School for the Ph.D., the Anthropology Department requires the following:
1. Formation of an advisory committee and establishment of a program of study in consultation with the committee.
2. Specific courses to be taken are determined by students and their advisory committees. Students should plan to devote a minimum of 4 years beyond the B.A. to attain the Ph.D.
3. Demonstration of competence in statistics by completing Statistics 531 and 532 with a grade of B or better.
4. Demonstration of knowledge of one foreign language. This language should normally be French, German, Russian or Spanish, but another language may be substituted at the committee's discretion. This requirement may be met by:
   a. Successful performance on a language examination administered by the appropriate language department.
   b. Completion of the intermediate (200 level) sequence of a language with a grade of B or better in the second semester.
   c. Completion of the second semester of specialized reading courses for graduate students with a grade of B or better.
5. Written and oral comprehensive examinations in three areas of specialization to be determined by the committee.

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.A. program in Anthropology is available to residents of the states of Louisiana (concentration in zoarchaeology only), South Carolina or Virginia (concentration in cultural or zoarchaeology only). The Ph.D. program is available to residents of Alabama, Arkansas, Louisiana, Mississippi, South Carolina, or West Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES
410 Principles of Cultural Anthropology (3) Exploration and illustration of major concepts, theories, and methods in cultural anthropology, with application to analysis of specific ethnographic samples. Prereq: 130.
411 Linguistic Anthropology (3) Basic linguistic concepts applied to research in cultural anthropology, investigation of relationship between language and culture. Prereq: 130 or 130 in Linguistics 200. (Same as Linguistics 411.)
412 Folklore in Anthropology (3) Introduction to anthropolological study of folklore, using folklore and folk materials from various tribal, peasant, and complex societies. Prereq: 130 or consent of instructor.
413 Dynamics of Culture (3) Major forms of culture change, ranging from evolution and diffusion to religious revitalization and continuity and change in diverse cultural settings through use of archaeological, ethnohistoric, and contemporary cases. Prereq: 130.
414 Political Anthropology (3) Organization and dynamics of power and politics in both stateless and state-level societies. Involves study of symbols, rituals, and ideologies in producing and reproducing power relations; relationship between actors (individuals) and structures. Encapsulation of traditional political forms and systems within modern states. Prereq: Cultural anthropology or consent of instructor. 415 Ethnographic Research (3) Conceptual and practical exploration of methods and techniques cultural anthropologists use in fieldwork. Prereq: Cultural Anthropology or consent of instructor.
431 Historical Archaeology Laboratory (3) Laboratory procedures for processing, identification, and interpretation of artifacts from historical sites. Instructional and interpretive material from historic East Tennessee sites used for class projects. Recommended prerequisite: Historical Archaeology 441.
440 Cultural Ecology (3) Concepts and methods in studying dynamic interaction between prehistoric and present day cultures and their environments; ecological theory, methods of analysis, and review of selected case studies. Prereq: 120, 130, 410, or consent of instructor. 450 Current Trends in Anthropology (3) Analytical, integrative review of current directions of research and theory in anthropology.
452 Selected Topics in Anthropology (3) Theoretical issues in anthropology for undergraduate students. Topics include practical experience or laboratory study of anthropological materials. Prereq: Either Human Origins, Prehistoric Archaeology, Cultural Anthropology or consent of instructor. May be repeated. Maximum 6 hours.
461 African Prehistory (3) African cultural history from earliest evidence of human activity to time of European contact. Stone age of African south of Sahara, Prereq: 120 or consent of instructor. (Same as Afro-American Studies 414.)
462 Early European Prehistory (3) Origins and evolution of human culture in Europe through beginnings of settled life. Paleolithic and Mesolithic chronology and lifeways. Prereq: 120 or consent of instructor. 463 Rise of Complex Civilizations (3) Development of complex societies in Old World from origins of agricultural economics to rise of States. Mesolithic, Neolithic, and Metal Age lifeways in Africa, Europe, and Asia. Prereq: 120 or consent of instructor.
465 Urban Archaeology (3) Field archaeology and interpretation of archaeological remains on historic urban sites in U.S. Lectured and field and laboratory research on urban sites in East Tennessee. Recommended prerequisite: Prehistoric Archaeology.
466 Human Osteology (3) General osteology of man. Identification and interpretation of anthropological remains in bone collections. Prereq: 130 or consent of instructor.
467 Zooarchaeology (3) Zooarchaeology as a subdiscipline of archaeology. General zooarchaeology: theoretical and methodological issues in zooarchaeology. Prereq: 120 or consent of instructor. 468 Primate Behavior (3) Social organization and behavior of selected primates: group composition, size, and structure; patterns of mating; other social interactions; communication; and cultural behavior, application of primate studies to human behavior. Prereq: 110 or consent of instructor.
469 Human Response to Environmental Stress (3) Physiological and psychological stress from physical environment and psychological environment. Prereq: 110 or consent of instructor. 470 Thesis (1-15) P/NP only. E 493 Independent study in anthropology. May be repeated. Maximum 18 hrs.
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 has a fee for degree completion only. May be repeated. S/NC only. E 510 Method and Theory in Cultural Anthropology (3) Development of primary theoretical orientations by cultural anthropologists; formation of research problems and methods of data collection, organizing, and utilizing data. Prereq: Consent of instructor.
511 Special Topics in Cultural Anthropology (3) Seminars for advanced students on topics of special interest to cultural anthropologists. Comparative social organization, religion, and art. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. 512 Urban Studies in Anthropology (3) Process of urbanization examined cross-culturally: theory and method in researching urban communities; urban problems and applied anthropology.
513 Rural Studies in Anthropology (3) Theory, method, and ethnographic research on selected problems and aspects of traditional agrarian groups in U.S. and peasant societies. Prereq: Cultural area course or equivalent. May be repeated. Maximum 6 hrs. 514 Anthropology of Development (3) Application of anthropological theory, method, and research on selected problems and aspects of traditional agrarian groups in U.S. and peasant societies. Prereq: Cultural area course or equivalent. May be repeated. Maximum 6 hrs.
515 Medical Anthropology (3) Cultural impact on disease patterns, theories of disease causation, and models of therapy. Theoretical and applied aspects of the anthropological study of health and disease. Prereq: Consent of instructor. 516 Nutritional Anthropology (3) Anthropological contributions to study of food-related cultural and biological variability in past and present populations. Prereq: 110, 120, 130, or consent of instructor. Recommended prerequisite: Basic nutrition course.
517 Forms of Social Inequality (3) Anthropological perspectives on inequalities stratified along lines of rank, caste, race, ethnicity, and class; inequalities engendered by sex role structure. Construction of social distinctions before and after rise and consolidation of modern world system. Intersections of race and ethnicity with class and gender.
520 Seminar in Zoology (3) Approaches to analysis of zoological data. Identification of major vertebrate groups, aboriginal use of vertebrate remains; introduction to laboratory use of comparative collections. Prereq: 120 or consent of instructor.
521 Laboratory Studies in Zoology (3) Examination and comparison of major vertebrate groups, shells of terrestrial and aquatic molluscs, in relation to animal remains from archaeological contexts. Basic osteology and shell characters of species encountered in archaeological sites; use of comparative collections. May be repeated. Maximum 8 hrs. 522 Seminar in Archaeology (3) Theoretical and practical issues in contemporary archaeology: ethnoarchaeology, paleoethnobotany, isotope analyses, ceramic analysis, historical archaeology, and regional archaeological cultures. May be repeated. Maximum 9 hrs.
530 Fieldwork in Archaeology (3-9) Practicum in surveying, excavating, processing, and analysis of archaeological data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
531 Quantitative Methods in Archaeology (3) Application of quantitative methods to archaeological data. May be repeated. Maximum 9 hrs.
532 Quantitative Methods in Archaeology (3) Development of primary theoretical orientations by cultural anthropologists; formation of research problems and methods of data collection, organizing, and utilizing data. Prereq: Consent of instructor.
587 Laboratory in Forensic Anthropology (3) Discussion and micro and macroanatomical response to loading. Prereq: Consent of instructor.

585 Anthropometry (3) Techniques of measuring and interpreting the functional analysis problems; interpretation of statistical results. Liniments, Demography, vital statistics, pathology, nutrition, and measures of biological relationships as related to population and modern humans. Prereq: 480.

583 Skeletal Biology (3) Practical and theoretical approaches to analysis of prehistoric human skeletal remains. Demography, dietary statistics, pathology, nutrition, and measures of biological relationships as related to population. Prereq: Consent of instructor.

584 Quantitative Methods in Biological Anthropology (3) Application of statistical procedures to bianthropological problems; interpretation of statistical results. Linear models. Prereq: Statistics 532 or equivalent.

585 Anthropometry (3) Techniques of measuring and describing skeletal material and human subjects; practical applications to growth, nutrition and human engineering. Prereq: Consent of instructor.

586 Bone Anatomy and Physiology (3) Examination of bone microstructure, cellular anatomy, hormonal regulation and micro and macroanatomical response to loading. Prereq: 480 or consent of instructor.

587 Laboratory in Forensic Anthropology (3) Discussion and lab experience with forensic anthropological techniques: radiographic analysis, dental examination, hair analysis, bone microstructure. Prereq: Human Origins, 480, 581 or consent of instructor. 2 hrs and 1 lab.

589 Anthropological Genetics (3) Application of population and quantitative genetic theory to study of human and non-human primate populations. Prereq: Consent of instructor.

591 Foreign Study (1-15) See page 32.

592 Off-Campus Study (1-15) See page 32.

593 Independent Study (1-15) See page 32.

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

601 Advanced Graduate Research (1-6) Independent investigation of special problems in anthropology by advanced graduate students. May be repeated. Maximum 12 hrs. Only 3 hrs may count toward 600-level requirement.

610 Seminar in Cultural Anthropology (3) Selected topics, primarily for doctoral students in cultural anthropology. May be repeated. Maximum 6 hrs.

611 Theory in Cultural Anthropology (3) Critical evaluation of current issues in theory and data interpretation, primarily for doctoral students in cultural anthropology.

620 Seminar in Nutritional Anthropology (3) Analytical review of major theoretical viewpoints in nutritional anthropology. Prereq: 516 and consent of instructor.

660 Advanced Seminar in Archaeology (3) Selected topics in prehistoric and historic archaeology. May be repeated. Maximum 6 hrs.

690 Selected Topics in Physical Anthropology (3) For doctoral students in biological anthropology. May be repeated. Maximum 6 hrs.

691 Selected Topics in Paleoanthropology (3) May be repeated. Maximum 6 hrs.

695 Gross Human Anatomy (9) Skeleton, muscles, and cardiovascular system. Dissection of cadavers. Prereq: 480 or Human Biology. 5 hrs and 5 labs.

Architecture

(College of Architecture and Planning)

MAJOR

DEGREE

Architecture ........................................... MArch.

J. William Rudd, Dean
William J. Lauer, Associate Dean

Professors:
Anderson, G. I., M.Arch. ...................... Illinois
Cooney, G. (Emeritus), B.Arch. .............. Harvard
Greger, F., M.Arch. ............................... Pennsylvania
Kelso, R. M., M.S. ................................. Tennessee
Kersavage, J. A., D.Sc. ......................... Southern Cal
Lauer, W. J. (Liaison), M.S.Arch. Engr. ....... Iowa
Lester, A. J., M.Arch. ............................ Virginia
Lizon, P., Ph.D. .................................. Pennsylvania
Moffett, M. S., Ph.D. ............................. MIT
Robinson, M. A., M.Arch. ...................... Pennsylvania
Rudd, J. W., M.A. ................................. Northwestern
Shell, W. S., M.Arch. ............................. Columbia
Wodehouse, J. S., M.Arch. ...................... Pennsylvania
Wodehouse, L. M., Ph.D. ....................... St. Andrews

Associate Professors:
Coddington, J., M.Arch. ........................... Pennsylvania
Hersch, M. E., B.Arch. .......................... Columbia
Kaplan, M., M.Arch. .............................. Harvard
Kinzy, S. A., Ph.D. ............................... SUNY (Buffalo)
Martella, W. E., B.Arch. ....................... California
Naranjo, V. (On Leave), B.Arch. ............... Belgrade
Rabun, J. S., M.Arch. .............................. Texas

Assistant Professors:
Fox, L. D., M.Arch. ............................... Cranbrook
Fich, R. C., B.Arch. .............................. Tennessee
Livingston, M., M.F.A. ......................... Wisconsin
Moir-McClellan, T. W., M.Arch. .............. Michigan
vonBouwow, P., M.S. ............................ Tennessee
Ward, S. M., M.F.A. ............................. Tennessee

MASTER OF ARCHITECTURE PROGRAM

The School of Architecture offers two tracks leading to the Master of Architecture degree. Track 1 is for students seeking the first-professional degree who already hold a Bachelor's degree or an advanced degree in another field. Track 2 is for students with an accredited professional degree who seek to develop an area of specialization.

Admission Requirements

In addition to meeting The Graduate School's minimum requirements, admission requires a baccalaureate degree from an accredited Track 2 institution, an NAAB accredited program, or foreign equivalent with a minimum 3.0 GPA. Candidates with a GPA less than 3.0 may be considered for conditional admission when evidence of exceptional promise is identified. The School requires a separate application for Architecture including an essay and three letters of recommendation. A personal on-site interview is desirable but not mandatory.

For Track 1 applicants, twelve semester hours in humanities and a basic understanding of physical principles, systems and analytical procedures, and mathematical principles and analytical procedures, a general knowledge of Western architectural history, and a general understanding of the use of computers is also required. Track 2 applicants must also submit a portfolio of design and research work.

Degree Requirements

Track 1 requires a minimum of 48 semester hours of undergraduate preparation and 57 semester hours of graduate coursework, taking approximately 3 1/2 years of full-time study. Track 2 requires a minimum of 30 semester hours of graduate coursework. Both tracks require 6 hours of Thesis 500 with a public presentation and oral defense of the thesis. Retention in the program is contingent upon evidence of satisfactory progress toward the degree. Each student's progress will be reviewed each semester by the Coordinator of Graduate Studies. Any questions regarding progress will be reviewed by the Graduate Program Advisory Committee.

For further information, contact the School of Architecture.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

403 Introduction to Preservation (3) History, theory, and legal aspects of architectural preservation and restoration.

404 Preservation Technology (3) Techniques of preservation methods of analysis, history of materials and technology used in old buildings. Prereq: 403.

405 Descriptive Analysis of Historic Buildings (3) Identification and analysis of characteristic elements of buildings from various architectural periods, American architecture survey techniques.

410 History and Theory of Urban Form (3) Patterns of urban form design.

411 Architecture Since 1945 (3) Recent architectural developments and views of future.

412 Non-Western & Indigenous Architecture (3) Building responsive to climate, material availability, and economic level, as designed by anonymous builders. Prehistoric times to present throughout world. Fertile Crescent; Indus Valley; Hindu, Buddhist, and Mughal architecture of India, China, and Japan.

413 Tennessee Architecture (3) History of settlement patterns and building in Tennessee. Reading assignments, lectures, discussion, and field trips. Historical research using primary material.

414 History of Architectural Technology (3) Building materials and construction techniques from antiquity to present.

415 Medieval Architecture (3) History of architecture from the fall of Rome to beginning of Renaissance.


420 American Architecture, 1840-1940 (3) Stylistic periods from Gothic Revival through twentieth century.

421 History of Landscape Architecture (3) Intellectual, societal, and geographical influences that provide theoretical basis for design throughout history. Selected examples of landscape architecture analyzed in terms of design.

422 Modern East European Architecture (3) Twentieth-century architecture in Russia, Czechoslovakia, Poland, Hungary, East Germany, Romania, Bulgaria, Yugoslavia.

426 Special Topics in History, Theory, and Criticism (1-4) Special topics in history-related subjects. May be repeated. Maximum 6 hrs.


442 Ground Structure Interaction (3) Behavior of structures subjected to earthquake forces. Ground structure interaction. Prereq: Consent of instructor.

443 Building Energy Analysis (3) Balancing heat flow through external skin of residential and small and large commercial buildings. Local climate evaluation. Site planning, building size and orientation, window area, wall treatment, insulation control, and other design elements. Energy use quantification methods and economic analysis of energy efficient design features. Architectural program analysis of external and internal loads dominated buildings. Prereq: 341.

444 Advanced Environmental Control Systems (3) In-depth analysis and innovative concepts in design of heating, ventilating, and air conditioning. Prereq: 341.

445 Advanced Lighting (3) In-depth analysis and innovative concepts in design of lighting. Prereq: 342.

473 Architectural Photography (3) Photography as design, research, and presentation medium. Application of photographic techniques, printing and processing. Color and black and white.

**Art**

(College of Liberal Arts)

**Major**

**Degree**

Don F. Kurka, Head
William C. Kennedy, Associate Head

Professors:

- Blain, Sandra J., M.F.A. — Wisconsin
- Braake, P. M., M.F.A. — Yale
- Clarke, R. A. (Emeritus), M.S. — Wisconsin
- Cleaver, Dale G. (Emeritus), Ph.D. — Chicago
- Daehnert, R. H., M.F.A. — Wisconsin
- Falsetti, Joseph S., M.F.A. — Ohio State
- Goldenstein, M. B., M.F.A. — Nebraska
- Kennedy, William C., M.F.A. — Wisconsin
- Kurka, Don F., Ph.D. — New York
- Lee, B., M.F.A. — Yale
- Leland, W. E., M.F.A. — Tennessee
- Livingston, P. R., M.F.A. — Wisconsin
- Martinson, Fred, Ph.D. — Chicago
- Nichols, J. P., M.F.A. — Michigan
- Peacock, D., M.F.A. — Iowa
- Riesing, T. J., M.F.A. — Nebraska
- Stewart, F.C., M.F.A. — Claremont
- Yates, S., M.F.A. — North Carolina (Greensboro)

**Associate Professors:**

- Habel, Dorothy, Ph.D. — Michigan
- LeFevre, Richard, M.F.A. — Rochester
- Lyons, B., M.F.A. — Arizona State
- Moffatt, F., Ph.D. — Chicago
- Naff, A., Ph.D. — Pennsylvania
- Saute, T., M.F.A. — Wisconsin
- Wilson, D. M., M.F.A. — California (San Diego)

**Assistant Professors:**

- Hiles, Timothy, Ph.D. — Penn State
- Longobardi, Pam (Liaison) — Montana State
- Staples, Carolyn, M.F.A. — Michigan State

The Master of Fine Arts is the terminal degree in studio art. It is offered in the concentration areas of ceramics, graphic design, illustration, drawing, fiber-fabrics, painting, printmaking, sculpture, and watercolor. Inter-area studies are available with consent of the faculty.

**The Master's Program**

To become a candidate, the applicant must be admitted by The Graduate School and approved by the Department of Art. In addition to the admission requirements of The Graduate School, the Department of Art specifically requires the following:

1. A detailed letter of intent including statement requesting assistantship, if desired.
2. Three letters of recommendation from former professors or professionals in the field.
3. An undergraduate major in art or evidence of equivalent proficiency.
4. A portfolio to be evaluated by the faculty. Further information is available by writing to the Department of Art.

**M.F.A. Requirements**

A minimum of 60 hours is required:

1. Successful completion of 20 hours of studio in a concentration area. An inter-area program must be approved by the graduate faculty only after the second semester in residence. Ten hours of concentration must be in second year courses (512, 514, etc.).
2. A minimum of 9 hours of art history for graduate credit.
3. Eleven hours of electives which may consist of any combination of courses offered by the University for graduate credit.
4. Art 599, Project in Lieu of Thesis (20 hours). A third year of semi-independent study. Student must have completed all other coursework prior to registration.
5. A student with the permission of the area faculty can petition to take 3 hours of outside coursework toward the degree. The candidate's committee will consist of a minimum of 3 members and a maximum of 6 members and will be appointed prior to registration for Art 599. Three members of the committee shall be as follows: one from the candidate's concentration area who shall be the major professor, one from art history, and one from a studio discipline outside the concentration area.

**Exhibition and Oral Examination:** With the completion of all requirements for the M.F.A., the student must produce an exhibition and, in the presence of that work, must satisfactorily complete an oral examination.

**Academic Standards**

1. First-year evaluation: At the end of the first 2 semesters in residence, the student must present a portfolio for evaluation by the faculty and receive permission to continue in the program.
2. Second-year evaluation: With completion of all coursework, the student must present work for evaluation by the faculty and receive permission to register for Projects in Lieu of Thesis.
3. If, in a review by the student's major area faculty, the student's progress is deemed insufficient, the faculty may recommend a work period without advancement toward the degree, probation with specific goals set for a specific time, or dismissal.

