustion and system analysis and design, second law analysis. Prereq: 332, 344, 345. Coreq: 473. 3 lbs. Sp, Su.

479 Thermal Engineering Design (4) Design of complete thermal-fluid systems, economic, technical and optimization aspects. Participation in team design.

561 Advanced Topics in Fluid Dynamics (3) Advanced topics in fluid dynamics. Prereq: 541.

562 Advanced Topics in Fluid Dynamics (3) Advanced topics in computational fluid dynamics. Prereq: 542.

563 Advanced Topics in Fluid Dynamics (3) Advanced topics in flow and mixing. Prereq: 543.

565 Advanced Topics in Fluid Dynamics (3) Advanced topics in turbulence. Prereq: 544.

566 Advanced Topics in Fluid Dynamics (3) Advanced topics in fluid dynamics. Prereq: 545.

567 Advanced Topics in Fluid Dynamics (3) Advanced topics in fluid dynamics. Prereq: 546.

568 Advanced Topics in Fluid Dynamics (3) Advanced topics in fluid dynamics. Prereq: 547.

569 Advanced Topics in Fluid Dynamics (3) Advanced topics in fluid dynamics. Prereq: 548.

570 Advanced Topics in Fluid Dynamics (3) Advanced topics in fluid dynamics. Prereq: 549.

571 Biomechanics of Hard and Soft Tissue (3) Introduction to biomechanics, and analytical methods for modeling tissue. Continuum mechanics analysis of hard and soft tissues, including fluid flows. Flow properties of blood, rheology of blood in micro vessels, viscoelasticity of fluids and solids, mechanical properties of blood vessels, skeletal, heart and smooth muscle, bone and cartilage. Research paper.


576 Expert Systems in Engineering (3) (Same as Nuclear Engineering 576 and Mechanical Engineering 576.)

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

578 Fuzzy Systems in Engineering (3) (Same as Nuclear Engineering 578.)

581 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Prereq: Consent of instructor. May be repeated with consent of department.

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

590 Selected Engineering Problems (3-5) Enrollment limited to students in engineering program. Prereq: Consent of advisor. May be repeated, maximum 6 hrs. S/NC only.

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

600 Doctoral Research and Dissertation (3-15) Prereq: Consent of advisor. May be repeated. 0-15 hrs. S/NC only.
Metallurgical Engineering
See Materials Science and Engineering

Microbiology
(College of Arts and Sciences and College of Veterinary Medicine)

MAJOR

Microbiology........................M.S., Ph.D.
Veterinary Medicine....................D.V.M.

Robert Moore, Head

Professors:
Beck, Raymond W. (Emeritus), Ph.D., Wisconsin
Becker, Jeffrey M., Ph.D., Cincinnati
Brian, D. A., Ph.D., D.V.M., Michigan State
Monte, T. C. (Emeritus), Ph.D., Maryland
Moore, R. N., Ph.D., North Carolina
Riggsby, W. Stuart, Ph.D., Yale
Rouse, B. T., Ph.D., Guelph

Associate Professors:
Savage, Dwayne C. (Emeritus), Ph.D., California
Sayler, Gary S., Ph.D., Idaho
Stacey, G. (Liaison), Ph.D., Texas
White, D. C. (Distinguished Scientist), Ph.D., Rockefeller
Woodward, J. M. (Emeritus), Ph.D., Kansas

Assistant Professors:
Wilhelm, Steve, Ph.D. .................. Western Ontario
Zaghouani, Habib, Ph.D. ............... Paris

The Department of Microbiology offers both the M.S. and Ph.D. Students have the option of selecting from a variety of graduate research programs. For a departmental brochure, contact the department head.

ADMISSION REQUIREMENTS

Students are expected to have completed an undergraduate program with a 3.0 or better GPA on a 4.0 system. Included in the undergraduate course credits should be (1) a full year of general biological science, (2) one year of college-level chemistry, including one year of organic, (3) two years of physics, and (5) an introductory course in microbiology. In many cases, deficiencies in requirements may be removed by taking appropriate courses during the first year of graduate study. The department also requires the general portion of the Graduate Record Examination. A satisfactory score on each part is 550 or higher with rare exceptions. Three letters of recommendation should be submitted by current or former faculty members.