**ACADEMIC COMMON MARKET**

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.F.A. program in Art is available to residents of the states of Alabama (concentration in watercolor only) or Arkansas (concentration in graphic design/illustration only). Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

**Graduate Minor in the History of Art**

A graduate minor in Art History may be arranged with consent of the student's committee, the instructors involved, and The Graduate School. Prerequisite is an undergraduate Art History minor, or its equivalent, and reading knowledge of French, German, or Italian, unless waived by the Art History faculty.

**GRADUATE COURSES**

**400 History of Photography (3)** Survey of history of photography from introduction of daguerreotype and calotype to more recent trends. Aesthetics and use of photography as medium for artistic expression.

**401 Individual Class Projects in Fabric (3-6)** Prereq: Two-Dimensional Fabric, Three-Dimensional Fabric or consent of instructor. May be repeated. Maximum 12 hrs.

**402 Individual Class Projects in Fiber (3)** Prereq: Two-Dimensional Fabric, Three-Dimensional Fabric or consent of instructor. May be repeated. Maximum 12 hrs.

**403 Computer Enhanced Design (3)** Exploration of computer systems, software and techniques. Prereq: Introduction to Computer Enhanced Design or consent of instructor. May be repeated. Maximum 6 hrs.

**405 Advanced Computer Enhanced Design (3)** Prereq: 404 or consent of instructor. May be repeated. Maximum 6 hrs.
409 Special Topics in Fiber/Fabric (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

411 Drawing IV (6) Individualized pursuit of personal drawing techniques and concepts; supplemented by individual and group critiques; weekly life drawing sessions. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

413 Painting IV (6) Individual concepts and personal expression with varied media. Prereq: 313. May be repeated. Maximum 12 hrs.


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


424 Ceramics: Clay and Glazes (3) Clay chemistry, clay bodies, glaze theory, glaze calculation, intensive formulating, mixing and testing of clay bodies and glaze formulas. Prereq: 321 and 322.

425 History of Ceramics Seminar (3) Ceramics from ancient through contemporary. Ceramics sculpture, and vessel aesthetics and individual presentations. May not be used toward art history requirement. Prereq: 321 and 322.

426 Kilns: Design, Construction and Operation (3) Designing kilns, traditional and modern refractories, construction methods, and operation of wood, gas, and electric kilns. Prereq: 321 and 322.

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


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

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

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


453 Advertising Illustration (3) Advertising illustration media and techniques as applied to product illustration. Prereq: 354.

454 Editorial Illustration (3) Editorial illustration media and techniques as applied to book, magazine, and newspaper illustration. Prereq: 453.

456 Graphic Design/Illustration Practicum (1-12) Practical exercise in illustrative techniques or rearrangement of department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hrs.

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


463 Lithography III (3-4) Individual projects through advanced color editioning methods from stones and aluminum plates. Prereq: 365. May be repeated. Maximum 12 hrs.


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

471 History of North American Art (3) Landmarks in painting, architecture, sculpture, and design from prehistoric to present. Prereq: 363. May be repeated. Maximum 12 hrs.


474 History of Modern Architecture in Europe and America (3) 19th-century styles, Sullivan and Skyscraper, 20th-century: Viennese leaders, the Bauhaus, Gropius, Van der Rohe, Le Corbusier, and Wright. Aalto to Kahn, Tange and Metabolism, Archigram, Soleri, and Venturi.


476 History of 20th-Century Painting and Sculpture in Europe (3) Cezanne, Van Gogh, Gauguin, Symbolism, Fauvism, German Expressionism, Cubism, Futurism, Constructivism, Surrealism and Social Realism, Conceptual art.

479 Special Topics In Art History (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.

481 Museology I: Museums, Purpose and Function (3) Development of museums of art, history, natural and applied science. (Same as Anthropology 481.)

482 Museology II: Exhibition Planning and Installation (3) Exhibition concept development and implementation. Exhibition design and installation techniques. Publicity, production, matting and framing, shipping and storage. Prereq: 481 or consent of instructor. (Same as Anthropology 484.)

484 Museology III: Field Projects (1-12) Special field projects: restoration, preservation, registration, and related research on or off campus. Prereq: 481 and 482. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)

485 History of Printmaking (2) Prints from 15th century to present. 20th century in Europe and U.S. Prereq: 172 and 173.

486 Art of Indian Asia (3) History of Indian art: Central Asia and Southeast Asia.

489 Studies in Art History (3) Concentration in individually selected area. Prereq: 12 hrs of art history and consent of instructor. Prereq: Determined by department. May be repeated. Maximum 6 hrs.

490 Individual Problems (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

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

502 Registration for Use of Facilities (3-15) Required for the student to be automatically registered during an academic 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
Astronomy

See Physics and Astronomy

Audiology and Speech Pathology

(College of Liberal Arts)

MAJORS

DEGREES

Audiology ........................................ M.A.
Speech and Hearing Science ........................ Ph.D.
Speech Pathology ........................................ M.A.

Patrick J. Carney, Head

Professors:

Asp, Carl W., Ph.D. ....................... Ohio State
Carney, Patrick J. (liaison), Ph.D. .............. Iowa
Luper, Harold L., Ph.D. ...................... Ohio State
Nabelek, Igor V., Sc.D. ...................... Prague
Peterson, H. A., Ph.D. ....................... Illinois
Silverstein, B., Ph.D. .......................... Purdue

Associate Professors:

Burchfield, Samuel B., Ph.D. .................. Michigan State
Ferrell, Charles J., M.A. ..................... Tennessee
Wallace, Glorijean L., Ph.D. .................. Northwestern

Assistant Professor:

Gordon, Pearl A., Ph.D. ..................... Tennessee
Krishnan, Ravi A., Ph.D. ..................... Texas

THE MASTER’S PROGRAM

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

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

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

Students may elect either the thesis or the non-thesis option. Students in both programs are required to take 511. The Master’s program with thesis will include a minimum of 30 semester hours of approved graduate credit in speech/language pathologic or a minimum of 33 semester hours of approved graduate credit in audiology. Including 6 hours of 500 credit in the preparation of an acceptable thesis representing the original independent work, and a final oral examination. At least two-thirds of these total hours must be at the 500 or 600 level, including no more than 6 hours of thesis and no more than 6 hours of practicum. Students in the non-thesis option program must present a total of 36 semester hours in the speech/language pathology program or 39 semester hours in the audiology program of approved graduate credit and pass a final written examination.

THE DOCTORAL PROGRAM

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

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

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

The total program is a minimum of 60 semester hours, including a minimum of:
1. 24 semester hours in dissertation 600.
2. 6 semester hours in a research tool.
3. 6 semester hours in a cognate area outside the department.
4. 24 semester hours in 600-level coursework within the department of which:
   a. a minimum of 6 semester hours in the topic of major interest;
   b. a minimum of 6 semester hours in topic(s) of related interest;
   c. 2 semester hours in 611; and
   d. 3 semester hours in supervised teaching experience.
5. A comprehensive examination to demonstrate scholarly knowledge of audiology, speech and language pathology, and speech and hearing science; and advanced knowledge of the specifics of the area of concentration.
6. A final oral examination.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

431 Stuttering (3) Nature, appraisal and treatment. Prereq: 304 or consent of instructor.

433 Observation of Clinical Practice (1) Prereq: Speech and Language Development, Articulation Disorders, or consent of instructor. (Same as Special Education 433.)

434 Clinical Practice in Speech-Language Pathology (1-15) 449 and consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval. (Same as Special Education 434.)

440 Voice Disorders (3) Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 304, 326, or consent of instructor. (Same as Special Education 440.)

455 Problems in Speech Pathology (1-3) Prereq: Consent of instructor.


465 Speech and Language of the Culturally Different Child (3) Speech and language differences of children of various minority groups, of different ethnic and class membership and from different geographic regions.

473 Audiology II (3) Basic principles of clinical audiology: pure tone, speech, masking and screening and toss of special audiologic tests. Prereq: 371. (Same as Special Education 473.)

494 Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification components, characteristics, assistive devices, speech acoustics, speech perception, speech reading, parent-infant,
542 Hearing Disorders (3) Effects of herbidity, de- 
velopment/aging, diseases, and physical agents on hearing. 
Prereq: 473 or equivalent or consent of instructor.

543 Amplification Technology (3) Description of hear-
ning aid circuits, components and performance character-
istics. Electrococlay analyses of hearing aids. Coupler material and geometry effects. Practical experience in troubleshooting, repair, and construction of hearing aids. Prereq: 473 and 507 or equivalents of consent of instructor.

544 Amplification for the Hearing-Impaired (3) Speech 
acoustics/psychoaoustics. Influence of noise, rever-
beration and auditory pathogy on speech perception.
Prerac: for selecting amplification. Psycholological con-
Consideration, orientation dispersions, auditory pro-
tes, Prereq: 473, 507, and 543 or equivalents or consent of instructor.

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

546 Advanced Audiology (3) Theoretical bases for 
behavioral audiology and acoustic immittance mea-
Surement. Prereq: 473 or equivalent or consent of in-
structor.

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

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

549 Hearing Science (3) Study of psychoacoustic phe-
nomena and how they relate to perception and diagno-
sis audiology. Prereq: 473, 507, and 546 or equivalents or consent of instructor.

550 Seminar in Audiology (1-3) Significant research in 
avarious areas of audiology. Prereq: Consent of instruc-
tor. May be repeated. Maximum 10 hrs.

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

554 Seminar in Multicultural Issues in Communica-
tion Disorders (3) Discussion of current research rel-
vet to cultural language differences: Prereq: 465 or equiva-
lent or consent of instructor.

555 Special Problems in Speech-Language Pathol-
y (1-3) Prereq: Consent of instructor. May be re-
peated. Maximum 6 hrs.

556 Independent Study in Speech-Language Pathol-
y (1-3) Prereq: Consent of instructor. May be re-
peated. Maximum 6 hrs.

557 Management and Supervision for Speech-Lan-
guage-Hearing Professionals (3) Management sys-
tems, accountability, performance appraisal and clinical 
supervision for audiologists and speech language path-
ologists interested in private practice, supervisory or 
administrative positions.

561 Tutorial in Child Language Pathology (2) Interac-
tions with various staff members of Pediatric Language 
Programs, selected topics. Prereq: 461 or consent of instructor. 
May be repeated. Maximum 8 hrs.

563 Practical Applications of Language Habilitation 
Techniques (3) Various methods and procedures used in 
treating delayed and disordered preschoolers. Alternative 
and augmentative systems included. Prereq: 461 or equiv-
lent or consent of instructor.

564 Pediatric Audiology (3) Theoretical and practical 
considerations in evaluation and treatment of hearing 
loss in children and adults. Audiological intervention in 
case management of hearing impaired child: amplifica-
tion, educational alternatives, and state and federal 
guidelines.

565 Electrophysiological Assessment of Auditory 
Function (1-1.5) Prereq: 473, 507, and 546, or 
equivalents or consent of instructor.

570 Psycholinguistic Concepts in Speech Pathol-
y (3) Psycholinguistic concepts and information the-
Research and Development Specialization
1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering (engineering management).
3. Six hours of electives from the major field, mathematics or engineering.
4. Six hours of Aviation Systems 500 demonstrating the ability to conduct and report on an independent investigation.

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

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

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

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

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Aviation Systems is available to residents of the states of Arkansas, Kentucky, Mississippi, South Carolina, or West Virginia. Additional information may be obtained from the Graduate Admissions Office.

GRADUATE COURSES
500 Thesis (1-15) P/NP only. E
501 Aviation Systems: An Overview (3) Aviation systems, present and future. Socioeconomic base, aerospace and propulsion technology, meteorology, air traffic control, airport community interface, and technological and development trends pertinent to present status and future development of air transportation.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
503 Air Vehicles (3) Current capabilities and future requirements for civilian and military air vehicles. Parameters significant for air vehicle type selection, integration of air vehicle into aviation systems. Prereq: 501.
505 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulatory agencies, organizational structure, administrative and enforcement procedures. Prereq: 501.
506 Aircraft Design (3) Design process, compromise of conflicting requirements, economical, industrial, and legal aspects. Definition of mission requirements, synthesis and optimization techniques, safety and reliability, systems integration, standards and regulations, teamwork, and decision-making process.
510 Special Topics in Aviation Systems (3) Current problems. Prereq: Consent of instructor. May be repeated with consent.
558 Measurement Science I (3) (Same as Nuclear Engineering 558, Chemical Engineering 558, Civil Engineering 558, Electrical and Computer Engineering 558, Engineering Science and Mechanics 558, Mechanical Engineering 558 and Aerospace Engineering 558.)
589 Measurement Science II (3) (Same as Nuclear Engineering 558 and Engineering Science and Mechanics 558.)

Biochemistry

John W. Koontz, Head

Biochemistry ............................................. M.S., Ph.D.
Churich, Jorge E., Ph.D. ................. Sheffield
Joshi, J. G., Ph.D. ......................... Poona
Monty, Kenneth J., Ph.D. ............... Rochester
Salo, T. P. (Emeritus), Ph.D. .............. Michigan
Wicks, Wesley D., Ph.D. ................. Harvard
Associate Professor:
Koontz, John W. (Liaison), Ph.D. ....... Kentucky
Assistant Professors:
Feinberg, R. H. (Emeritus), Ph.D. ....... California
Howell, Elizabeth E., Ph.D. ............. Lehigh
Petersen, Cynthia B., Ph.D. .......... LSU
Roberts, Daniel M., Ph.D. ......... California (Davis)
Serpersu, Engin H., Ph.D. ........... Hacettepe

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

THE MASTER’S PROGRAM

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

THE DOCTORAL PROGRAM

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

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

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

GRADUATE COURSES

410 Cellular and Comparative Biochemistry (4) Electrolyte behavior, chemistry and structure of proteins; enzyme behavior and biological function; catalysis and energy capture; synthetic metabolism; nucleicacid function, protein synthesis, and biochemical genetics; regulation of biological processes. Prereq: Chemistry 350-60-69 and Biology 110-20, 3 hrs and 1 discussion. F,Sp.


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

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

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

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

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

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

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

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

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


603 Current Topics in Biochemistry (1) Seminars and lectures dealing with current advances in field of chemical biology. Required every semester in residence. S/NC only. F,Sp.

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


606 Current Topics in Biological Membrane Research (1) Prereq: 410 or equivalent. May be repeated. Maximum 6 hrs. (Same as Microbiology 606). S/NC only. F,Sp.

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

Biomedical Sciences

(Office of the Vice Chancellor for Academic Affairs)

MAJOR

DEGREES

Biomedical Sciences .................... M.S., Ph.D.

Raymond A. Popp, Director

Professor:

Olins, Donald E., Ph.D. .............. Rockefeller

Research Professor:

Olins, Ada L., Ph.D. ............... New York

Research Associate Professor:

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

Research Assistant Professor:

Foote, Robert S., Ph.D. ............ Duke

Uberbacher, Edward C., Ph.D. ....... Pennsylvania

Shared Faculty:

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

Bunick, Gerald J., Ph.D. ............ Pennsylvania
Cook, John S., Ph.D. ................... Princeton
Fry, R. J. M., M.D. .......... Dublin
Fujimura, Robert K., Ph.D. ........ Wisconsin
Godfrey, Virginia L., D.V.M., Ph.D. .. Tennesse
Hartman, Fred C., Ph.D. .......... Tennessee
Jacobson, K. Bruce, Ph.D. ........ Johns Hopkins
Kannel, Steve, Ph.D. ............. California (San Diego)
Larimer, Frank W., Ph.D. .......... Florida State
Lee, Kai-Lin, Ph.D. .................... Tulane
Littlefield, Gayle, Ph.D. ........... Georgia
Mazur, Peter, Ph.D. ............... Harvard
Mural, Richard, Ph.D. .............. Georgia
Niyogi, Salil K., Ph.D. ............ Northwestern
Popp, Raymond A. (Liaison), Ph.D. ..., Michigan
Ritchik, Eugene M., Ph.D. ........... Duke
Russell, Liane B., Ph.D. .......... Chicago
Shugart, Lee H., Ph.D. ............. Tennessee
Snyder, Fred L., Ph.D. ............. North Dakota
Solomon, A., M.D. ................. Duke

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

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

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

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

ADMISSION REQUIREMENTS

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply.

Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need preparation in biology, mathematics, physics, and organic and physical chemistry. A course in physical chemistry is offered by the school in order to meet the last requirement. It is recommended that deficiencies in preparation, as identified in the admission process, be eliminated prior to entrance.

Requests for application forms, information on admission, financial support, and housing should be sent to Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Division of ORNL, Box 2009, Oak Ridge, Tennessee 37831-8077.

THE DOCTORAL PROGRAM

1. Satisfactory (B grade or better) completion of the following core courses or their equivalent: Biochemistry (511); Biophysical Biochemistry (514); Genetics (515); Cell Biology (518); Computing for the Life Sciences (525); and Statistics for Biologists (574).

2. Three semesters of Biomedical Sciences Laboratory (531-533).

3. Participation in at least one of the seminars during each term of residence after the first year is strongly recommended.

4. Satisfactory completion of formal advanced courses in the areas of the student's interests. The number and nature of the required advanced courses will vary depending upon the student's background and area of specialization.

5. Passing both written and oral comprehensive examinations.

6. A dissertation reporting the results of original and significant scientific research. A minimum of 24 semester hours of course 600 is required.

7. A final oral examination on the dissertation.

8. A formal seminar presentation of the dissertation research.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

The graduate faculty has designed a Master of Science program in Biomedical Sciences primarily to fill the need for such a degree within the Oak Ridge National Laboratories; however, a limited number of students from other institutions may be accepted if space is available. The requirements for the degree are:

1. Graduate credit or a proficiency in the following core courses: Biochemistry (511); Biophysical Biochemistry (514); Cell Biology (518); plus any three of the following courses: Genetics (515); Molecular Genetics (517); Statistics for Biologists (574); or Computing for the Life Sciences (525).

2. Thirty hours of approved graduate courses including 8 hours for thesis.

3. For admission to candidacy: Completion of any required prerequisite courses and one semester of graduate coursework with a B average. Admission to candidacy forms must be filed at least one full semester prior to receipt of degree.

4. A Master's committee of three approved faculty members upon admission to candidacy.

5. A thesis reporting original and significant scientific research.

6. Passing a final oral examination.

GRADUATE COURSES

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

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

507 Physical Chemistry (3) Thermodynamics; phase equilibria; chemical equilibrium; electrostatic force; surface chemistry; electrolyte solutions; kinetics; conductivity; viscosity; diffusion.

511 Biochemistry (3) Chemistry of carbohydrates, lipids, proteins, and coenzymes; enzyme kinetics intermediary metabolism; and photosynthesis; biosynthesis of amino acids; lipids, and macromolecules. Coreq: 507.

514 Biophysical Biochemistry (3) Chemistry of lipids, proteins, and macromolecules; fundamental aspects of structure and function; properties of proteins in solution; structures of macromolecules in solution; molecular conformations; inter- and intramolecular forces; principles of microscopy. Prereq: 511.

515 Genetics (3) Mendelian genetics, mitosis and meiosis; transmission genetics; mapping and linkage; genetics of phage, bacteria and eucaryotes; mapping, linkage, mutagenesis; cytological inheritance. Mechanisms of recombination, chromosome structure and replication.

516 Cell Biology (3) Structure and composition of major organelles of eucaryotic cells. Pertinent methods and techniques; liposomes and mitosis; cell cycle; chromosome structure; nuclear RNA metabolism; nuclear and ribosomal biosynthesis; survey of specialized cells. Structure of genetic transcription and translation in bacteria. Coreq: 511.

525 Computing for the Life Sciences (3) Interactive computing. Mini- and micro-computing environments: Basic, Fortran, and Pascal programming; applications of statistics, graphs, text manipulation, and computer communications.

531-33 Biomedical Sciences Laboratory (3.3) Approaches and technologies in various areas of modern biology. Students spend a semester in each of three laboratories conducting research in different areas of biomedical science. Required of all first-year students.

543-46-49 Graduate Research Participation (3.9) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

551-52-53 Special Topics in Biomedical Sciences (3.3,3) Either tutorials or formal lectures. Potential topics: X-ray diffraction and crystallography; excited-state biology; physical chemistry of macromolecules; pathology; mammalian genetics.

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


651-52-53 Advanced Topics in Biomedical Sciences (3.3) Current and future research developments: protein synthesis, protein chemistry and enzyme mechanisms; cryobiology, and special topics. Either as tutorial or literature survey requiring substantial student preparation. May be repeated.

660 Mammalian Genetics (3) Known genetic variants affecting each organ system of experimental mammals, especially laboratory mice. Inheritance of phenotypical and biochemical traits in rodents and other laboratory rodents. Prereq: 515.


Botany

(College of Liberal Arts)

MAJOR

Botany .................................................. M.S., Ph.D.
Edward E. Schilling, Head

Professors:

Caponetti, J. D., Ph.D. ..................... Harvard
Clebsch, E. E., Ph.D. ..................... Duke
DeSelm, H. R. (Emeritus), Ph.D. ...... Ohio State
Admissions Requirements
The Botany Department offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, botany, cytology, cytogenetics, ecology, genetics, lichenology, morphology, mycology, phycology, phylogeny, and taxonomy. Educational service is required of each graduate candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses. For further information, contact the Department Head or the Graduate Coordinator.

Grade Courses

The Botany Department requires scores from the general and biology subject portions of the Graduate Record Examination, at least three 5-hour courses in botany related to the student's area of concentration. The requirements are set at the 600 level. The major professor and department head.

The Botany Department requires scores from the general and biology subject portions of the Graduate Record Examination, at least three 5-hour courses in botany related to the student's area of concentration. The requirements are set at the 600 level. The major professor and department head.

Required Courses

The Doctor of Philosophy program is patterned to fit the needs of students who desire a less extensive course of study than the Ph.D. program. However, the applicant must be equally well prepared and display an aptitude and ability for advanced study. The M.S. includes thesis and non-thesis options.

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

1. Satisfactory completion of a written examination on all work offered for the degree. The student's committee may require specific courses for the completion of the degree. Most students spend from three to five years working on their Ph.D.

2. Satisfactory performance on a final written examination on all work offered for the degree. The student's committee may require specific courses for the completion of the degree. Most students spend from three to five years working on their Ph.D.

3. Satisfactory performance on an oral examination following the written examination. The student's committee may require specific courses for the completion of the degree. Most students spend from three to five years working on their Ph.D.

4. Satisfactory performance on an oral comprehensive examination. May be repeated. S/NC

5. Satisfactory completion of 600 level hours at the master's degree level (excluding dissertation).


7. Presentation of a departmental seminar near the end of the doctoral program.

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

Graduate Courses

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


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

426 Paleobotany and Palynology (3) Same as Geology 426.

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

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organ systems; media preparation and maintenance of cultures. Prereq: 110-20 or Biology 110-20 or equivalent. Prereq: 310-20, 426, 132, 412; Microbiology 310 or 319; Ornamental Horticulture and Landscape Design 330; and Plant and Soil Science 331.

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


502 Registration for Use of Facilities (2-15) 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 counted toward degree requirements. May be repeated. S/NC only. E

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

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

507 Biological Illustration (3) Principles and applications of photography (B/W and Color) photomacro- and photomicrography, drawing, graphics and video for recording and presentation for research and publication of data in pictorial and graphic form.
509 Morphology and Evolution of Basidiomycetes (4) Structure and function of somatic and sexual life cycles as applied to evolution in group. Cultures and specimens in lab. Prereq: 310 or equivalent.

510 Introduction to Electron Microscopy - Transmission Electron Microscopy (4) (Same as Zoology 510.)

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

516 Biosystematics (3) Major experimental methods in systematics and application to specific types of systematic problems. Cytology, numerical nomenclature, chaetognathology and cladistics.

521-22 Advanced Plant Physiology I, II (3,3) 521- Plant biochemistry and metabolism, respiration, photosynthesis, carbon partitioning, and biosynthesis of specialized plant products: terpenoids, alkaloids, phenolics and plant growth regulators. 522-Genetic interpretation of differentiation, dormancy, mutation, flowering and senescence. Laboratory emphasis on normal structural changes, genetic controls, hybridization, speciation and aberrant meiotic systems and somatic chromatid exchanges. Prereq: 310 and at least one semester of Biochemistry or Biochemistry 410 and 1 semester of Introductory Plant Physiology or Cell Biology.

530 Advanced Taxonomy of Flowering Plants (3) Evolution and classification of families of angiosperms, local flora. Prereq: 330 or equivalent. 2 hrs and 1 lab. F.A

531-32 Special Problems in Botany (1-4,1-4) May be repeated. Maximum 12 hrs.

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

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


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

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

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

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

582 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various instrumental methods, ion exchange resins, adsorption spectrometry, disc electrophoresis, paper chromatography, and radioactivity measurement; basic principles of radiation, and use and detection of radiotopes. Prereq: Chemistry 350, 360; Physics 121, 122. May be repeated. Maximum 5 hrs. S/NCo only.

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

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

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

600 Doctoral Research and Dissertation (3-15) Prereq: consent of instructor.

609-07 Advanced Topics in Botanical Sciences (1-3, 1-3) Experimental botany, functional morphology and systematics of vascular plants, cryptogamic botany, cytology and cell biology, genetics, plant physiology and ecology. May be repeated. Maximum 12 hrs.

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

655 Environmental Assessment and Sustainable Development in Third World Countries (3) (Same as Ecology and Planning 655.)

657 Applied Ecology (3) (Same as Ecology 657.)

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

### Broadcasting

**MAJOR DEGREES**

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

**Professors:**

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

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

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

**Associate Professors:**

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

Ziegler, Dhyana, Ph.D. ......................... Southern Illinois

**Assistant Professors:**

Buchman, Joseph, Ph.D. ............................. Indiana

Wilkinson, Jeffrey, Ph.D. ............................. Georgia

**Adjunct Professor:**

Nelson, Lindsey, B. A. ............................. Tennessee

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

**GRADUATE COURSES**

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

420 Television Sales and Promotion (3) Problems and practices of television and cable sales and promotion. Case studies in sales and sales management; use of ratings and computers in sales presentations and advertising campaigns. Practical experience in television sales and promotion. Prereq: Radio and Television Management.

430 Producing for Television (3) Principles of television production and field production, both technical and creative. Writing, producing, shooting, and editing video stories and programs, 3/4 cameras, recorders, and editing system. Prereq: 330. E


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


597 Independent Study (3) Prereq: Consent of Instructor. MAY be repeated. Maximum 6 hrs. E

598 Internship (3) Full-time (30-40 hrs per week) work experience in news, production, or sales and management with non-university professional organization. Educational experience beyond that available at university. May be repeated with consent of instructor. Maximum 120 hrs. E

### Business Administration

**MAJOR DEGREES**

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

The College of Business Administration offers two college-wide programs, the MBA and the Ph.D., with a major in Business Administration. Two tracks are available for the MBA: the regular, full-time program and an executive program. A dual degree program is also available with the College of Law leading to the J.D.-M.B.A. To obtain application materials, write or call: Office of Graduate Business Programs, Suite 527, Stokley Management Center, College of
Academic Common Market

An agreement among southern states for sharing graduate programs allows legal residents of these states to enroll in certain programs at UT Knoxville on an in-state basis. The Ph.D. in Business Administration (concentration in logistics and transportation only), Kentucky (concentration in logistics and transportation only), or West Virginia; the MBA is available to residents of Alabama, Arkansas, Florida (concentration in logistics and transportation only), or Louisiana. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

Academic Standards

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

The MBA Program

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

The MBA program consists of a common first-year core and a wide selection of second-year elective courses. The first-year core develops a general management foundation upon which specialization is developed in the second year. Electives. The objective of the program is to develop leaders able to enhance the success of their organizations. The program consists of two 15-credit-hour MBA core courses in the first year and eight concentration/elective courses in the second. Each elective course is 3 semester hours of graduate credit.

Admission Requirements

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

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

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

Prerequisites

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

MBA Core

The MBA core consists of two 15-hour courses, one taken each semester. The courses are taught by the MBA core faculty in an integrated fashion and through a year-long simulation requiring students to learn the functional fundamentals (accounting, finance, management, marketing) when they need to apply them to solving a specific business problem. The topics introduced within this course follow three major themes: the functional fundamentals (learned within a cross-functional framework); the role of the firm in society (with attention to stakeholder value, economics, and the ethical and legal environment of the firm); and personal and team development. Students will be exposed to the assessment and delivery of customer value, statistical process control, continuous systems improvement, and the role of quality in competitive organizations.

Students in the first-year core undertake active learning within a team-based environment. Many core requirements are experiential exercises in which self-discovery within a team setting is an important component of the learning process. Individualized support is provided for developing both written and oral communication skills.

Concentration and Electives

A concentration area may be indicated on the MBA Program Application or this declaration may be deferred until after matriculation. In any event, selection must be made no later than completion of 15 hours of MBA program coursework. Requests for changes in concentration area must be submitted for approval to the Office of Graduate Business Programs. Among the 8 courses in the concentration/electives block, at least 3 but not more than 4 must be in one of the following concentration areas. For specific courses required in concentration areas, see the appropriate field of instruction:

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

The remaining elective courses (4 to 5) must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the college. Courses outside the College of Business Administration as well as courses listed in the Graduate Catalog numbered below 500 may be included in this block only with written prior permission via formal petition to the Office of Graduate Business Programs.

Transfer Credits

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

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

Other Requirements

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

To qualify for the degree, the student must achieve a B average (3.0) or above in MBA core courses required in his/her program, a B average or higher in courses comprising the concentration area, and a B average or higher in the overall program. Each student must write a satisfactory analysis of a comprehensive case administered at the end of the first year.

Business Administration Concentration

For complete listing of MBA program requirements, see above.

- MBA Concentration: New Venture Analysis and Entrepreneurship

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

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

PRE-MBA PROGRAM

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

Admission requirements are higher than those normally expected of MBA applicants. Desired qualifications include a minimum 3.4 GPA and a GMAT score of 600 or higher.

Students interested in the program are counseled initially in the Liberal Arts Advising Center regarding admission standards and Liberal Arts requirements. At the end of their second year, they have a conference with the Associate Dean to arrange admission. Students are advised of their prospects for formal admission. Students who are likely candidates are advised to take the Graduate Management Admission Test in October of the third year, and to submit an application to the MBA program. The admission decision is made by January of the third year.

Upon admission, students begin MBA coursework in the fourth year and are awarded a BA degree at the end of that year. Upon successful completion of the fifth year (minimum of 30 semester hours of graduate credit), the student receives the MBA degree.

DUAL J.D.-MBA PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual program leading to the conferment of both the Doctor of Jurisprudence and the Master of Business Administration. The dual program benefits students by combining the skills and perspectives of the business and law schools, and is designed for those interested in pursuing a career in business management and law.

Admission Requirements

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., The Graduate School and College of Business Administration for the MBA degree, and by the Dual Program Committee.

Students who have been accepted by both colleges may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both colleges. Such approval will be granted, provided that dual program studies be started prior to entry into the dual degree program.

Students interested in entering the dual degree program should submit a letter of application to the Dual Program Committee.

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

Curriculum

A dual program candidate must satisfy the graduation requirements of both colleges.

Students withdrawing from the dual 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 program.

The College of Law will award up to 9 semester hours of credit toward the J.D. for acceptable performance in approved graduate-level courses offered by the College of Business Administration. The College of Business Administration will award up to 9 semester hours of credit toward the MBA for acceptable performance in approved courses offered in the College of Law. The approval of courses is the responsibility of the Dual Program Committee and the student's assigned advisor.

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

Awarding of Grades

Grades for graduate business courses accepted by the College of Law and grades for law courses accepted by the College of Business Administration will be converted to either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college in which such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a law course in which the student has earned a 2.3 grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar at the University shall show the actual grade assigned by the instructor without conversion.

Approved Dual Credit

MBA courses to be counted toward the J.D. program must include 9 semester hours approved by the College of Law. Law courses to be counted toward the MBA must be selected from those approved by the Director of Graduate Business Programs.

EXECUTIVE MBA PROGRAM

The executive MBA is designed for fully-employed individuals holding middle and upper level positions in organizations that wish to strengthen their attainment of an MBA degree for the benefit of both company and individual. This is a one-year program of three consecutive terms combining coursework on and off campus. Each term requires two residence sessions which are integrated with off-campus work in a structured program of study, case work, problem solving, and analyses and applications within the participant's sponsoring organization. The off-campus work requires substantial and regular contact with program faculty and other participants.

The objective of the program is to develop executives to lead change and enhance the success of their organizations. This program provides the context for managers to evolve their skills and perspectives from a functional focus to a broader set of strategic management skills and views that will equip them to provide leadership in a business environment that is changing rapidly in terms of global markets, information technology and workforce relationships. The curriculum utilizes the College's recognized strengths in customer value, cross-functional systems and quality and is designed to involve the participant in applying these concepts within his/her organization during the course of study.

The program consists of three 12-hour core courses and a 9-hour sequence which is a project of diagnosis and analysis of a significant strategic issue in the sponsoring organization.

Admission Requirements

All participants begin and complete the program together in one twelve-month period. Sessions will usually begin in January of each year. The deadline for applications to the executive program of the MBA is July 1 of the previous year. International students and students whose native language is not English must meet special requirements for admission to The Graduate School of UT Knoxville, and they are advised to make inquiries well in advance of the MBA program application deadline.

To be considered for admission the applicant must be proposed by his/her company or organization and must submit a complete application file. A completed file includes the Graduate School's financial and academic transcripts of prior college work, the MBA program application, two completed applicant recommendation forms, and the Graduate Management
Admissions Test (GMAT) score report. The first items should reach The Graduate School one month before the MBA application deadline to allow for processing.

For admission to this program, primary consideration is given to the applicant's work history and the proposal from the sponsoring organization and to other activities that demonstrate the potential for leadership. Other criteria include scores on the GMAT and the Test of English as a Foreign Language (TOEFL) for those whose native language is not English. There is no automatic cut-off for either grade-point averages or GMAT scores.

**Curriculum**

The program is taught by a core faculty of 10 professors assisted by other faculty on an ancillary basis. The core faculty develop the entire curriculum and teach it in an integrated, interdisciplinary manner. The MBA program for executives is completed in three terms and requires registration for 15 hours in each term. The first term is comprised of Executive Core I and Management Project I; it includes two residence sessions. The second term is comprised of Executive Core II and Management Project II; it includes two residence sessions. The third term is comprised of Executive Core III and Management Project III. It includes two residence sessions, the first of which will be in some international venue.

The core courses are a full-term curriculum with reading and study, case work and problem solving, as well as analyses and applications within the sponsoring organization during the off-campus periods. The topics introduced within these courses follow five major themes: the functional fundamentals (learned within a cross-functional framework); the role of the firm in society (with attention to stakeholder value, economics, and the ethical and legal environment of the firm); the role of the firm in the global environment; organizational culture and change management; and personal and team development. Students will be exposed to the assessment and delivery of customer value, statistical process control, continuous system improvement, and the role of quality in competitive organizations.

The management project, to be carried out as an independent study project, involves the diagnosis and analysis of some significant aspect in the sponsoring organization and will be based on applying major themes in the core courses. The written project and presentation to senior management and faculty serves as the comprehensive examination. All of the off-campus work will require substantial and regular contact with faculty and other program participants.

**Transfer Credits**

Because of the integrated nature of the curriculum, no credit hours for courses already taken may be substituted for those in the executive program of the MBA.

**Other Requirements**

The Application for Admission to Candidacy must be approved by three faculty members and the Associate Dean for Academic Affairs in the College of Business Administration. It should be submitted to the Office of Graduate Admissions and Records by the end of the fourth residence session, for graduation at the end of the third term.

**THE DOCTORAL PROGRAM**

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

**Admission Requirements**

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

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

**Program of Study**

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

Since the program focuses on the development of competent scholars, heavy emphasis is placed on both teaching and research skills. As part of the doctoral program, each student is required to serve as a teaching assistant to an undergraduate business class or as a research assistant to a senior faculty member. Typically, the College of Business Administration offers financial support for doctoral students during their tenure in the program.

The Ph.D. program is highly flexible, offering a wide array of concentrations and cognates. Moreover, heavy emphasis is placed on individualized instruction and close student-faculty interaction. Instruction takes the form of regular classes, seminars, and independent study and research. Students are also encouraged to attend lectures and discussions by visiting scholars throughout the year.

There are six concentrations offered in the Ph.D. program:

- Accounting
- Finance
- Management (Operations Management and Strategic Management)
- Marketing
- Logistics and Transportation

More detailed information concerning these specific areas is available by writing directly to each department chairperson and by referring to the appropriate fields of instruction.

**Degree Requirements**

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

Following are specific degree requirements:

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

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

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

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

3. Basic Core: Economics 510 (or approved substitute) is required, except that Management 557 (or equivalent) may be substituted with prior approval.

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

5. Concentrations: The concentration is the focal point of the Ph.D. program. Students are expected to master the literature and research techniques in the concentration area and to do quality research as evidenced by the preparation of an acceptable dissertation. A minimum of 12 semester hours of coursework is required, including at least 9 hours of doctoral seminars. Graduate work taken in the concentration at other institutions is considered by the temporary doctoral advisory committee in approving the specific coursework required. Available concentrations are: accounting, finance, management (operations management and strategic management), marketing, and logistics/transportation. See the appropriate fields of instruction for specific course requirements.

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

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

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

Doctoral Committee

A doctoral student is advised to give serious attention early in the program to the composition of his/her doctoral committee. In accordance with Graduate School policy, the student and the major professor identify a doctoral committee composed of at least four faculty members; three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. When the doctoral committee has been formed, the temporary doctoral advisory committee ceases to exist.

Admission to Candidacy

Students may apply for admission to candidacy for the Ph.D. after maintaining at least a "B" average in coursework, successful completion of comprehensive examinations, and acceptance of a research proposal for the dissertation by the student's doctoral committee. Admission to candidacy must be approved at least one full semester prior to the date the degree is conferred. (Admission in the fall permits graduation in the following spring semester.)

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

Dissertation

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

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

GRADUATE COURSES

504 Core I (15) Development of roles and responsibilities of business manager. Functional fundamentals (accounting, finance, marketing, operations, human resource management) through year-long case in which knowledge is applied to solution of simulated real-world experience. Continuous systems improvement and delivery of customer value: role of firm in society (with attention to stakeholder value, ethics, and the ethical and legal environment of firm). Personal leadership skills: teambuilding, written and oral communication, and assessment of students' leadership abilities. Prereq: Admission to MBA program or consent of Director of Graduate Business Programs.

505 Core II (15) Continuation of 504. Functional fundamentals through year-long case. Case-study work on organizational reality, global competition, managing technology, ethics and social responsibility, and strategic planning. Capstone integrated business simulation. Prereq: 504 or consent of Director of Graduate Business Programs.

506 Information Engineering and Management (3) Design and management of information necessary to accomplish organizational objectives using activity blueprints, entity-relationship diagrams, data baseline design principles, views and diagram, ICADE (Computer-Aided Software Engineering) tools.

510 Management of Responsive Service Organizations (3) Management of organizations which respond to customer requests rather than to produce inventory: non-product economics, relationship building and management methods built on enabling, empowering, monitoring and mentoring employees as they diagnose and respond to individual customer needs.

551 Executive Core I (12) Integrated semester course: two 11-day periods in residence with substantial reading, study and analyses during off-site periods. Integration of major business functions through strategic perspective, application of functional knowledge to technical and strategic issues. Role of firm in society as it treats economic/legal environment and develops purpose of the firm as delivering value to customers and other stakeholders.


553 Executive Core III (12) Continuation of 552. One 11-day period and one 2-week period of residence at international site. Reading and study, analyses and applications within sponsoring organization. Role of firm in environment: global economic, legal and cultural issues. Strategic management/strategic deployment topics and organizational culture, design and change management for global competition. National and international current issues. Prereq: 552. Coreq: 553.

561 Management Project I (3) Company project. Preliminary investigation of significant strategic issue (new initiative, program, or significant organizational change) to enhance organizational effectiveness in sponsoring organization. Work within firm under guidance of faculty to develop proposal which defines issue and scope of project. Proposal to be approved by company and faculty. Prereq: Admission to executive program of MBA and cooperation of sponsoring organization. Coreq: 551.


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

Chemical Engineering

(Major of Engineering

(College of Engineering)

MAJOR

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

John W. Prados, Head

Professors:

Bogue, Donald C., Ph., D......................... Delaware

Byers, Charles H. (Adjunct), Ph.D........... California

Clark, Edward S., Ph.D.......................... California

Counce, Robert M., Ph.D....................... Tennessee

Crawford, Lloyd W. (UTSI), Ph.D........... Cincinnati

Culberson, Oran L. (Emeritus), Ph.D..... Texas

Donaldson, Terry L. (Adjunct), Ph.D............ Pennsylvania

Dos, James W. (Adjunct), Ph.D.............. Tennessee

Fellers, John F., Ph.D............................ Akron

Frazier, George C., Jr. (Condra Prof.)