Each new graduate student meets with an advisory committee chaired by the departmental Director of Graduate Studies to plan a program of study for the first one or two semesters until a research advisor is selected. All first-year students participate in a laboratory rotation program during the first semester of study. This program allows the student to adjust smoothly to the research projects of the department, to develop a background of research procedures and concepts, and to facilitate the selection of a research professor. Usually the student selects a research professor toward the end of the laboratory rotation period. The major professor assists in the selection of and committing out of a suitable research program and in the naming of a thesis or dissertation committee.

THE MASTER'S PROGRAM

The program leading to the M.S. is designed to provide the student with broad basic knowledge, to permit the acquisition of technical competence in the fundamentals of research, and to encourage creative and independent thinking. Two to three calendar years are usually required for the course of study that has the following requirements: (1) 30 hours including 6 thesis credits; (2) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F system; (3) a 3.0 GPA in courses taken in the department; (4) a complete course sequence in biochemistry or molecular biology; (5) presentation of a research thesis and its oral defense.

THE DOCTORAL PROGRAM

The program leading to the Ph.D. is designed to develop the student's ability to pursue independent and original research in microbiology and allied fields, to teach both oral and written communication of the results of research to the scientific community, and to train effective teachers. Students may enter the program after receiving either a bachelor's or master's degree. Students who enter with a bachelor's degree usually receive the Ph.D. after four or five years; those with the master's degree usually take three or four years to complete the degree. Departmental requirements are: (1) a 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F scale; (2) a 3.0 GPA in courses taken in the department; (3) satisfactory performance in at least one semester as a teaching assistant; (4) one semester of physical chemistry; (5) one course in statistics; (6) two semesters of biochemistry or molecular biology; (7) satisfactory performance in a comprehensive examination that must be attempted before the end of the fifth semester in the program and passed before admission to candidacy; and (8) the presentation of a research dissertation and its oral defense.

GRADUATE COURSES

410 Bacterial Physiology (3) Modern concepts of structure and function of bacterial cell. Prereq: Introduction to Microbiology.
420 Medical Microbiology (3) Disease-producing microorganisms, including bacteria, rickettsia, chlamydia, fungi. Prereq: Introduction to Microbiology.
429 Medical Microbiology Laboratory (2) Laboratory exercises in medically important areas of microbiology: microorganisms, pathogenesis and immunology. Prereq: Introduction to Microbiology Lab.
430 Immunology (3) Principles of inflammation and immunity; immunoglobulin structure and theories of formation and diversity; complement, hypersensitivities, cell cooperation and recognition in immune mechanisms; soluble factors. Prereq: General Genetics.
470 Microbial Ecology (3) Physiological diversity and taxonomy of microorganisms from natural environments. Functional role of microorganisms in natural and simulated ecosystems. Prereq: 310.
500 Thesis (1-15) P/NP only. E

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

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

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

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

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

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

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

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

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

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

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

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

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

610 Topics in Microbial Physiology (1-3) Prereq: 410 or consent of instructor. May be repeated. Maximum 12 hrs.

620 Topics in Microbial Pathogenesis (1-3) Prereq: 420, 430 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Topics in Immunology (1-3) Prereq: 430 or consent of instructor. May be repeated. Maximum 12 hrs.

640 Topics in Virology (1-3) Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hrs.

650 Topics in Microbial and Molecular Genetics (1-3) Prereq: 411 or consent of instructor. May be repeated. Maximum 12 hrs.

670 Advanced Topics in Environmental Microbiology (1-3) Prereq: 420 or consent of instructor. May be repeated. Maximum 12 hrs.
Modern Foreign Languages and Literatures

(Comprehensive Arts and Sciences)

**MAJORS**

<table>
<thead>
<tr>
<th>French</th>
<th>M.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>German</td>
<td>M.A.</td>
</tr>
<tr>
<td>Spanish</td>
<td>M.A.</td>
</tr>
<tr>
<td>Modern Foreign Languages</td>
<td>Ph.D.</td>
</tr>
</tbody>
</table>