Perona, Joseph J., Ph.D......................... Johns Hopkins

Hansen, Marion G., Ph.D....................... Wisconsin

Holmes, John M. (Emeritus), Ph.D........... Tennessee

Moore, Charles F., Ph.D......................... Louisiana State

Parish, Trueman (Adjunct), Ph.D.............. Rice

Perona, Joseph J., PE, Ph.D............... Northwestern

Prados, John W. (University Prof.) (Liaison),

Ph.D., PE, Ph.D................................ Tennessee

Scott, Charles D. (Adjunct), Ph.D........... Tennessee

Thomas, Carl O., Ph.D.......................... Tennessee

Watson, Jack S., Ph.D............................ Tennessee

Associate Professors:

Basarar, Osman A. (Adjunct), Ph.D........ Minnesota

Bienkowski, Paul R., Ph.D..................... Purdue

Bruns, Duane D., Ph.D.......................... Houston

Cochran, Henry D. (Adjunct), Ph.D........... MIT

Davison, Brian H. (Adjunct), Ph.D......... Cal Tech

Downs, James E. (Adjunct), Ph.D............ Tennessee

Folsom, Tommy J. (Adjunct), Ph.D........... Wisconsin

Scott, Timothy C. (Adjunct), Ph.D........... Wisconsin

Sheth, A. (CUTSI), Ph.D....................... Northwestern

Vogel, Ernest F. (Adjunct), Ph.D........... Texas

Webber, Frederick E., Ph.D................... Minnesota

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

THE MASTER'S PROGRAM

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

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

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

4. A final oral examination covering the thesis, related fields and graduate coursework. **Non-Thesis Option**: Under certain conditions, a candidate may apply for a non-thesis program. To be eligible, a candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience or research publications would be examples of such evidence. The departmental faculty will consider each application individually. Upon acceptance, the requirements for completion of the non-thesis option are as follows:

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

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

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

**THE DOCTORAL PROGRAM**

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

Department requirements consist of the satisfactory completion of:

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

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

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

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

**GRADUATE COURSES**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>401</td>
<td>Chemical Engineering Data Analysis</td>
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<td>403</td>
<td>Introduction to Optimization</td>
<td>3</td>
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<td>415</td>
<td>Computer Applications in Chemical Engineering</td>
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<td>425</td>
<td>Introduction to Chemical Process Economics</td>
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<td>440</td>
<td>Transport Phenomena</td>
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<td>480</td>
<td>Equipment Design and Economic Methods</td>
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<td>485</td>
<td>Hydrocarbon Processing</td>
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<td>Thesis (1-15)</td>
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<td>Graduate Seminar</td>
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<td>502</td>
<td>Registration for Use of Facilities</td>
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<td>505</td>
<td>Approximate Methods in Chemical Engineering</td>
<td>3</td>
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<td>507</td>
<td>Application of Numeric Linear Algebra</td>
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<td>531</td>
<td>Advanced Chemical Engineering Thermodynamics</td>
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<td>532</td>
<td>Statistical Mechanics</td>
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<td>541</td>
<td>Fluid Mechanics and Polymer Processing</td>
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<td>542</td>
<td>Diffusive and Stagewise Mass Transfer Operations</td>
<td>3</td>
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<td>551</td>
<td>Chemical Reactor Analysis</td>
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<td>Process Modeling and Simulation (3)</td>
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<td>561</td>
<td>Process Modelling and Simulation</td>
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<td>575</td>
<td>Applied Microbiology and Bioengineering</td>
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<td>581</td>
<td>Industrial Pollution Prevention</td>
<td>3</td>
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<td>585</td>
<td>Process System Reliability and Safety</td>
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<tr>
<td>588</td>
<td>Measurement Science</td>
<td>3</td>
</tr>
<tr>
<td>631</td>
<td>Advanced Topics in Statistical Thermodynamics and Molecular Dynamics</td>
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<tr>
<td>641</td>
<td>Advanced Diffusional Operations</td>
<td>3</td>
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<td>642</td>
<td>Advanced Topics in Polymer Processing</td>
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<tr>
<td>651</td>
<td>Advanced Reactor Analysis</td>
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<tr>
<td>651</td>
<td>Advanced Topics in Process Dynamics and Control</td>
<td>3</td>
</tr>
<tr>
<td>675</td>
<td>Microbial Systems Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

**Lectures, Class Notes, and Presentations**

- **Chemical Engineering 555**: Process Modeling and Simulation. Model development from basic principles. Model development from plant test. Use of models in operation, optimization and control. Prereq: Consent of Instructor.
- **Chemical Engineering 575**: Applied Microbiology and Bioengineering. Cross-disciplinary course combining basic concepts in microbiology, biochemistry, reaction kinetics, and biochemical and environmental engineering. Commercial processes, biodegradations/wastewater treatment, analysis of basic bioreactor systems, biosensors, and immobilization methods. Fundamental laboratory techniques during 6-week laboratory period. (Same as Environmental Engineering 575, Agricultural Engineering 575 and Microbiology 575.)

**Principles of Chemical Separations**

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

**Modeling and Design of Bioreactor Systems**

Discussion of different classes of models: structured, unstructured, discrete and continuous. Parameter estimation and model discrimination. Methods for measurement of model parameters, indirect component balancing and direct component balancing; model selection; Herbert's model- steady state analysis; dynamics, lag function experiments. Design and operation of fed-batch, batch and continuous commercial bioreactors. Important design considerations: analytic methods and bio-reactors, oxygen and heat transfer, growth parameters, gene transfer and sterilization. Advanced bioreactor concepts — emphasis on continuous operation. Coupled systems with immobilized biocatalyst. Fundamental understanding of bioreactor kinetics and system dynamics; process control and optimization. Prereq: 575.

**Technical Review and Assessment**


**Industrial Pollution Prevention**

Principles and practical aspects of industrial wastewater minimization. Regulatory environment, waste minimization strategies, economic analysis, process safety, case study: analysis of alternative waste minimization/management technologies. Prereq: Graduate standing in engineering or consent of instructor.

**Process System Reliability and Safety**

Same as Nuclear Engineering 585.

**Measurement Science I (3)**

(Same as Nuclear Engineering 588, Aviation Systems 588, Civil Engineering 588, Mechanical and Chemical Engineering 588, Engineering Science and Mechanics 588, Mechanical Engineering 588 and Aerospace Engineering 588.)

**Special Topics in Chemical Engineering**

May be repeated. Maximum 6 hrs.

**Doctoral Research and Dissertation (3-15)**

Maximum 6 hrs.
one-half year of inorganic chemistry is also recommended. Students lacking any of these prerequisites may be admitted with appropriate deficiencies that must be removed without graduate credit. Applicants are required to take the general Graduate Record Examination.

Students minoring in Chemistry are required to present as a prerequisite two years of chemistry including quantitative analysis.

THE MASTER'S PROGRAM

The department offers concentrations in six areas for the M.S.: analytical chemistry, environmental chemistry, inorganic chemistry, organic chemistry, polymer chemistry, and physical chemistry.

The requirements for the M.S. in Chemistry consist of the satisfactory completion of:

1. Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 500.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
3. Prescribed remedial courses based on performance on entrance examinations.
4. A written examination on the general Graduate Record Examination.
5. A final oral examination.

THE DOCTORAL PROGRAM

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

The requirements for the Ph.D. in Chemistry consist of the satisfactory completion of:

1. Research and a dissertation to give at least 60 hours of graduate credit in Chemistry 600. Registration for Use of Facilities (3-15) is required for resident graduate students. S/NC only.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.
3. Prescribed remedial courses based on performance on entrance examinations.
4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Eighteen additional hours in courses at the 500 level or above, including the presentation of at least one oral examination.
6. A final oral examination.

THE REQUIREMENTS FOR THE M.S. IN CHEMISTRY

The requirements for the M.S. in Chemistry include:

1. Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 500.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
3. Prescribed remedial courses based on performance on entrance examinations.
4. A written examination on the general Graduate Record Examination.
5. A final oral examination.

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2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.
3. Prescribed remedial courses based on performance on entrance examinations.
4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Eighteen additional hours in courses at the 500 level or above, including the presentation of at least one oral examination.
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4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Eighteen additional hours in courses at the 500 level or above, including the presentation of at least one oral examination.
6. A final oral examination.
nation, organometallic, biinorganic compounds, Pre-
req: 530. Sp

532 Experimental Methods of Inorganic Chemistry (3) Electronic, infrared, Raman, microwave, NMR, ESR, nuclear quadrupole, Mossbauer, mass, and photoelec-
tron spectroscopies for characterization of inorganic compounds. Prereq: 530. F

540 Nuclear and Radiochemistry (3) Nuclear proper-
ties, radioactivity, radiotiochemical processes, nuclear reactions and matter, radiation detection. Prereq: 1 yr of physical chemistry.

550 Structure and Reactivity In Organic Chemistry (3) Structure and bonding in organic compounds; mol-
ecular orbit theory, stereochemistry, conformational analysis, and molecular mechanics; substituent effects on acidity and reactivity; introduction to reaction mechan-
isms. Prereq: 360. F


552 Organic Reaction Mechanisms (3) Techniques and principles in study of organic reaction mechanisms; applications and interpretations in polar, radical, and pericyclic reactions; reactive intermediates. Prereq: 550. Sp

553 Spectroscopic Characterization of Organic Com-
ounds (2) Organic structure elucidation using spectro-
scopic methods: nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry. Prereq: 360 or equival-
ent. F

554 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS and multinuclear FT NMR spectrometers. Devel-
opment of problem-solving ability in area of spectro-
scopic characterization of organic molecules. Prereq: 360 or equivalent. Coreq: 553. F

570 Quantum Chemistry and Spectroscopy (3) Basic principles of quantum mechanics and their applications to molecular theory, molecular structure, and spectroscopy; introduction to group theory. Prereq: 1 yr of physical chemistry. F

571 Advanced Quantum Chemistry and Spectro-
scopy (3) Prereq: 570 or consent of instructor. Sp

572 Thermodynamics and Statistical Mechanics (3) Macroscopic and microscopic description of equilibrium systems. Basic principles of thermodynamics and statis-
tical mechanics, and application to selected chemical systems. Prereq: 1 yr of physical chemistry. F

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

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

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

584 Organic Chemistry of Polymers (3) Synthesis of monomer mechanisms, stereochemistry, sequence di-
tribution, and kinetics of polymerizations. Formation of block, graft, and network polymers. Reactions on poly-
mers. Prereq: 550 or equivalent. Sp

595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solution and bulk properties, rubber elasticity, kinetics of polymerization, polymer thermody-
namics. Prereq: 550 or equivalent. Sp

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

601 Chemistry Research Proposal (2) Preparation and oral defense of original written research proposal based on thorough survey of chemical literature. Prereq: Consent of head. 5/NC only. E

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

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

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 5501-52 or consent of instructor. May be repeated. Maximum 12 hrs.

651 Orbital Symmetry Control (3) Application of Woodward-Hoffmann rules and other theories to mecha-
nism and stereochemistry of organic pericyclic reac-

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

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

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Child and Family Studies
(College of Human Ecology)

MAJORS

DEGREES

Child and Family Studies
M.S. Human Ecology
Ph.D.

Associate Professors:

Allen, J., Ph.D. Purdue
Buehler, C., Ph.D. Minnesota
McInnis, Jackie H., Ph.D. Florida State
Cunningham, Jo Lynn, Ph.D. ..... Michigan State
Moran, James D., Ph.D. ......, Oklahoma State
Nordquist, V. Mick, Ph.D. Tennessee
White, Priscilla, Ed.D. Tennessee

Associate Professors:

Catron, C., Ed.D. Vanderbilt
Mallia, Jullia, Ph.D. Iowa State
Smith, Delores, Ph.D. Oklahoma State

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

Because the doctoral degree is a research degree, students at this level receive substantial preparation in statistics and research methodology. Interested students should contact the department head.

ADMISSION REQUIREMENTS

A completed file for review includes a College of Human Ecology application, Graduate Record Examination (GRE) scores for the general section, and completion of three

Graduate School Rating Forms by individuals who can attest to the potential for graduate education. Forms may be obtained from the department or Dean's Office, College of Human Ecology.

Admission to the program is contingent upon faculty evaluation of GRE scores, under/graduate/gpa, rating forms, and work experience. Prerequisites for admission to the Master's or doctoral program are 9 semester hours of either upper division undergraduate or graduate social science.

THE MASTER'S PROGRAM

An individual program of study may be designed by the student in cooperation with his or her major professor and committee. The program provides for a concentration in either child development or family studies. Specializations in the child development concentration consist of early childhood education, early childhood special education, early childhood administration, and child development. Specializations in the family studies concentration consist of family life intervention and family science. Thesis and non-thesis options are available in both concentrations. Students should also consider an interdisciplinary minor in geology to provide a life span perspective to human development or family studies.

All students in the child development concentration must enroll in CFS 510, 533, and 571. At least 6 hours in a cognate area outside the department must be completed. Thesis students are required to take the following: 3 hours of 500-level research methods, 3 hours of 500-level statistics, 6 hours of CFS courses in the area of concentration, 6 hours of thesis credit and an oral comprehensive examination. Non-thesis students are required to take the following: 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 564, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

Students in the family studies concentration must enroll in CFS 580, 591, and 540 or 560. At least 6 hours in a cognate area outside the department are required. Thesis students are required to take the following: 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 564, 565; 9 hours of CFS courses in the area of concentration, 6 hours of thesis credit and an oral comprehensive examination. Non-thesis students are required to take the following: 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 564, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

Students in the child development/early childhood licensure must enroll in College of Education courses: 574, 575, 591, and C&I 505. Thesis students are required to take the following: 3 hours of 500-level statistics, CFS 510, 512, 570, 571; 3 hours from CFS 580, 591, 540, 590; 6 hours of thesis credit and an oral comprehensive examination. Non-thesis students are required to take the following: 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 564, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

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

THE PH.D. CONCENTRATION

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

Requirements include:
1. Minimum 10 credits in child and family studies required foundation courses: 510, 550, 570, 571;
2. Minimum 12 credits in 500- and 600-level courses in child development or family studies, with at least 3 credits in 600-level courses (in addition to the required courses described in #1);
3. Minimum 6 credits in a cognate area;
4. Minimum 9 credits in graduate-level social statistics; at least 3 of these credits in a more specialized area than a sequence of survey courses;
5. Minimum 3 credits of specialized research methods;
6. Pre-doctoral research project approved by student's committee;
7. College Professional Seminar, Human Ecology 610;
8. Minimum 8 credits of electives;

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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

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

510 Survey of Theory and Research in Child Development (3) Theoretical models and research literature in child development (conception through adolescence); application to research intervention and education. Prereq: 9 hrs. of either upper division undergraduate or graduate social science or consent of instructor. P

512 Survey of Research in Early Childhood Education (3) Current literature and issues in early childhood education. Prereq: 510 or equivalent or consent of instructor. Sp


521 Organizations I Management in Early Childhood Education (3) Designing, implementing, and evaluating physical and human resources in educational environments. Development of skills in environmental organization, interpersonal leadership, and supervision of staff. Prereq: 512 or equivalent or consent of instructor.

522 Naturalistic Interventions for Parents and Teachers of Young Children (3) Common problems faced by parents and teachers; methods available to modify problem behavior. Prereq: 510 or equivalent or consent of instructor. F

530 Families of Handicapped Children (3) Developmental nature of families' experiences in caring for handicapped children, especially during infancy and early childhood. Prereq: 510 or consent of instructor.

540 Parent-Child Relations (3) Influence of parents on children, influence of children on parents, reciprocal interaction between parents and children, applications of systems models, child abuse, and impact of divorce on children. Prereq: 500 or equivalent or consent of instructor. F

550 Survey of Theory & Research in Family Studies (3) Research issues and literature in family studies; use of family conceptual frameworks, development of theoretical concepts and application to research and family life programs. F

552 Family in Contemporary Social Thought (3) Alternative conceptualizations of family in current social thought. Variations of family construction by race, gender, and social class. Sp,A

560 Marital Dyad (3) Communication, power, sexuality, marital stability, satisfaction. Prereq: 550 or equivalent or consent of instructor. F


563 Family Life Education Programs (3) Planning, implementing and evaluating programs in marital, parent-child, and family relationships, and parenthood education. Prereq: Consent of instructor. (Same as Home Economics 563.) F

564 Practicum in Human Development or Family Studies (3) School and community programs. Education for human development and family living. Prereq: Consent of instructor. S/N only. E

565 Practicum in Human Development or Family Studies II (3) School and community programs concerned with education for human development and family living. Prereq: Consented to and supervised within project. Prereq: 564 and consent of instructor. S/N only. E

566 Approaches to Family Intervention and Counseling (3) Various theoretical approaches for family intervention and counseling. Structural, systemic, experiential and social learning schools of practice. Effects of intervention from perspective of their impact on family functioning and communication. Prereq: Graduate Educational and Counseling Psychology 566.) Sp


571 Research Seminar (1) Presentation and critique of research projects. Prereq: Departmental major or consent of instructor. May be repeated. S/N only. E

574 Analysis of Teaching for Professional Development (2) (Same as Education 574.)

575 Professional Internship in Teaching (1-8) (Same as Education 575.)

580 Special Topics in Human Development or Family Studies (1-3) Research, theses, and projects in current issues in child development or family studies; divorce, handicapped children, symbolic interaction, work and family, Piaget, mainstreaming children, theory and research in human sexuality, cognition. Prereq: 5 graduate hrs in major, or consent of instructor. May be repeated with different topics. Maximum 9 hrs. E

581 Directed Study in Human Development or Family Studies (1-3) Individual learning experiences in specific topics in child development or family education or family studies. Prereq: 6 graduate hrs or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E

590 Assessment of Development and Learning in Young Children (1-3) Theory, empirical research and practices related to measurement of development and learning in young children. F,A

591 Clinical Studies (4) (Same as Education 591.)

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

610 Advanced Special Topics in Human Development or Family Studies (1-3) Study of research and theory related to current issues. Prereq: 12 graduate hrs in major or consent of instructor. May be repeated with different topics. Maximum 6 hrs. E

620 Advanced Directed Study in Human Development or Family Studies (1-3) Advanced, in-depth individualized learning experiences in specific topics in child development, early childhood education, or family studies. May be repeated with different topics. Maximum 6 hrs. E

630 Advanced Developmental Processes (3) Sociocultural, cognitive, and language development during infancy and childhood. Normative and nonnormative development. Prereq: 510 or equivalent or consent of instructor. S/N only. E

631 Adolescent Development in Families (3) Nonnormative and normative adolescent development: physical, cognitive, moral, social, familial, sexual, and personality development. Prereq: 510 or equivalent or consent of instructor. F,A

632 Advanced Study in Family Interaction (3) Human communication and conflict management within the family context. Theoretical perspectives for familial processes, adjustment, decision making, and coping. Prereq: 550 or equivalent or consent of instructor. Sp,A

633 Survey Design and Analysis (3) Analysis of methods and measures used in family science research. Prereq: 550, 571, 3 hrs graduate statistics, or consent of instructor. S/N only. Sp,A

Civil and Environmental Engineering

(College of Engineering)

MAJORS

Civil Engineering ........................................... M.S., Ph.D

Environmental Engineering .......................... M.S.

(Ph.D. through Civil Engineering)

Gregory D. Reed, Head

Professors:

Burkette, E. G. (Fred N. Peebles Prof.), Ph.D ........................................... Illinois

Chatterjee, A., Ph.D ........................................... North Carolina State

Davis, W. T., Ph.D ........................................... Tennessee

Ghosh, M. (Goodrich Chair of Excellence), Ph.D ........................................... Illinois

Goodpasture, D. W., Ph.D ........................................... Illinois

Greco, W. L., Ph.D ........................................... Michigan State

Hastington, K. W. (Emeritus), Ph.D ........................................... Northwestern

Humphreys, J., B. (Emeritus), Ph.D, Texas A&M
Miller, W. A. (Granger Prof.), Ph.D. .............. Georgia Tech
Reed, G. D. (Liaison), Ph.D. ...................... Arkansas
Robinson, R. B. (Fisher Prof.), Ph.D. ............ Iowa State
Sc.D. ........................................ New Mexico State
Tschacht, M. A. (Condra Prof.), M.S. ............. MIT
Walker, C. R. (Emeritus), M.S. ................. M.I.T.
Wegmann, F. J., Ph.D. ......................... Northwestern

Associate Professors:

Wegmann, F. J., Ph.D. ..................... Northwestern
Walker, C. R. (Emeritus), M.S. ............... M.I.T.
Tschantz, B. A. (Condra Prof.), offered to graduates of recognized under-
air quality, mixed waste management, and Science in Environmental Engineering with
engineering, geotechnical/materials engineering, in construction engineering, environmental
Master of Science and Doctor of Philosophy
Wright, J. M., M.S. ......................... Tennessee
Corum, J. M., Ph.D. ....................... Illinois
Nappo, C. J. (Adjunct), Ph.D. ............... Georgia Tech
Miller, T. L., Ph.D. ....................... Tennessee
Hansen, J. H., Ph.D. ......................... Missouri
Bennett, R. M., Ph.D. ....................... Illinois
Drumm, E. C., Ph.D. ......................... Arizona
Hansen, J. H., Ph.D. ......................... Missouri
Hyfants, G. J. (Adjunct), Ph.D. ............... Vanderbilt
Miller, T. L., Ph.D. ....................... Tennessee
Moore, A. B., M.S. ....................... Tennessee
Tiry, R. F. (Emeritus), B.S. ...................... Marquette

Assistant Professors:

Alavian, V. (Adjunct), Ph.D. ............... Wisconsin
Bennett, R. M., Ph.D. ....................... Illinois
Drumm, E. C., Ph.D. ......................... Arizona
Hansen, J. H., Ph.D. ......................... Missouri
Hyfants, G. J. (Adjunct), Ph.D. ............... Vanderbilt
Miller, T. L., Ph.D. ....................... Tennessee
Moore, A. B., M.S. ....................... Tennessee
Nappo, C. J. (Adjunct), Ph.D. ............... Georgia Tech
Richards, S. H., Ph.D. ......................... Tennessee
Smoot, J. L., Ph.D. ......................... VPI

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

The MASTER'S PROGRAM

The Master of Science programs in Civil Engineering and Environmental Engineering are offered to graduates of recognized undergraduate curricula.

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

Civil Engineering

The Department of Civil and Environmental Engineering offers two options for the Master of Science with a major in Civil Engineering. The thesis option is offered to students who have completed at least one-half of their coursework with a grade of B or better. The non-thesis option requires a written thesis or project that must be approved by the student's major professor.

THE DOCTORAL PROGRAM

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

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 24 semester hours must be in 600-level courses.
2. A minimum of 24 semester hours of advanced engineering design courses selected from a list provided by the student's committee.
3. Support courses in related scientific and engineering fields, amounting to approximately 24 semester hours, subject to approval by the student's faculty committee. These related fields will normally include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields.
4. A minimum of 9 semester hours of mathematics will be required beyond the civil engineering undergraduate requirements.
5. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.
6. Upon completion of at least one-half of all coursework, each student must pass a comprehensive examination.
7. After completion of the dissertation, each student must pass a comprehensive examination administered by a faculty committee.

ACADEMIC COMMON MARKET

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

Civil Engineering

GRADUATE COURSES

406 Legal and Ethical Aspects of Engineering (2)
421 Portland Cement and Asphalitic Concrete (3)
451 Highway Engineering (3)
472 Steel Design (3)
474 Reinforced Concrete Design (3)
485 Analysis of Framed Structures (3)
496 Principles of Geohydrology (3)
490 Water Resources Project Design (3)
494 Urban Drainage Engineering (3)
495 Water Resources Development and Management (3)

406 Legal and Ethical Aspects of Engineering (2) Legal principles underlying engineering work; laws of contracts, torts, real property; problems of professional registration and ethics. Prereq: Senior standing.
421 Portland Cement and Asphalitic Concrete (3) Aggregate properties and tests, tests of portland cement concrete, mix design methods for concrete and asphalt, concrete admixtures, tests of asphalt and asphalt mixes, and nondestructive testing. Prereq: 351, 2 hrs and 1 lab.
451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; application of various engineering principles and techniques to the process of planning, locating, and design of highway facilities; both geometric and pavement design. Prereq: 210, 251, 352.
472 Steel Design (3) Design of plate girders and com-posite beams; consideration of members subjected to combined stresses; design of typical framed building members. Prereq: Senior standing.
474 Reinforced Concrete Design (3) Reinforced concrete continuous beams and floor slabs, columns with combined axial loads and bending, footings and retaining walls. Prereq: 471.
485 Principles of Geohydrology (3) (Same as Geological Sciences 485.)
490 Water Resources Project Design (3) Coherent development of multipurpose reservoir and dam project, data acquisition, spillway and outlet works design, earth and gravity dam stability analyses, drains and filters, maintenance and operation principles, and dam safety concepts. Prereq: 350, 355.
494 Urban Drainage Engineering (3) Design and management of stormwater conveyance and control structures. Application of hydrologic and hydraulics principles to design of drainage systems for urban, strip mining, and highway development; design of inlet structures, ditches, culverts, and detention/retention basins; application of commonly-used computer runoff models; evaluation of land-use on streamflow quantity and quality. Prereq: 350, 355.
495 Water Resources Development and Management (3) Principles of water resources project development, planning and management. Institutional framework: water law, evaluation procedures for comparing and selecting among water resources development alternatives, multiobjective planning, principles of engineering economics, benefit-cost analysis, and cost allocation methods; environmental impact assessment procedures; decisions using risk-based methods; case studies. Prereq: Senior standing.
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 upon conclusion of faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Urban Systems: Engineering and Management (3) Various urban systems usually under the responsibility of city manager and/or city engineer: streets, lighting, water, sewerage, refuse collection. Personnel management, finance, and public relations. Prereq: 521; Graduate standing or consent of instructor.


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

531 Soil Stabilization (3) Mechanical stabilization of soils by compaction, drainage, and blending; chemical stabilization of soils by ion exchange, waterproofing and modifying soils and additives. Reinforced earth and stabilization with geosynthetics. Prereq: Introduction to Soil Behavior.


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

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

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

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

545 Rock Excavation (3) Characteristics of explosives and blasting into rock formations. Design of rock blasting, tunneling and trenching. Prereq: Construction Methods and Equipment.

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

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

553 Geometric Design and Layout of Roadways and Community Facilities (3) Functional and geometric design and rural and urban roads of all classes; subdivision layout; configuration of urban roads of all classes; techniques for access control; freeway interchanges and intersections; and parking. Prereq: 451 or consent of instructor.

554 Urban Transportation Planning (3) Transportation problems in urban area; systematic planning for identifying existing and future problems; travel surveys and demand models; evaluation of transportation facilities; evaluation of economic impact; computer programs; special topics: urban goods movement, transportation system management. Prereq: 552 or graduate standing.

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

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

557 Transportation Planning and Operations with Micro-Computer Applications (3) Transportation system management techniques and application of microcomputers to analysis of transportation actions. Prereq: 551 or 555.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationship between various transportation modes and between transportation and other functional development. Application of transportation planning tools to establish existing travel patterns, modeling of demand, proposing alternatives and evaluation. Prereq: Graduate standing. (Same as Planning 557.)


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

561 Statically Indeterminate Structures (3) Deflections of beams and trusses; force methods; moment distribution and other displacement methods; secondary stresses. Prereq: 351.

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

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

566 Structural Reliability (3) Application of probability theory and statistics to evaluating reliability of structures; development of safety factors and probability based design codes. Prereq: Graduate standing or consent of instructor.

571 Behavior of Steel Structures (3) Behavior of steel structural members due to static and fatigue loading; relation between research results and current specifications for design. Prereq: 574.

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

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

574 Behavior of Reinforced Concrete Members (3) Moment-curvature and load-deflection relationships for reinforced concrete beams; combined bending and axial load; shear and torsion; relation between research results and specifications for design. Prereq: 471.

575 Repair and Retrofitting of Structures (3) Techniques, methods, and materials for repair and retrofitting of deteriorated or overstrengthened structures, foundation underpinning, retrofitting of steel fatigue failures. Prereq: 472.

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

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

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

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

600 Doctoral Research and Dissertation (3-15) Prerequisite: 500.

637 Numerical Models for Geologic Materials (3) Numerical models to represent the stress-strain volumetric relationships for soils, rock, and concrete; nonlinear elastic models; classical plasticity models; critical state and caved plasticity models; multiple surface models; determination of parameters from laboratory tests; numerical implementation. Prereq: 520 and Engineering Science and Mechanics 539.

639 Soil Dynamics (3) Behavior of soils and soil-structure systems under time dependent loading; wave propagation in elastic media; principles of seismic reflection techniques; effects of earthquakes and vibrating machines on soils and foundations; dynamic and cyclic soil testing for determination of soil properties. Prereq: 533, 555, and 556 or Engineering Science and Mechanics 431.

651 Analysis Techniques for Transportation Systems I (3) Analysis of trip generation, trip distribution, mode split and traffic assignment, employing mathematical, statistical, and computer science techniques. State of the art and new modeling techniques. Prereq: 554 or 558.

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

655 Urban Transportation Planning (3) Planning and design of urban road networks and transportation systems. Prereq: 651.

666 Advanced Structural Reliability (3) Monte Carlo methods; structural system reliability; random processes; dynamic loads on structures. Prereq: 561.

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

674 Behavior of Reinforced Concrete Beams and Slabs (3) Strength and behavior of statically indeterminate reinforced concrete beams and frames; limit analysis; behavior, analysis, and design of reinforced concrete structures; yield line theory; computer elements solutions, and ACI Code Method. Prereq: 574.

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

**Environmental Engineering**

**GRADUATE COURSES**

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

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

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

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

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

522 Floodplain and Urban Flood Management (3) Review of national, regional, and local flood problems; state of the art flood damage reduction alternatives: structural and nonstructural; Institutional and community responses; policies, programs, organizations, regulations, and legal aspects; floodplain hydrology and hydraulic; HEC-2: floodway encroachment, flood hazard zone and damage potential determinations; cast studies. Prereq: Civil Engineering 390 or consent of instructor for non-majors.

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


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

535 Ground Water Hydrology (3) Dynamics of flow and contaminant transport in porous media; hydrodynamics, dispersion, and convective transport; layered soils, unconfined flow, and groundwater contaminant transport phenomena. Analytical and numerical solution of flow and transport equations. Prereq: Hydraulics and Hydrology or Civil Engineering 485 for geology majors. (Same as Geological Sciences 535.)

540 Remote Sensing for Transportation and Facilities Siting (3) Principles of remote sensing; sources of data and data acquisition systems; photo interpretation, analog and digital techniques for analysis of aerial and terrestrial photos, radar and thermal imagery with application to transportation and facilities planning, construction and operation. Prereq: Consent of instructor.

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

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

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

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

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

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

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

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

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

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

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

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

590 Special Problems in Environmental Engineering (1-6) May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

595 Special Topics (1-6) May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

596 Special Readings (1-4) Readings related to current developments in field. May be repeated. Maximum 9 hrs.

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

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

651 Industrial Waste Unit Operations and Processes (3) Theoretical design and laboratory modeling of industrial waste treatment processes and operations. Prereq: 551, 553. Prereq or coreq: 552. 2 hrs and 1 lab.


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

691 Special Topics in Environmental Engineering (3) Selected advanced problems of current interest. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

141 Cicero and Techniques of Latin Prose Composition (3) For advanced students in Latin, practice in prose composition, writings of Cicero the model. Prereq: 351-352 or consent of instructor. Sp

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

431-432 Selected Readings from Latin Literature (3,3) For advanced students in Latin, oracle, historical writings, poetry of ancient Rome in original Latin. Prereq: 351-352 or consent of instructor. Sp

220 Air Quality Standards and Regulations (3) In-depth study of national, regional, and state regulations. Prereq: Senior standing.

221 Advanced Air Quality Standards and Regulations (3) In-depth study of national, regional, and state regulations. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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

532 Selected Readings in Latin Literature (3,3) For advanced students in Latin, oracle, historical writings, poetry of ancient Rome in original Latin. Prereq: 351-352 or consent of instructor. Sp

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

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

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

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

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

541-42 The Latin Epic: Lucrertius, Vergil (3,3) Advanced study of epic masterpieces of Lucrertius and Vergil; both Georgics and Aeneid of Vergil.

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

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

(College of Communications)

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

DEGREES

Professors:
Ashdown, Paul G., Ph.D................. Bowling Green
Crook, James A., Ph.D................. Iowa State
Everett, George A., Ph.D................. Iowa
Howard, Herbert H. (Liaison), Ph.D.... Ohio
Littmann, Mark, Ph.D................. Northwestern
Miller, Mark, Ph.D................. Michigan State
Singletary, Michael W., Ph.D........ Southern Illinois
Swan, Norman R., Ph.D................. Missouri
Taylor, Ronald E., Ph.D................. Illinois

Associate Professors:
Buchman, Joseph, Ph.D................. Indiana
Hoy, Maria, Ph.D................. Oklahoma State
Lucarelli, Susan M., Ph.D................. Tennessee

ACADEMIC COMMON MARKET

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

ACADEMIC STANDARDS

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

THE MASTER'S PROGRAM

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

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

Degree Requirements

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

1. Ten hours of core courses—Communications 510, 512, 540, and 550, the first three of which must be taken during the first two semesters of the student's program, except with written approval of the Assistant Dean for Graduate Studies for the College.

2. Twelve hours within one department of the college, at least 6 hours at the 500 level or above. An internship, if needed, is included.

3. Three hours for the thesis option and 9 hours for the non-thesis option of electives from a list provided by the department in area of concentration.

4. Six hours of thesis work (Communications 500), including a thesis seminar, or a 3-hour project (Communications 590).

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

A student's internship experience requires approval by his/her advisor. Credit will be given through Advertising 598, Broadcasting 598, or Journalism 598 on the basis of 3 hours of credit for the equivalent of 13 weeks of full-time professional experience. This credit is to be included in the hour requirements for the M.S. program. Previous professional experience will be evaluated by the student's committee.

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

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

THE DOCTORAL PROGRAM

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

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

The Master's degree is not required for entry into or completion of the doctoral program.

Program planning, however, will permit the Master's degree to be earned if desired. Students lacking academic or professional experience in communications will be required to take prerequisite courses. In general, however, the program may be completed within three academic years of full-time study beyond the Bachelor's degree. Those holding Master's degrees should anticipate two or more years of full-time study for completion of the Ph.D.

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

1. A 3.0 (4.0 system) grade-point average in undergraduate studies, or 3.5 for graduate work if applicant holds a Master's degree;

2. Above the fifth percentile in verbal and quantitative aptitude on the Graduate Record Examination;

3. Endorsement by at least three former teachers or professional colleagues; and

4. A statement of the applicant's goals and reasons for pursuing the doctorate. Personal interviews with members of the Ph.D. Admissions Committee are recommended and may be required. Professional experience in some field
of communications is a highly desirable criterion for admission. A minimum of 88 hours of approved graduate work is required for the Ph.D.

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

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

Admission to candidacy must be attained at least two semesters prior to graduation and requires successful completion of a written comprehensive examination.

Each doctoral student's progress will be reviewed annually by the Doctoral Committee of the College of Communications. Results will be reported to the student by his/her program advisor, who will convey the committee's recommendation concerning the student's remaining in the program (non-binding) and suggestions for improvement in performance.

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

Plan course offerings in the College of Communications for a full calendar year are published the preceding November. This information is available from the Dean's Office, 302 Communications Building, 974-3031. See also courses listed under Advertising, Broadcasting, and Journalism.

GRADUATE COURSES

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

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

502 Registration for Use of Facilities (3) Required for the student not otherwise registered during a 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. F

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

560 Seminar in Communications Management (3) Organizational structure and functions of communications corporations; development of objectives, strategies, and tactics. Analysis of financial statements and case studies. Computer-intensive.

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

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

597 Independent Study (3) Reading, research or projects on special topics in communication. On individual basis, under faculty supervision. Consent may be repeated. Maximum 6 hrs. E

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

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

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

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

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

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

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

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

642 Qualitative Research (3) Theory and application of qualitative research methods to social science and communications research. Theoretical considerations underlying symbolic interactionism as translated into research strategies of participant observation, life history, interviewing, archival analysis, case studies. Prereq: 612 or consent of instructor. Su

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

692 Advanced Topics in Communications Theory and Methodology (3) Advanced study of communication issues, theories and methods. May use qualitative, historical, or scientific research methods. May be repeated. Prereq: 622, 632, 642 or 652 or consent of instructor. Sp

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

696 Seminar in Mass Communications Management (3) Organizational structure and functions of communications corporations; development of objectives, strategies, and tactics. Analysis of financial statements and case studies. Computer-intensive.

697 Independent Study (3) Reading, research or projects on special topics in communication. On individual basis, under faculty supervision. Consent may be repeated. Maximum 6 hrs. E

698 Seminar in Specialized Areas (1-6) P/NP only. E

699 Seminar in Specialized Areas (3) P/NP only. E

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

Comparative and Experimental Medicine

Office of the Vice Chancellor for Academic Affairs

MAJOR

DEGREES

Comparative and Experimental Medicine................. M.S., Ph.D.

L. N. D. Pottgieter, Director

Joint Graduate Coordinating Committee:

Fuhr, J. E., Ph.D., Medical Biology
Lawler, J. E., Ph.D., Psychology
Lozzio, C. M., Medical Biology
Pottgieter, L. N. D. (Liaison), Ph.D., Veterinary Teaching Hospital
Sims, M. H., Ph.D., Veterinary Teaching Hospital

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

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

ADMISSION REQUIREMENTS

General Requirements

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

Requirements for Admission to the Master of Science Degree Program

Applicants must have a baccalaureate degree with coursework in chemistry through organic, mathematics through calculus, physics, and basic biology. More advanced study in
biology such as biochemistry, mammalian anatomy, histology, cell biology, or other appropriate biomedical courses from an accredited university is recommended.

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

Requirements for Admission to the Doctor of Philosophy Program

Applicants generally will be expected to have a Master's degree in one of the biological sciences or a professional degree in one of the medical sciences, (e.g., M.D., D.D.S., D.V.M.). An individual having a baccalaureate degree with a strong background in the physical and biological sciences may be admitted upon presenting evidence of exemplary performance on the Graduate Record Examination.

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

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

ACADEMIC COMMON MARKET

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

### Computer Science

(College of Liberal Arts)

<table>
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<tr>
<th>MAJOR</th>
<th>DEGREES</th>
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<tbody>
<tr>
<td>Computer Science</td>
<td>M.S., Ph.D.</td>
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</table>

Jesse H. Poore, Head

Professors:

- Dongarra, Jack, Ph.D., New Mexico
- Gonzalez, R. (ECE), Ph.D., Florida
- Langston, Michael A., Ph.D., Texas A&M
- Poore, J. H., Ph.D., Georgia Tech
- Sherman, Gordon R. (Emeritus), Ph.D., Purdue
- Thomason, Michael G., Ph.D., Duke

Associate Professors:

- Case, Jeffrey D., Ph.D., Illinois
- Leuze, Michael R., Ph.D., Purdue
- MacLennan, Bruce J., Ph.D., Purdue
- Whitehead, Bruce (UTSS), Ph.D., Michigan

Assistants Professors:

- Beck, Michael, Ph.D., Cornell
- Berry, Michael W., Ph.D., Illinois
- Blair, Jean R. S., Ph.D., Pittsburgh

Booth, Heather D., Ph.D. Princeton
Gregor, Jens, Ph.D., Aalborg (Denmark)
Mehl, Dorothea (UTSS), Ph.D.
Florence, David, Ph.D.
Mitchler, David C., Ph.D.
Plank, James S., Ph.D.
Princeton
Plank, James S., Ph.D.
S. P. Duke University
Plank, James S., Ph.D.
Spanish, David W., Ph.D.
Texas A&M
Vander Zanden, Bradley, Ph.D., Cornell
Vose, Michael D., Ph.D.

**THE MASTER’S PROGRAM**

Two semesters of calculus plus two additional semesters of college mathematics (e.g., linear algebra, differential equations, probability) and a course in Discrete Structures and System Programming are required for admission. For the master's degree, 30 semester hours of graduate credit are required, 24 of which must be 500 level or above.

**Doctoral Research and Dissertation**

24 hours of graduate courses beyond the equivalent of a master's degree (i.e., beyond 30 graduate credit hours) graded A-F. Computer Science 530, 560 and 580 are required for the degree. At least six hours of 600-level graded courses must be taken in computer science at UT. The student's advisor and committee will establish the specific course requirements. The comprehensive examination consists of a departmental written examination and a subsequent oral examination conducted by the student's committee.

**GRADUATE COURSES**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>420</td>
<td>Advanced Topics in Machine Intelligence (3)</td>
</tr>
<tr>
<td>430</td>
<td>Advanced Topics in Hardware Systems (3)</td>
</tr>
<tr>
<td>460</td>
<td>Advanced Topics in Software Systems (3)</td>
</tr>
<tr>
<td>470</td>
<td>Advanced Topics in Scientific Computation (3)</td>
</tr>
<tr>
<td>471</td>
<td>Numerical Analysis (3)</td>
</tr>
<tr>
<td>472</td>
<td>Numerical Algebra (3)</td>
</tr>
<tr>
<td>480</td>
<td>Advanced Topics in Theoretical Computer Science (3)</td>
</tr>
</tbody>
</table>

**THE DOCTORAL PROGRAM**

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

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

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

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

Original research reported in a dissertation of high quality is emphasized. The minimum hour requirements are 24 hours of course 600 level.

538 Computer Networks (3) Design and operation of networks. Hardware and software systems; communications subsystems. Prereq: System Programming and 532.


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

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

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


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

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

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

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

576 Sparse Matrix Computations (3) Solution of large sparse linear systems; graph models, rounding techniques, symbolic factorizations, data structures, numerical algorithms, complexity analyses, parallel algorithms. Prereq: Numerical linear algebra.

580 Foundations (3) Finite automata and regular sets, push-down automata and context-free languages, Turing Machines, recursively enumerable sets, undecidability, Cook's theorem and NP-completeness. Prereq: Discrete Structures.