### Assistant Professors:

- Blackwell, Stephen H., Ph.D. - Indiana
- Cruz-Camara, Nuria, Ph.D. - SUNY (Buffalo)
- Essif, Lee, Ph.D. - Brown
- Hoang, Peter, Ph.D. - Wisconsin
- Kapitan, Gregory, Ph.D. - Pennsylvania
- Maxim, Hiram H., Ph.D. - Texas
- McAlpin, Mary K., Ph.D. - Columbia
- O'Neill, Stefanie, Ph.D. - McGill
- Silva-Filho, Edu, Ph.D. - North Carolina
- Williams, Juno, Ph.D. - Ohio State
- Yim, Chi-hung, Ph.D. - Yale

The Department of Modern Foreign Languages and Literatures offers graduate programs leading to the Master of Arts degree in French, German, and Spanish, and the Doctor of Philosophy degree with a major in Modern Foreign Languages. Inquiries should be addressed to the head of the department.

### THE MASTER'S PROGRAMS

#### French

**Thesis Option:**

1. Completion of a minimum of 24 semester hours in coursework plus at least 6 hours in course 500 Thesis. French 501 is required. A maximum of 6 hours may be taken at the 400 level, the rest at the 500 level, and under certain conditions the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours (including 6 hours of thesis) must be taken in the major, 6 in the minor.

2. A thesis, with a minimum of 6 semester hours in course 500.

3. A written examination covering the coursework and selected items from a master reading list.

4. A final oral examination covering the thesis.

**Non-Thesis Option:**

1. Completion of at least 30 semester hours, with a maximum of 9 at the 400 level, the rest at the 500 level, including French 561. Under certain conditions, the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours must be taken in the major, 6 in the minor.

2. Three term papers that have been accepted by the student’s advisory committee.

3. A written examination covering the coursework and selected items from a master reading list.

4. A final oral examination to discuss the papers.

#### German

**Thesis Option:**

The minimum requirements are 24 semester hours of coursework and 6 hours of Thesis 500. German 510 and 519-20 are required, as are three courses on German literature or culture, one of which may be at the 400 level. In addition, students must take three further courses, one of which may be chosen from 411-12 or 485. All graduate teaching assistants should take 512, and other candidates may take 512 or any other course above 500. A maximum of three 400-level courses may be counted toward the 24 semester hours of course credit. All M.A. candidates must sit for a standardized language examination, such as the Zentrale Mitteleuropäischenprüfungen. Students who are interested in future Ph.D. level study are strongly advised to choose the thesis option.

**Non-Thesis Option:**

The minimum requirements are 30 semester hours of coursework, including at least one 600-level course, for which a seminar paper is required. German 510 and 519-20 are required, as are three courses on German literature or culture, one of which may be at the 400 level. In addition, students must take three further courses, one of which may be chosen from 411-12 or 485. All graduate teaching assistants should take 512, and other candidates may take 512 or any other course above 500. A maximum of three 400-level courses may be counted toward the 30 semester hours of coursework. A common final exam over the designated reading list is required, as is a standardized language exam, such as the Zentrale Mitteleuropäischenprüfungen. Each non-thesis M.A. candidate will have a committee of three faculty members in German to whom the student will submit a dossier consisting of the seminar paper and one paper previously submitted in a graduate course. The length and type of the papers is described in greater detail in the Manual for Graduate Students in German.

#### Spanish

**Thesis Option:**

1. Completion of a minimum of 24 semester hours in coursework plus at least 6 hours in course 500 Thesis. Spanish 550 is required. A maximum of 6 hours may be taken at the 400 level, the rest at the 500 level, and under certain conditions the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours (including 6 hours of thesis) must be taken in the major, 6 in the minor.

2. A thesis, with a minimum of 6 semester hours in course 500.

3. A written examination covering the coursework and selected items from a master reading list.

4. A final oral examination covering the thesis.

**Non-Thesis Option:**

1. Completion of at least 30 semester hours, with a maximum of 9 at the 400 level, the rest at the 500 level, including Spanish 561. Under certain conditions, the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours must be taken in the major, 6 in the minor.

2. Three term papers that have been accepted by the student’s advisory committee.

3. A written examination covering the coursework and selected items from a master reading list.

4. A final oral examination to discuss the papers.

### THE DOCTORAL PROGRAM

The Ph.D. in Modern Foreign Languages requires advanced training in a major language and either a second language or applied linguistics.