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

586 Computability and Computational Complexity (3) Computability by abstract devices, recursively enumerable sets, decidability, NP-completeness, polynomial-time hierarchy. Prereq: 580.

593 Independent Study (1-15) May be repeated.

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

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

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

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

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

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

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

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

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

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

Curriculum and Instruction

(College of Education)

MAJOR DEGREES

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

J. Estill Alexander, Head

Professors:

Alexander, J. Estill. (Liaison), Ed.D. ... Kentucky Allison, C. B., Ph.D. ... Oklahoma Bellon, Jerry J., Ed.D. ... California Blank, Kermit J., Ph.D. ... Ohio State

Burfest, William E., Ed.D. ... Texas Tech Christiansen, Mark A., Ph.D. ... Kansas Davis, A. R., Ph.D. ... Ohio State Dessart, Donald J., Ph.D. ... Maryland Doak, E. Dale, Ed.D. ... Colorado Frandsen, Henry, Ph.D. ... Illinois French, R. L., Ph.D. ... Ohio State

Hipple, Theodore W., Ph.D. ... Illinois Huff, P., Ph.D. ... Ohio State

Hull, H. N., Ed.S. ... Peabody Jost, Karl J., Ed.D. ... Oklahoma

Knight, Lester N., Ph.D. ... Texas Mallik, Anand, Ed.D. ... Columbia Mays, N. Ph.D. ... Southern Illinois McNulty, Lomnie D., Ed.D. ... Indiana Myer, M. E., Ph.D. ... Florida Ray, John R., Ed.D. ... Tennessee Roeseke, C. E., Ph.D. ... Ohio State

Rowell, C. Glennon, Ed.D. ... George Peabody Turner, T. N., Ed.D. ... Penn State

Wisniewski, Richard, Ed.D. ... Wayne State

Associate Professors:

Cagle, Lynn C., Ed.D. ... Georgia Chance, Charles A., Ph.D. ... Ohio State deMarrais, Kathleen, Ed.D. ... Cincinnati Grant, A. D., Ph.D. ... Wisconsin Hatch, J. Amos, Ph.D. ... Florida Hodge, R. L., Ph.D. ... Texas Ryan, Thomas K., Ed.D. ... Ball State Watkins, J. Paul, M.S. ... Tennessee

Wiley, Patricia D., Ed.D. ... Houston

Assistant Professors:

Bardon, Laura M., Ph.D. ... Maryland Hendricks, D. A., Ph.D. ... Alabama

Graduate programs are designed to improve scholarship and educational competence in a number of areas leading to the Master of Science, the Specialist in Education, the Doctor of Education, and the Doctor of Philosophy with a major in Education.

THE MASTER'S PROGRAM

The department offers two tracks for the Master's degree. Track 1 is for students who are already certified to teach in a curriculum and instruction discipline at the area level or those who are seeking a Master's degree without certification. Track 2 is for students seeking initial licensure. Thesis and non-thesis options are available for both tracks.

Track 1 - Concentrations are available in art education, curriculum and instruction, educational leadership, English education, foreign language education, instructional media and technology, mathematics education, reading education, science education, social foundations, and social science education. The non-thesis option requires the completion of 30 hours of coursework. The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500.

Specific requirements for the concentration in art education are: For the thesis option, Art Education 510, 520, and 593; 3 hours of 500-level elective courses in art history; 9 hours of 400- or 500-level elective courses in studio art; C & I 517, 520; 3 hours selected from C & I 511, 526, 542, 543, 544, 555, 558, 569, or 588 and 6 hours of Art Education 500. The non-thesis option requires Art Education 510, 520, 593 and 590; 3 hours of 500-level elective courses in art history; 6 hours of 400- or 500-level elective courses in studio art; C & I 517, 580; 3 hours selected from C & I 511, 526, 542, 543, 544, and 3 hours selected from 555, 558, 569 or 588.

The non-thesis option culminates in an exhibition of original works of art produced under the direction of a faculty specialist, accompanied by a written analytical and critical essay. This essay must include a philosophical statement, an explanation of process and media for each work presented, and a compositional analysis of each work.

Track 2 - Concentrations are available in art education, elementary teaching and in secondary teaching. For art education, the non-thesis requirements are Art Education 510, 520, 550, and 540; Education 574, 575, 591; C & I 517 and 3 hours selected from C & I 511, 526, 542, 543, 544, 555, 558, 569 or 588 for a total of 36 semester hours. For elementary or secondary teaching, the non-thesis requirements are Education 574 and 591, 6 hours; Internship, 12 hours; specialty methods, 6 hours; and 12 hours of electives as approved by the student's committee, for a total of 36 hours.

The thesis option for all concentrations requires 6 additional hours of Thesis 500 for a total of 42 hours.

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

THE SPECIALIST PROGRAM

The Educational Specialist degree program with a major in Curriculum and Instruction encompasses concentrations in the following areas: curriculum, elementary education, English education, foreign language education, instructional media and technology, mathematics education, reading education, science education, social science education, and social science education.
ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program (concentration in foreign language education only) in Curriculum and Instructor is available to residents of the state of Louisiana. The Ed.S. program (concentration in reading education only) in Curriculum and Instructor is available to residents of the state of South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

Art Education

GRADUATE COURSES

500 Thesis (1-15) P/NC only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
504 Studies and Theory in Language Development (3) Studies and theory of language development in children. Prereq: 1 elementary school language arts course or consent of instructor. F
505 Elementary and Middle School Teaching Methods (3) Content area teaching and development of students to apply methods. Prereq: 422. Coreq: 575. F
507 Teaching Poetry Grades 7-12 (3) Research and theory in application to teaching of poetry. Design of strategies and materials for teaching and reading of poetry. Review of texts and materials. F
508 Teaching Composition in the Secondary School (3) Teaching grammar, description, exposition, and argumentation; writing process and marking of student papers. Sp
509 Teaching Fiction in the Secondary School (3) Teaching novels and short stories. F
515 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC only. E
516 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC only. E
517 Seminar (1-3) Curriculum, instructional technology, elementary education, secondary education, or social foundations as related to goals of students' programs. May be repeated. Maximum 6 hrs. S/NC or letter grade. E
518 Educational Specialist Research and Thesis (2) May be repeated. Maximum 4 hrs. P/NC only. E
519 Educational Specialist Research and Thesis (2) P/NC only. E
520 Techniques of Research in Education (3) Study and application.
521 Teaching Social Studies in Elementary and Middle Schools (3) Planning and techniques. Trends in curriculum, development of concepts and generalizations, integration of social sciences. Prereq: Course in teaching of social studies or consent of instructor. Sp
522 Teaching Mathematics in Elementary and Middle Schools (3) Instructional strategies for helping elementary school children learn mathematics. Examination, development and use of materials for creating active learning environment. Prereq: 443 or equivalent or consent of instructor. F, Su
523 Diagnosis and Correction of Children's Difficulties in Learning Mathematics (3) Children's difficulties in learning mathematics and procedures for helping classroom teacher correct difficulties. Prereq: 522 or equivalent or consent of instructor. F, Su
525 Strategies, Programs and Materials for Teaching Elementary Social Studies (3) Analysis of new and innovative social studies program materials and techniques. Exploration of current trends in social studies education. Prereq: Previous course in teaching of social studies or consent of instructor. Sp
526 Philosophy of Education (3) Truth, knowledge, and valuation in relation to work of schools. F, Su
527 Elementary School Curriculum (3) Examination, evaluation and application of curriculum designs in ele-
mentary school. Trends and issues which affect elementary education. Prereq: Consent of instructor. F, Su

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

529 Practicum in Diagnosis and Remediation of Difficulties in Learning Mathematics (2) Assessment and practicum experience with children having difficulties in learning elementary school mathematics. Prereq: 523 or consent of instructor. May be repeated. Maximum 4 hrs. Su

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

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

532 Instructional Research: Analysis and Application (3) Analysis of research on instruction. Translation and application of research findings into instructional procedures. Prereq: Consent of instructor. F, Su

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

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

535 Curriculum Evaluation and Program Improvement (3) Historical background and importance of educational evaluation in relation to curriculum development. Understanding systematic curriculum evaluation approach and applying it to improve program development and implementation. Prereq: Consent of instructor. E, Su

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

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

538 Practicum in Diagnosis of Reading Problems (2) Theoretical and practical applications of specific reading diagnostic instruments; testing of elementary and/or secondary school students, preparing case study reports, and conducting parent conferences. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp

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

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

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

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

544 Survey in Contemporary Philosophies of Education (3) Existentialism, phenomenology, philosophical analysis, Marxism, structuralism, hermeneutics and other philosophies. Prereq: Consent of instructor. F

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

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

547 Topics in Philosophy of Education (3) May be repeated. F, Su

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

550 Assessment and Correction of Language Arts Disabilities (3) Developmental approaches to diagnosis and correcting language arts difficulties; analysis of children's work. Prereq: At least one language arts course or consent of instructor. Su

552 Developmental Reading Practicum (3) Diagnosing and correcting reading problems with emphasis on prescriptive reading needs. Prereq: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Su

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 schools. Sp, Su

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

560 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research proposals. Overview of qualitative research methods: ethnography, case study, historiography, biogra phy, oral history. Critical reading and evaluation of qualitative research studies. F, Su

561 Educational Statistics (3) Applications of descriptive and inferential statistics to educational and instructional problems. Use of electronic calculators in educational research. Prereq: Program prerequisites and consent of instructor. F

562 Direction and Supervision of Student Teaching (3) Roles and responsibilities of cooperating teachers and student teachers, policies and procedures of student teaching program; elements of clinical supervision; overview of research. F, Su

564 Curriculum for Early Childhood Education (K-3) (3) Theoretical foundations and current research in content and skill areas of curriculum for kindergarten-grade 3; application to local school setting. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. Sp, Su

565 Instructional Trends and Issues in Science Education (3) Analysis of current trends in science instruction, instructional materials, testing, evaluation, personnel needs, and community college science teachers, and application of learning theory to teaching biological, physical, and environmental sciences. Prereq: 496, 422, or equivalent. F

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

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

568 Teacher-Parent-Community Relations (3) Techniques for effective relations between parents and teachers; examination of roles and expectations; parental involvement; volunteer programs; influence of community on educational process. Prereq: Consent of instructor. Sp, Su

569 Advanced Production of Audiovisual Software (3) Hand and mechanical lettering, film picture mounting-laminating, overhead projection, audio production, TV studio orientation, sync-taping, multi-screen presentations, educational television and the like. (Same as Library and Information Science 569.) F, Sp

573 Utilization of Educational Television and Radio (3) Television and radio as instructional and training media. Selecting, making and evaluating instructional/training videos and audio materials. Prereq: Consent of instructor. F

577 Introduction To Data Processing in Curriculum and Instruction (3) Analysis of current activities in educational computing and data processing. Curriculum, instructional, research, and classroom management applications from microcomputers to super computers. Prereq: Consent of instructor. F, Su

578 Teaching English as a Second Language (3) Instructional methods. Utilization of assessment procedures to diagnose English linguistic proficiency; materials for non-native speaker in K-12 classroom. Required for Tennessee ESL (K-12) certification. Prereq: Consent of instructor.

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

581 Seminar in Mathematics Education (3) Current issues influencing instruction in mathematics in schools, elementary through college. Related teaching methodologies. Opportunities for work on special problems. Prereq: Undergraduate course in teaching of mathematics. F

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


584 Seminar in Early Childhood Education (3) Analysis of research and theory in early childhood education; educational process of young children. Prereq: Course in early childhood education. May be repeated. Maximum 6 hrs. Sp, Su


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


588 Instructional Theory and Design (3) Relationship of curriculum to instruction; examination of instructional and related learning theories; instructional models and teaching strategies. Prereq: 581. F, Sp

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

590 Seminar in Teaching English in Secondary School (1-3) Content varies. Theoretical and practical approaches to teaching English in secondary school. May be repeated. Su

592 Linguistics and the Teaching of English (3) Grammar, usage, semantics, dialectology, history of language, and lexicography. Su
635 Teacher Education in America (3) For students preparing to enter teacher education. Brief historical development, program analysis and evaluation, current issues, and future directions. F

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

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

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

652 Advanced Studies in Educational Anthropology and/or Sociology (3) Ethnographic methods applied to formal and non-formal educational settings. Analysis of selected research in field. Prereq: EC1; 2 courses in cultural anthropology, or consent of instructor. Sp


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


672 Interpretation and Application Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction, newer methodologies and strategies. Utilization of research to improve curriculum and instruction practice. Prereq: research in curriculum and instruction. Prereq: research in instructional media. Sp

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

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

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

685 Educational Leadership: Theory and Practice (3) Theories of leadership applied to various educational settings. Prereq: Consent of instructor. F

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

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


Ecology
(College of Liberal Arts)

MAJOR

DEGREES

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

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

Shared Faculty:
Adams, Marshall, Ph.D., ORNL
Amundsen, C. C., Ph.D., Botany
Blaylock, B. G., Ph.D., ORNL
Boeke, Christine R. B., Ph.D., Zoology
Buckner, E. R., Ph.D., Forestry, Wildlife & Fisheries
Bunting, Dewey L. (Liaison), Ph.D., Zoology
Burghardt, G. M., Ph.D., Psychology
Clebsch, E. E. C., Ph.D., Botany
Cooper, Lee, Ph.D., ORNL
Coutant, C. C., Ph.D., ORNL
D'Angelo, D. L., Ph.D., ORNL
Dearden, B. L., Ph.D., Forestry, Wildlife & Fisheries
Delcourt, Hazel, Ph.D., Geology
Delcourt, Paul A., Ph.D., Geology
Dimmick, Ralph W., Ph.D., Forestry, Wildlife & Fisheries
Drake, James A., Ph.D., Zoology
Eckert, Arthur C., Ph.D., Zoology
Emanuel, William, Ph.D., ORNL
Etnier, D. A., Ph.D., Zoology
Farkas, Walter, Ph.D., Environmental Practice
Fribourg, Henry A., Ph.D., Plant & Soil Science
Gardner, R. H., Ph.D., ORNL
Gehr, C. W., Ph.D., ORNL
Gist, C. S., Ph.D., ORNL
Gittelman, John L., Ph.D., Zoology
Goss, L. Barry, Ph.D., Scien. Appl.
Greenburg, Neil, Ph.D., Zoology
Gross, L. J., Ph.D., Mathematics
Hallam, Thomas G., Ph.D., Mathematics
Harden, Carol P., Ph.D., Geography
Herbes, S. E., Ph.D., ORNL
Hildebrand, S. G., Ph.D., ORNL
Hilty, J. W., Ph.D., Entomology & Plant Pathology
Horn, Sally P., Ph.D., Geography
Houston, M., Ph.D., ORNL
Kelly, J. M., Ph.D., TVA
Kimmel, B. L., Ph.D., ORNL
McCarthy, J. F., Ph.D., ORNL
McCracken, C. F., Ph.D., Zoology
McKinley, M. L., Ph.D., Geology
McLaughlin, S. B., Ph.D., ORNL
Multolland, P. J., Ph.D., ORNL
Nodvin, Stephen C., Ph.D., CPSU
Norby, Richard, Ph.D., ORNL
O'Neill, R. V., Ph.D., ORNL
Pagni, R., Ph.D., Chemistry
Parker, Charles, Ph.D., ORNL
Pelton, Michael R., Ph.D., Forestry, Wildlife & Fisheries
Pimm, S. L., Ph.D., Zoology
Pless, C. D., Ph.D., Entomology & Plant Pathology
Post, W., Ph.D., ORNL
Reed, R. M., Ph.D., ORNL
Rehder, J. B., Ph.D., Geography
Reichle, D. E., Ph.D., ORNL
Rennies, J. C., Ph.D., Forestry, Wildlife & Fisheries
Reynolds, John H., Ph.D., Plant & Soil Science
Riechert, Susan E., Ph.D., Zoology
Rose, K. A., Ph.D., ORNL
Sayler, Gary S., Ph.D., Microbiology
Scharbaum, S. E., Ph.D., Forestry, Wildlife & Fisheries
Schneider, Gary, Ph.D., Forestry, Wildlife & Fisheries
Smith, W. O., Ph.D., Botany

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36. Stacey, G., Ph.D., Microbiology
37. Stewart, A., Ph.D., ORNL
38. Strane, R. J., Ph.D., Forestry, Wildlife & Fisheries
39. Turner, Monica G., Ph.D., ORNL
40. Vaught, G., Ph.D., Zoology
41. Walton, B. T., Ph.D., ORNL
42. Waehly, E. L., Ph.D., Chemistry
43. West, D. C., Ph.D., ORNL
44. White, David C., Ph.D., Microbiology
45. Wilson, J. L., Ph.D., Forestry, Wildlife & Fisheries
46. Witherspoon, J. P., Ph.D., ORNL

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

ADMISSION REQUIREMENTS

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

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

THE MASTER'S PROGRAM

Within the minimum requirements of The Graduate School, the program of study must include Ecology 573, 574, and 610 as designated, or an approved equivalent and one course from an approved list of quantitative methods offerings. The list is available from the ecology office and is updated annually by the Ecology Curriculum Committee. The remainder of a student's course program is determined in consultation with the graduate committee. A listing of approved campus-wide ecology offerings is provided to each student during orientation. A graduate minor in ecology is available on an individual basis.

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. This doctoral program must include Ecology 573, 574, and 610 as designated, or an approved equivalent and one course from an approved list of quantitative methods offerings. A student cannot enroll for dissertation hours until the research proposal has been discussed and approved by the doctoral committee. A foreign language is required.

ADVISORS

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

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. Not may be used toward degree requirements. May be repeated. S/NC only. E
510 Special Problems in Ecology (1-3) Individual investigations in ecology. May be repeated with consent of instructor. Maximum 6 hrs.
550 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. Appropriate for students in Planning and Environmental Engineering.
555 Implementation of Environmental Policy (3) Goals and problems of environmental legislation, National Environmental Policy Act; purpose, preparation, and evaluation of environmental impact statements and similar multidisciplinary studies. Prereq: 520 or 573 or course work or experience in environmental law.
556 Development Planning in the Third World (3) (Same as Planning 556.)
561 Environmental Toxicology (3) (Same as Biochemistry 561.)
573 Population Biology (3) (Same as Zoology 573 and Botany 573.)
574 Communities and Ecosystems (3) Patterns underlying principles behind short and long term community and ecosystem organization, dynamics, energetics and nutrient cycling.
600 Doctoral Research and Dissertation (3-15) P/NP only. E
604 Current Topics in Environmental Toxicology (1) (Same as Biochemistry 604.)
for the MBA degree. Students interested in the MBA program should contact the Director of Graduate Business Programs, College of Business Administration.

ACADEMIC STANDARDS

A graduate student whose grade-point average falls below 3.0 will be placed on probation. A student on probation will be dropped from the program unless his/her cumulative grade-point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next semester's coursework established by the degree program for full-time students and the next two semester's coursework as established by the degree program for part-time students.

THE MASTER'S PROGRAM

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

The non-thesis option requires 30 hours of coursework at the 500 level or above. Of these, at least 24 hours (at least 18 hours of which are in economics) must be at the 500 level or above. Of the remaining 18 hours in economics, at least 15 hours must be in one field of economics. Of the 30 hours, a maximum of 9 hours in courses approved by the department may be taken in fields other than economics.

Students electing the non-thesis option are required to pass a final comprehensive examination. The thesis option requires 30 hours of coursework at the 400 level or above. Of these, at least 24 hours at the 500 level or above, 6 hours of which may be thesis hours. Of the remaining 18 hours at the 500 level or above, at least 15 hours must be in economics and must include 511, 512, 513, and 514. A maximum of 6 hours may be in an area other than economics.

THE DOCTORAL PROGRAM

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

1. Students are required to complete the following core requirements:
   a. Economic Theory: Microeconomic theory by comprehensive examination or by completion of 511, 512 with a B+ average or higher, and macroeconomic theory by comprehensive examination or by completion of 513, 514 with a B+ average or higher.
   c. Mathematical and Quantitative Economics: 581, 582. The 582 requirement may be waived for students completing 661, 682.
   d. Economics of Resources and Environmental Policy: 570 or 600.

2. Students are required to demonstrate their competence by comprehensive examination in two fields of specialization with the approval of the department. At least one of which must be selected from the following: comparative systems, economic development, economic history, economic theory, economic history of labor and human resources, industrial organization, international economics, public finance, and regional and urban economics.

3. Students are required to complete a comprehensive examination in economics at the 500 level or above, outside the core subject areas and outside the two fields of specialization.

4. Students are required to complete a dissertation, including an oral defense, to give at least 24 hours of graduate credit (600).

BUSINESS ADMINISTRATION CONCENTRATION

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

MBA Concentration: Economics.

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

GRADUATE COURSES

400 Special Topics (3) Topics vary. Prerequisites: Determined by department. May be repeated.
413 Macroeconomic Fluctuations (3) Analysis of historical data, methods of analyzing macro-economic fluctuations, theoretical explorations of cycles, and role of monetary and fiscal policies in aggregate economy. Major writing requirement. Prerequisites: Intermed.; Microeconomics or consent of instructor.

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

435 Industrial Organization Analysis (3) Monopoly and competition in United States economy; relationship of market structure, business behavior, and economic performance. Major writing requirement. Prerequisites: 201.

442 Analytical Labor Economics (3) Problems connected with labor market. Intensive treatment of small numbers of topics. Health economics, economics of education, economics of public goods, economics of consumption, labor market behavior, social decision making. Prerequisites: 201. Major writing requirement. Prerequisites: 341.

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

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

472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual taxes and of tax systems, non-tax sources of revenue, fiscal federalism. Major writing requirement. Prerequisites: 341.

482 Introduction to Mathematical Economics (3) Application of basic mathematical tools: calculus, matrix algebra, etc. to major topics of economic theory. Prerequisites: Intermediate Microeconomics 511 or better and Calculus.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered in 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 Fundamentals of Microeconomics (3) Theory of consumer behavior and demand, theory of production and cost, behavior of perfectly competitive and monopolistic environments. For non-economics majors. Not available for students with credit for 511. Prerequisites: 311 or equivalent.

511-12 Microeconomics Theory (3) Theory of consumer choice and demand, theory of production and cost, behavior of perfectly competitive and monopolistic environments. For non-economics majors. Not available for students with credit for 511. Prerequisites: 311 or equivalent.

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


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

526 Economic History of the U.S. (3) Interpretation of American economic structure and policies from colonial times. Prerequisites: Graduate standing in economics or consent of instructor.

532 Labor Relations and Collective Bargaining (3) (Same as Management 532.)


582 Elements of Econometrics (3) Elementary economic concepts and techniques. Statistical inference, linear regression, estimation, hypothesis testing, generalized least squares, distributed lags, and simultaneous equations. Applications of these topics to economic problems. Prerequisite: Introductory statistics.

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

612 Advanced Microeconomics Theory (3) Prerequisites: 512 or equivalent.

613 Advanced Macroeconomics Theory (3) Prerequisites: 514 or equivalent.

619 History of Economics (3) Background for and origins, concerns, methods, and conclusions of neoclassical economics; W.S. Jevons, A. Marshall, C. Menger, L. Walras, and principal developments in microeconomics after 1900. Background for and origins, concerns, methods, and conclusions of economics of J.M. Keynes and principal developments in macroeconomics after Keynes. Prerequisites: 515.

621-22 International Economics (3,3) Comparative advantage, trade migration, commodity composition of trade, protectionist devices, political arguments, trade liberalization, U.S. trade policy, exchange rate determination, balance of payments adjustment, multinational corporations, and international capital flows. Prerequisites: 512 and 514.

623 Development Economics: Theories and Policies (3) Principal theories explaining economic behavior in developing countries and policies and strategies used to promote development. Prerequisites: Undergraduate degree in economics or consent of instructor.

624 Development Economics: Western Impact on Asia and Africa (3) Studies of consequences of contact between developed world and developing countries of Asia and Africa. Prerequisites: 21 hrs of upper division undergraduate social science or consent of instructor.
Education

(College of Education)

MAJOR DEGREE
Education .................................................. Ph.D.

THE MASTER'S PROGRAM

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

Course requirements for the M.S. program include:

- Fall Semester
  - Internship 4 hrs
  - Specialty Studies 6 hrs
  - Analysis of Teaching for Professional Development 2 hrs

- Spring Semester
  - Internship 8 hrs
  - Clinical Studies 4 hrs

- Post Internship
  - Concentration Area 12 hrs
  - TOTAL 36 hrs

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

THE DOCTORAL PROGRAM

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

The program requirements, concentrations and specializations are:

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Minimum Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Area</td>
<td>14</td>
</tr>
<tr>
<td>Foreign or Computer Language (demonstrate proficiency)</td>
<td>6</td>
</tr>
<tr>
<td>General Core Requirements</td>
<td>16</td>
</tr>
<tr>
<td>--History and philosophy of education, (both areas must be represented)</td>
<td>4</td>
</tr>
<tr>
<td>--Learning theory and curriculum (both areas must be represented)</td>
<td>4</td>
</tr>
<tr>
<td>--Administrative theory</td>
<td>2</td>
</tr>
<tr>
<td>--Trans-college seminar: three consecutive semesters (including summer)</td>
<td>3</td>
</tr>
<tr>
<td>Alternative Core Requirements</td>
<td>3</td>
</tr>
<tr>
<td>--Courses in philosophy of science</td>
<td>3</td>
</tr>
<tr>
<td>--Trans-college Seminar: three consecutive semesters (including summer)</td>
<td>3</td>
</tr>
<tr>
<td>--Seminar in area of specialization</td>
<td>3</td>
</tr>
<tr>
<td>--Courses in learning theory/group or independent study</td>
<td>3</td>
</tr>
</tbody>
</table>

Concentrations

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

Cognate

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

Dissertation

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CONCENTRATIONS

Administrative Theory and Practice
Specializations:
1. School administration
2. Higher education administration
3. Organizational leadership and policy studies

Theories of Curriculum Development and Foundations of Education
Specializations:
1. Anthropological, historical, philosophical, and sociological bases for educational planning and curriculum
2. Principles and models for planning, developing, and evaluating educational programs
3. Research design for educational programs

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

Theories and Practice of Educational and Personal Adjustment
Specializations:
1. Counselor education
2. Counseling psychology
3. Educational psychology
4. School psychology

Foundations of Human Movement
Specializations:
1. Public health
2. Exercise Science
3. Adapted Physical Education
4. Exercise Physiology/Fitness
5. Motor Behavior: Motor Control
6. Motor Learning
7. Psychology of Sport
8. Socio-Cultural Foundations of Sport: History, Philosophy, Sociology

Health Education
Specializations:
1. Public health
2. Safety

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Education is available to residents of the states of Arkansas (concentration in administrative theory and practice only) or South Carolina (concentration in theories and practice of educational and personal adjustment only). Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.
Educational and Counseling Psychology

(College of Education)

MAJORS DEGREES

Guidance ......................... M.S.
Educational Psychology .......... M.S., Ed.D.
Educational Psychology and Guidance .... Ed.S.

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

R. Steve McCallum, Head

Professors:

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

Associate Professors:

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

Assistant Professors:

Harris, Shanette M., Ph.D. ....... Virginia Tech
Hutchins, Teressa A., Ph.D. ....... Georgia

The Department of Educational and Counseling Psychology offers graduate programs leading to the following: Master of Science with a major in Educational Psychology, concentrations in educational psychology and community counseling; Master of Science with a major in Guidance, concentrations in elementary guidance, secondary guidance, and school counseling; Educational Specialist with a major in Educational Psychology and Guidance, concentrations in educational psychology, school psychology, and school counseling; and Doctor of Education with a major in Educational Psychology, concentrations in counseling and education and educational psychology. The department also participates in the college-wide Ph.D. program with a major in Education. The concentration area is theories and practice of educational and personal adjustment with specializations in counselor education, counseling psychology, educational psychology, and school psychology.

Several programs in the department are accredited. The Ed.D. counselor education concentration and the Ph.D. specialization in counseling education are accredited by the Council for Accreditation of Counseling and Related Educational Programs; counseling and school psychology by the American Psychological Association; and school psychology by the National Association for School Psychology. Also, the school counseling and school psychology programs have the approval of the National Council for Accreditation of Teacher Education.

The Community Counseling and School Counseling programs are accredited by the Council for Accreditation of Counseling and Related Educational Programs. The program in Educational Psychology has been recognized as a "Designated Program" by the American Association of State Psychology Boards and the Council for the National Register of Health Service Providers in Psychology.

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

THE MASTER'S PROGRAMS

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

THE EDUCATIONAL SPECIALIST PROGRAM

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

THE DOCTORAL PROGRAMS

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education. For students applying to the Ph.D. program concentration located in this department, two applications are required: one for the Ph.D. in Education program and one for the department that specifies which specialization is desired (i.e., counseling psychology, counselor education, educational psychology, or school psychology). Applicants for the Ed.D. with a concentration in either counselor education or educational psychology fill out only the departmental application form.

Departmental admissions requirements include up-to-date scores from the GRE; the department admissions application form, letters of recommendation, and a writing sample. The following minimum number of hours is required in each program concentration/specialization: counseling psychology - 98; counselor education, Ph.D. - 100, Ed.D. - 79; educational psychology, Ph.D. - 92, Ed.D. - 89; school psychology, Ph.D. - 97. Residency for the Ph.D. programs is three consecutive semesters of full-time coursework and two consecutive semesters for the Ed.D. The Ph.D. program requires coursework in both a supporting specialization and a cognate area, as well as either foreign language or computer proficiency. Coursework in statistics and research design is a requirement in all doctoral programs. Pre-dissertation research participation is a requirement in the Ph.D. program. The concentrations/specializations in counseling psychology, counselor education, and school psychology each require a year-long practicum sequence and the equivalent of a year's full-time work as an intern in an appropriate counseling setting. The concentrations/specializations in educational psychology and counselor education also require supervised practicum experience in classroom teaching. All doctoral students take written comprehensive examinations in the program concentration, supporting specializations, and cognate areas. The guidelines for each program concentration may be consulted for further requirements.

MINOR IN GERONTOLOGY

Graduate students in the Department of Educational and Counseling Psychology may pursue a specialized minor in gerontology. This interdisciplinary program requires an understanding of the psychological and social issues associated with aging and the knowledge about aging in American society with his/her major concentration. Please refer to the Human Ecology for specific requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. and Ed.D. programs in Educational Psychology are available to
residents of the state of South Carolina. Additional information may be obtained from the Residency Advisor in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

410 Sex Role Development: Implications for Education and Counseling (3) Theory and research concerning development of person's sexual role and its relevance in educational and counseling settings. F,Su

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

432 The Disadvantaged Student: Psychoeducational and Research Regarding Etiology, Psychosocial Behavior and Appropriate Interventions. Sp

460 Self-Management in the Helping Professions (3) Applications of self-management strategies to career, socioemotional, and intellectual development of both helping professionals and their clientele. Prereq: Introductory course in psychology or consent of instructor. S/NC or letter grade. Sp,Su

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

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

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

503 Problems in Lieu of Thesis (1-3) May be repeated. Maximum 12 hrs. S/NC only. E

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

510 Psychological Theories of Human Development: Applied to Education (3) Theory and research on emotional, cognitive, and intellectual development over life span with applications to educational and therapeutic settings. F,Su

511 Cognitive Development: Implications for Education (3) Applications of theory and research related to higher mental problem-solving. Prereq: 510 or consent of instructor. F

515 Educational Applications of Behavioral Theories of Learning (3) Behavioral theories and research, conditioning, observational learning, and ethological learning as they apply to student motivation, discipline, and learning. F,Su

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

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

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

521 Statistics and Research Design: Application (3) Data collection and analysis. Descriptive techniques, estimation, logic of hypothesis testing and selected parametric and nonparametric tests. For Master's students conducting thesis and beginning doctoral students. Use of computer statistical packages. F,Su

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

526 Informal Methods of Assessment (3) Development and use of rating scales, check-lists, observation, test scores and case reports in assessment and counseling of children and adults. Prereq: 525, Sp

540 Seminar in School Psychology (3) Essentials of theory and practice of school psychology as professional specialty. Consideration of history and current issues in school psychology. Sp

541 Psychoeducational Assessment (3) Direct, psychometric and standardized assessment methods in learning environments. Prereq: Admission to school psychology program or consent of instructor. May be repeated. Maximum 6 hrs. Sp

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

545 Psychoeducational Consultation (3) Use of two and three-person models of consultation in educational and therapeutic settings based on behavioral, ecological, social learning and cognitive-behavioral theories. F

546 Practicum in Consultation (3) Application of consulting skills to educational settings. Coreq: 545. Sp

549 Internship in School Psychology (1-6) Supervised employment in departmentally approved school psychology internships. Prereq: admission to school psychology program and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

550 Introduction to Person Personnel Programs (3) History, philosophy, professional standards, counselor roles in relation to school and social health professionals, and ethics of profession. F

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

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

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

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

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

556 Seminar in Community Agency Counseling (1) Observation to practice in counseling and other career and professional ethics, certification requirements, and role identity of community agency counselors. May be repeated. Maximum 2 hrs. S/NC only. F

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

559 Internship in Community Agency Counseling (1-6) Supervised practicum employment at departmentally approved human services agency. Prereq: Admission to community agency program. May be repeated. Maximum 9 hrs. S/NC only. F

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

565 Approaches to Family Intervention and Counseling (3) (Same as Child and Family Studies 566.) Counseling clients from different cultural backgrounds in U.S. and abroad. Sp


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

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

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

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

609 Advanced Seminar in Curriculum and Learning (4) (Same as Curriculum & Instruction 609.)

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

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

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

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

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

659 Internship in Counselor Education (1-6) Supervised employment in departmentally approved internship site in counselor education. May be repeated. Maximum 12 hrs. S/NC only. E

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

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


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

665 Analysis of Research in Instructional Technology (3) Research on human learning, design of learning environments. Analysis of teacher behavior, text development, computer software design and video production. Prereq: 555, 585, SCM, 586, and 593. E

668 Practicum in Instructional Planning (3) Development and management of course or program of instruction in educational psychology. Prereq: 565, or consent of instructor. E

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


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

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

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

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

678 Theory and Practice of Counseling Supervision (3) Theory and practice of supervision in counseling. Prereq: 655, or 674, or consent of instructor. S/NC only. Sp

679 Internship in Counseling Psychology (1-6) Supervised employment in departmentally approved counseling psychology internship sites. Prereq: Admission to counseling psychology doctoral program and consent of instructor. May be repeated. Maximum 12 hrs. E

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

Assistant Professors:
Grubb, James J., M.S. Indiana State
High, Katherine N. (Adjunct), Ed.D. Tennessee

Visiting Professor:
Bogue, Grady, Ed.D. Memphis State

The Department of Educational Leadership offers graduate programs leading to the Master of Science with majors in Educational Administration and Supervision and in College Student Personnel (higher education), the Specialist in Educational Leadership, the Doctor of Education with a major in Educational Administration and Supervision, and the Doctor of Philosophy with a major in Education. Specializations may be developed in research, professional office positions, the principalship, and in other educational and social agencies.

The Ed.D. program also offers concentrations in higher education and in educational administration and supervision for practicing administrators. The higher education program combines theory and practice in an innovative demonstration of scholarly study and research. A blend of classroom instruction, individualized advising, and supervised practica and internships allows students to develop a specialization in academic administration, community-junior college administration, student personnel administration, financial management, and college teaching. The concentration for practicing administrators focuses on K-12 administrators currently in the field.

For additional information, contact the department head:

ADMISSION REQUIREMENTS

General test of the Graduate Record Examination; writing sample if GRE verbal is below 50th percentile; leadership potential judged by activities in organizations, and rating forms or letters of recommendation. The Ed.D. applicant must also interview with all faculty members on campus or elsewhere. Application deadlines are March 15 and October 1.

THE MASTER'S PROGRAM IN COLLEGE STUDENT PERSONNEL

This program is designed for individuals interested in entering the field of student personnel administration in colleges and universities and in community or junior colleges. The program has both a thesis and non-thesis option. A minimum of 36 hours, which includes 6 hours of practicum experience, is required in either option.

THE EDUCATIONAL SPECIALIST PROGRAM

Thesis Option
A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 518 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the thesis.

Non-Thesis Option
A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 503 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the problem papers.

THE DOCTORAL PROGRAM

For the Ed.D. program, the minimum hours are determined by the student's doctoral committee. Six to 9 hours must be in a cognate area within the college and 6-9 hours outside the college unless the student has a Master's degree in a field outside the College of Education. Two consecutive semesters of 604 must be taken during residence. An internship is highly recommended but not required. A foreign language requirement is at the discretion of the committee. A written comprehensive examination is given as well as an oral exam over the dissertation.

The Department of Educational Leadership also has an Ed.D. program for practicing school administrators. Please contact the department for further information.

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education.

Educational Administration and Supervision

GRADUATE COURSES

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

502 Registration for Use of Facilities (3-15) Required. E

513, 515, 516, and 535 or a demonstrated computer proficiency. The courses are prerequisites to other courses in the department.
513 Administrative and Organizational Theory in Education (3) Introduction to the theoretical and organizational foundations of management and leadership of educational programs and institutions. F, Su

515 Human Relations and Communication in Administration (3) Development and use of effective interpersonal and communication skills; interpersonal relations, conflict management, and roles of values, attitudes, and expectations in administration. F

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

518 Educational Specialist Research and Thesis (3) May be repeated. Maximum 6 hrs. P/NP only. E

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

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

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

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

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

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

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

580 Internship in Educational Administration (3) Field experience in appropriate educational setting working directly with administrator. At end of planned program of study. Placement by department assignment. Some on-campus classes in conjunction with 593 or 595. Prereq: 21 hrs in educational administration and supervision or consent of instructor. E

582 Educational Leadership and District-Level (3) Role of central administrative team; relationships, behaviors, conflicts, and strategies for developing an organization and maintaining effective school organization. At end of planned program of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F, Su

583 Educational Leadership--Principalship (3) Knowledge, skills and relationships for principal to be effective instructional leader. Simulation materials and field-based activities. Oral presentation and problems paper. At end of planned program of study. Prereq: 21 hrs in educational administration and supervision or consent of instructor. F, Su

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

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

593 Independent Study in Educational Administration (1-3) Prereq: Consent of instructor. May be repeated. E

595 Elementary Principals Seminar (1-3) For in-service training of elementary school administrators. Prereq: Presently elementary school administrator or consent of instructor. May be repeated. S/NC or letter grade. F, Sp

596 Middle School Principals Seminar (1-3) For in-service training of middle school administrators. Prereq: Presently middle school administrator or consent of instructor. May be repeated. S/NC or letter grade. F, Sp

597 Secondary Administrator Seminar (1-3) For in-service training of secondary school administrators. Prereq: Presently secondary school administrator or consent of instructor. May be repeated. S/NC or letter grade. F, Sp

598 Save Problems Seminar (3) Problems paper. Prereq: Presently school administrator or consent of instructor. F, F, Su

599 Doctoral Research and Dissertation (3-15) Prereq: Presently school supervisor or administrator, or consent of instructor. F, Sp

600 Doctoral Research and Dissertation (3-15) Prereq: Presently school supervisor or administrator, or consent of instructor. May be repeated. S/NC or letter grade. F, Sp

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

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

610 Internship in Educational Administration (3) Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical tasks of educational administration under supervision of practitioner and University representative. Prereq: Presently school supervisor or administrator, or consent of instructor. May be repeated. S/NC or letter grade. E

611 Current Issues in Educational Administration (1-3) Current topics for practicing school administrators. Prereq: Presently school supervisor or administrator, or consent of instructor. May be repeated. S/NC or letter grade. E

614 Statistical Methods for School Administrators (3) Statistical methods used in research in educational settings. F

615 Research Designs (3) Statistical methods for school administrators. Descriptive and experimental research methods, parametric and non-parametric statistical techniques used in research in educational settings. F

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

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

622 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) Exploring design and methodology for training school administrators at both pre-service and in-service levels. F

623 Seminar in Politics of Education (3) Interdisciplinary discussions of community power structures and special interest groups, based on literature and research from education, sociology, and political science. Field study. Prereq: 520, 525, 516 or equivalent or consent of instructor. F

624 Educational Finance and Business Management (3) Contemporary educational finance policies and their influence upon education, nation and citizens. F

646 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee compensation and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Prereq: 549 or consent of instructor. F, Su

653 Seminar in Educational Planning Methods (3) Exploration of alternative futures and advanced planning methodology. Sophisticated planning/forecasting techniques. Prereq: 553 or consent of instructor. F, Su

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

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

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

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

697 Seminar in Educational Facility Planning (3) Concepts and techniques for evaluating educational facilities, conducting comprehensive school surveys, and developing educational specifications. Prereq: 547 or consent of instructor. Sp

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

693 Independent Study in Educational Administration and Supervision (3) Prereq: Consent of Instructor. May be repeated. E

Higher Education

GRADUATE COURSES

455 Seminar in Student Leadership (1) Knowledge and skills in leadership roles for resident assistants, student government leaders, student activities, and other student organizations. Topics to be assigned. May be repeated. S/NC or letter grade. E

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

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

503 Problems in Lieu of Thesis (3-6) May be repeated. S/NC only. E

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

542 The College Student and the Court (3) Legal problems facing student personnel services in public higher education. Student discipline, housing, dress, enrollment, personnel policies, employment activities, fines, tuition and related federal regulations. F

543 American Higher Education in Transition (3) History, philosophy, purposes, functions, organizations and programs in American higher education. F

86 Educational Leadership

Associate Professors:

Assistant Professor:
Smith, L. Montgomery (UTSI), Ph.D. .......... Tennessee

Lecturers:
Adams, Raymond K. M.S., P.E. .......... Tennessee Martin, Clyde D., Jr., M.S. .......... Tennessee

The Electrical and Computer Engineering Department has a graduate committee to administer, promote, and advance the general well-being of the graduate program. The Department of Electrical and Computer Engineering and the Department of Nuclear Engineering jointly offer a Master's degree program in the field of fusion energy. Students may have the opportunity to do their Master's thesis at the Fusion Energy Division of the Oak Ridge National Laboratory or at the Plasma Science Laboratory, affiliated with the Electrical and Computer Engineering Department. A limited number of Graduate Research Assistantships are available at each location. Further information about this program is available from the Department.

THE MASTER'S PROGRAM
Graduate work leading to the Master of Science with a major in Electrical Engineering may be completed during one academic year of full-time study, or the degree may be obtained in two or three years of study in the evening. Graduate assistantships are available for outstanding students, who may obtain the Master's degree in one calendar year.

Admission Requirements
Students applying for admission to the Master of Science program and who hold a B.S. in Electrical Engineering are considered for admission on an individual basis. The minimum expectation is an undergraduate cumulative grade-point average of 3.0 out of 4.0 and a GPA of 3.0 for the senior year. A TOEFL score of 580 is required for international students.

Students who hold the B.S. or B.A. in a field other than electrical engineering are also expected to have a minimum cumulative grade-point average of 3.0 and a minimum senior year average of 3.0 in that field. These students should also have a background equivalent to that obtained by earning credit with a minimum 3.0 grade-point average in the Electrical Engineering courses normally taken at the 200 and 300 levels in the Bachelor's program in this department, and two senior electrical and computer engineering courses (and any labs associated with them) in the student's area of interest. Students from fields other than electrical engineering who have met the admission standards except for this background will be admitted only as non-degree students until they have completed coursework to provide this background.

Master's Degree Requirements
Specific degree requirements which must be met include:
1. Electrical and Computer Engineering 503 and 504.
2. Six semester hours of graduate credit in mathematics consisting of mathematics courses at the 500 level or higher which have been approved by the E.C.E. Graduate Committee.
3. An additional 12 semester hours of 500-level work in electrical and computer engineering courses or 6 semester hours of 500-level work in one area in electrical and computer engineering courses and 6 semester hours of 500-level work in another area approved by the student's Master's committee. The 500-level work in electrical and computer engineering courses must include at least 6 hours in the student's major area.
5. A final oral examination covering the thesis and related coursework.

THE DOCTORAL PROGRAM
The Ph.D. with a major in Electrical Engineering may be pursued in the concentrations of circuit theory, computers, electrophysics, communication theory, electromagnetic theory, plasma engineering, power systems, solid-state electronics, and control systems. Applicants must submit scores on the General Graduate Record Exam. Specific departmental requirements for the Ph.D. include the following:
1. A Master of Science or Master of Engineering degree.
2. A minimum of 48 semester hours of coursework beyond the B.S. excluding thesis research, and dissertation credit.
a. A minimum of 24 semester hours of work in electrical and computer engineering courses at the 500 and 600 levels.
b. A minimum of 9 semester hours of 600-level coursework. At least 3 semester hours of this work must be in an area other than the student's major area.
c. A minimum of 12 hours of mathematics courses approved by the Electrical and
Computer Engineering Graduate Committee. All 12 hours must be 400-level or above, and at least 6 hours must be at 500-level or above.

3. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

4. Satisfactory performance on both a qualifying and comprehensive examination. The qualifying examination is prepared by the electrical and computer engineering faculty and consists of a 3-hour written examination in each of four areas. Areas (1) mathematics and transform methods, and (2) basic electrical network analysis, are required of all Ph.D. students. Areas (3) and (4) are usually chosen from two of the graduate course divisions in the department and cover material from undergraduate courses and first year graduate courses. A student who fails the qualifying examination must take and pass the examination the next time it is offered to remain in the Ph.D. program. The qualifying examination is normally taken after the completion of 24 hours of graduate coursework or immediately after completion of a Master's degree. A minimum of 18 hours of graduate coursework must be completed after the student has taken the qualifying examination the first time.

The comprehensive examination is prepared by the student's doctoral committee and consists of a 3-hour written examination in the student's major area, a 2-hour written examination in a related area, and an oral examination. The comprehensive examination is normally taken at least six months after passing the qualifying examination. Part of the comprehensive oral examination will be a defense of a formal written dissertation proposal. The comprehensive examination must be passed and the dissertation proposal accepted by the student's doctoral committee before the student is reported as ready for admission to candidacy for the Ph.D.


Many of the electrical and computer engineering courses are offered in the evening. Engineers working in industry are encouraged to participate in the department's graduate program. Departmental graduate programs are also available at the Space Institute, Tullahoma.

Departmental actions regarding a graduate student may be appealed in writing, first to the Department Graduate Committee, then to the Department Faculty.

**GRADUATE COURSES**

Note: Courses required in the Electrical and Computer 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 and Computer Engineering except when required by the program.

405 Digital Signal Processing and Filter Design (3) Discrete-time signals and systems, sampling, discrete Fourier transforms, analog filter characteristics, nonrecurrent and recursive filter design, and CAD tools for filter design. Prereq: 312.


412 Linear Control System Design (3) Classical and modern techniques for design and compensation of linear feedback control systems. Prereq: Linear System Analysis.

413 Passive and Active Network Synthesis (3) Review of network analysis techniques, passive network driving point synthesis, transfer function synthesis, approximation theory, topics in active network synthesis. Prereq: 312.

421 Electric Energy Systems (3) Structure and operation of electric energy grid; load flow; economic load dispatch; planning; control; reliability. Balanced and unbalanced systems; fault protection; system stability. Prereq: Electric Utility Systems.


429 Digital and Analog Integrated Circuits (3) Basic processing and fabrication of active and passive components for monolithic circuits; integrated circuit fundamentals; design of analog and digital integrated circuits; standard digital logic circuits including TTL, ECL, Schottky, NMOS, CMOS, and GaAs gates and arrays, design concepts for op-amps, comparators, references, regulators, and other linear blocks. Includes laboratory experiments and projects. Prereq: Electric Energy System Components.

430 Digital and Analog Integrated Circuits (3) Basic processing and fabrication of active and passive components for monolithic integrated circuits; characteristics of bipolar, MOS and JFET transistors in typical devices. Active filters detection, modulation, demodulation, sample and hold, and comparators. Includes laboratory experiments and projects. Prereq: 429.

432 Analog Signal Processing Electronics (4) Transducers and signal processing for analog and mixed-signal systems, operational amplifiers, operational amplifiers and operational amplifiers and operational amplifiers. Includes laboratory experiments and projects. Prereq: Electronic Circuits.

432 Analog Signal Processing Electronics (4) Feedback amplifier principles, wideband low-power operational amplifiers, high-frequency and audio operational amplifiers, low-power supply design, oscillators, principles. Includes laboratory experiments and projects. Prereq: Electronic Circuits.


442 Antennas and Propagation (3) Linear antennas, arrays, other simple antennas. Antenna gain, impedance, communication link parameters. Wave propagation in earth's troposphere, ionosphere, reflections from earth; effects on link reliability. Prereq: Fields.

443 Microwave Circuits and Electronics (3) Scattered wave description of circuits; isolators and amplifiers, coupled transmission lines, power dividers, phase shifters. Loading and interconnection of systems. Power generation and amplification by switching, filtering and multiplexing devices. Transmission line and waveguide components. Includes laboratory experiments and projects. Prereq: Fields.


451 Microprocessors in Computer Engineering (4) Project-oriented course using microcomputer kit having monitoring system and development system with cross-assemblers, file management, and emulation capability. Interfacing and hardware/software trade-offs in interrupt driven applications. Term grade dependent on number of projects completed, homework solutions, and engineer- ing notebook. Includes laboratory experiments and projects. Prereq: Introduction to Logic Design of Digital Systems.


453 Data Acquisition Systems (4) Digital-to-analog conversion techniques; Quant. and R-2R ladder networks; error analysis of D/A converters; sample hold circuits, analog-to-digital conversion techniques; open loop systems; direct conversion; closed loop systems; delta-sigma systems; dual slope and successive approximation; error analysis of A/D converters; accuracy, linearity, drift, dynamic range, frequency response, gain, and noise and shielding; automatic testing of A/D and D/A converters; device service routines; signature analysis. Includes laboratory experiments and projects. Prereq: Introduction to Logic Design of Digital Systems and Electronic Circuits.


458 Plasma Magnetohydrodynamic Engineering (3) MHD approximation; MHD waves and instabilities; MHD in plasma systems; MHD in pulsed and steady-state power generation. Applications to fusion energy, industry, and astrophysics. Prereq: 361.

459 Plasma Kinetic Theory Engineering (3) Kinetic theory; beam-plasma system; driven waves in plasma; transverse waves, multiple beams and instability; Landau theory; microwave generation in plasmas and traveling wave tubes; free electron masers in circular geometry, gyrotron and orbitron. Design of plasma devices. Prereq: 361 or consent of instructor.

461 Introduction to Fusion Energy (3) High temperature plasma physics relevant to fusion plasmas, principles of fusion reactors, and engineering and physics constraints on fusion reactors. Prereq: Introduction to Plasma Engineering for ECE majors, or consent of instructor. (Same as Nuclear Engineering 463.)

462 Introduction to Fusion Energy II (3) Continuation of 463. Principles and phenomenology of tokamak reactor, advanced magnetic confinement concepts, advanced fusion fuels, fusion technology, plasma engineering, and fusion reactor design studies. Design project which integrates material in 463 and 464. Prereq: 463 or consent of instructor. (Same as Nuclear Engineering 464.)

463 Plasma Laboratory (1) Experiments and design project illustrating material covered in 461 and 462.


499 Advanced Digital Signal Processing and Filter Design (3) Discrete-time signals and systems, sampling, discrete Fourier transforms, analog filter characteristics, nonrecurrent and recursive filter design, and CAD tools for filter design. Prereq: 312.
519 Control Systems Design II (3) Digital control, variable structure control, state-space design of SISO systems, use of estimators and observers, comparison of classical and state-space methods of control system design, considerations for control system instrumentation. Prereq: 518.

521 Power Systems Analysis I (3) Matrix-vector representations of power networks, sequence modeling of power system components, unbalanced shunt and series effects. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 421 or equivalent.

522 Power Systems Analysis II (3) Operation and control of interconnected power systems, transient and dynamic performance, application of matrix-vector form with application to large scale power systems. Prereq: 521.

523 Power Electronics and Drives (3) Forced commutated inverters, advanced PWM techniques, current-fed inverters, vector and scalar control of induction machines, parameter variations, control principles of synchronous machines.


528 Advanced Electrical Machines I (3) Fundamental processes of electromechanical energy conversion; application in conventional devices. Differential equations for rotating machinery. Coreq: 524 or equivalent.

529 Advanced Electrical Machines II (3) Park's transformation and two-axis model, transient behavior of isolated and interconnected rotating machines. Prereq: 528.

531 Advanced Analog Electronics I (3) Physical operation of modern electronic devices; semiconductor devices: diodes, bipolar transistors, JFETs, and MOS-FETs. Small-signal equivalent circuits and noise models of active devices. Project laboratory. Prereq: 431, 432, 433, or consent of instructor.


542 Radiation and Propagation (3) Linear antennas, loop antennas, aperture antennas, optical transfer function. Canonical problems of modern geometrical theory of diffraction (GTD) and wave geometrical optics approximation, and accounting of far fields and near fields due to edge and surface diffraction. Horn, lens, and reflector antennas; computation of radar cross-section. Prereq: 541.


545 Introductory Microwave Networks and Components (3) Scattering and transfer representation for multipoles; unilateral and bilateral microwave and millimeter wave devices. Component and system parameter measurement techniques. Intermodulation degradation in microwave, millimeter wave oscillators and amplifiers, frequency sweep oscillators, time-train devices, parametric devices, mixers, switches.


493 Special Topics in Electrical and Computer Engineering (1-3) Topics related to recent developments and current practice. Prereq: Consent of instructor. May be repeated.

494 Special Problems in Electrical Engineering (1-3) Problems involving library and experimental research. Prereq: Consent of instructor. May be repeated. Maximum 5 hrs.

500 Thesis (1-15) P/NP only. E 502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or is on a course already completed. May not be used toward degree requirements. May be repeated. S/N/C or letter grade.

507 Microwave Engineering Seminar (1) Topics of interest discussed in weekly seminar. May be repeated. Maximum 6 hrs. S/N/C or letter grade.
Engineering Science and Mechanics

MAJOR DEGREES

Engineering Science ..................... M.S., Ph.D.
T. G. Carley, Acting Head

Professors:
Antar, B. (UTSI), Ph.D. .................... Texas
Carley, T. G. (Liaison), PE, Ph.D. ....... Illinois
Forrester, J. H., PE, Ph.D. ............... Iowa State
Jendrucko, R. J., PE, Ph.D. ............... Virginia
Koehler, D. R. (UTSI), Ph.D. ............ Florida
Kim, K. H., Ph.D. ......................... NC State
Krieg, R. D., Ph.D. ....................... New Mexico
Landos, J. D., PE, Ph.D. ................. Lehig
Lee, C. W. (Emeritus), Ph.D. ......... Illinois
McCay, T. D. (UTSI), PE, Ph.D. ...... Auburn
Pih, H. (Emeritus), Ph.D. ................ Illinois
Remenyik, C. J. (Emeritus), Ph.D...... Johns Hopkins
Scott, W. E., Ph.D. ...................... Johns Hopkins
Shahrokhi, F. (UTSI), Ph.D. .......... Oklahoma
Shobe, L. R. (Emeritus), Ph.D ........ Texas
Snyder, W. T., Ph.D. ..................... Northwestern
Soliman, O., PE, Ph.D. ................. Tennessee
Stoneking, J. E., PE, Ph.D. ............. Illinois
Wasserman, J., PE, Ph.D. .............. Cincinnati
Weitsman, Y. J., Ph.D. .................. Illinois
McKay, M. H. (UTSI), Ph.D. .......... Florida
Steinhoff, J. S. (UTSI), Ph.D. ......... Chicago

Associate Professors:
Boulet, J. A. M., Ph.D. .................. Stanford
Caruthers, J. E. (UTSI), Ph.D. ....... Georgia Tech
Engles, R. C. (UTSI), Ph.D. ............. VPI
Mathews, A., PE, Ph.D. ................. Illinois
McCay, M. H. (UTSI), Ph.D. .......... Florida

Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in Engineering Science are available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program concentrations include solid mechanics, fluid mechanics, computational mechanics, biomedical engineering, and optical engineering (UTSI only). In each of these concentrations, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant is advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his/her advisory committee, and must comply with the requirements of The Graduate School. The student's major professor may be selected from a department other than the Department of Engineering Science and Mechanics; however, at least one member of the student's graduate advisory committee must be on the faculty of the Department of Engineering Science and Mechanics.

A departmental application is required in addition to The Graduate School application. The names and addresses of four references must be included with the departmental application. The flexibility and interdisciplinary aspect of the program concentrations are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics or in related interdisciplinary studies such as biomechanics.

THE MASTER'S PROGRAM

Two M.S. options are offered: option I requires a thesis, while option II does not. The second plan is restricted to those students who have had significant engineering professional work experience.

In option I, a minimum of 30 semester hours including the thesis is required. In option II, a minimum of 33 hours is required. The requirements include the following:

<table>
<thead>
<tr>
<th>Hours Credit</th>
<th>I</th>
<th>II</th>
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<tbody>
<tr>
<td>Mathematics</td>
<td>6</td>
<td>6</td>
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</table>

Engineering courses* (Major concentration may include but is not restricted to courses offered by the Engineering Science and
A final examination is required under both options covering graduate coursework and the thesis.  

THE DOCTORAL PROGRAM

Specific departmental requirements for the Ph.D. Include:
1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the Master's thesis. These shall include a minimum of 24 semester hours in Doctoral Research and Dissertation and a minimum of 48 semester hours in other courses.
2. A minimum of 24 semester hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 500 and above, with at least 9 semester hours of 600-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.
3. A minimum of 12 semester hours in mathematics or computer science in courses numbered 400 and above, exclusive of a first course in ordinary differential equations.
4. Attendance and participation in graduate seminars and colloquia.
5. Two doctoral examinations must be passed to be admitted to candidacy for the Ph.D. in Engineering Science.

The purposes of qualifying examinations are:
a. To determine the qualifications of the student to continue the Ph.D. program, and
b. To identify the areas of strengths and weaknesses to guide the student's graduate coursework and research.

The qualifying examinations will be administered by the department's Graduate Studies Committee. The examination will be written and will cover at least four graduate level subject areas. One subject area will be mathematics, and the others will be designated by the student, subject to the approval of the department's Graduate Studies Committee.

The comprehensive examination is to be taken by students within 6 credit hours of completion of graduate coursework required for the Ph.D. degree. This examination is to be administered by the student's advisory committee and shall consist of both a written and an oral portion.

6. After successfully passing the qualifying and comprehensive examinations, the student must present the Ph.D. dissertation research proposal to the student's advisory committee and receive committee approval of the proposal before being admitted to candidacy for the Ph.D.

7. A final examination on the student's dissertation and related fields will be taken by the student after completion of the Ph.D. dissertation and course requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Engineering Science is available to residents of the state of Florida (concentration in biomedical engineering only). Additional information may be obtained from the Registrar's Office in the Office of Graduate Admissions and Records.

GRADUATE CREDIT FOR 400-LEVEL COURSES

Four hundred-level courses in engineering may be used for graduate credit at the discretion of the advising committee. However, at least two-thirds of minimum required credit hours in a Master's degree program must be at or above the 500 level.

GRADUATE COURSES

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

423 Fracture-Safe Design (3) Critical review of variables controlling fracture toughness; part and flaw geometry, temperature, load rate, section size, material; characterization of fracture toughness by stress intensity factors, strain energy release rates, integral COD data, transition temperature tests; use of fracture toughness data in design. Prereq: 321 and Materials Science and Engineering 201. (See also Materials Science and Engineering 475.) 3 hrs or 2 hrs and 1 lab.


431 Fundamentals of Vibrations (3) Free and forced vibrations of damped and undamped lumped parameter systems; energy methods; free vibration of continuous bodies. Prereq: 321, Mathematics 231.

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

435 Engineering Acoustics (3) Concepts of acoustics, measures of sound and their units, noise generation and transmission, noise control principles and applications, materials and procedures for noise abatement. Prereq: Introductory course in vibrations or acoustics. (Same as Materials Science and Engineering 475.) 3 hrs or 2 hrs and 1 lab.


461 Experimental Stress Analysis (3) Theory, techniques, and instrumentation of resistance strain gauges; theory and techniques of brittle coating methods; introduction to other strain gage techniques. Prereq: 321, Electrical and Computer Engineering 301. 2 hrs and 1 lab.

463 Photochemistry (3) Introduction to photolysis, photocatalysis, electrochemical methods, Molecular spectroscopy. Prereq: 321, Physics 232. 2 hrs and 1 lab.

466 Dynamic Data Acquisition (3) Use and calibration of instrumentation for measuring and recording dynamic events; Fourier analysis, transfer function analyses, digital signal processing, transduction, experimental parameter estimation with applications to modal vibration analysis. Prereq: 431, Electrical and Computer Engineering 301. 2 hrs and 1 lab.

471 Clinical Engineering and Bioinstrumentation (3) Function and characteristics of health care delivery systems; hospital organization and health care economics; development and management principles for hospital-based clinical engineering programs. Biomedical instrumentation system operational characteristics; performance of transducers, signal conditioning, data read-out and storage devices; evaluation of commercially available systems, selection and procurement methods, custom-designed systems, equipment maintenance and control programs for hospitals. Ethical issues and professionalism in clinical engineering. Prereq: Biomedical engineering, Introduction to Pattern Recognition.

473 Biomechanics (3) Mechanical properties of living tissues; biomechanics of injury; mechanics of prostheses; material compatibility of prosthetic devices; biomechanical problems related to impact. Prereq: 321.

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


501-05 Special Engineering Science Topics (1-3,1-3) Problems related to recent developments and practices. Open to juniors or seniors. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

502 Registration for Use of Facilities (3-5) Required of the student not otherwise registered during any semester that 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


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

525 Theory of Plates (3) Classical bending theory of thin plates; thick plates; buckling and large deflection problems. Prereq: 523 or 535.


Engineering Science and Mechanics 91
turbulent flows. Incompressible Navier-Stokes equations. Extensions to three dimensions, associated computational approximate solutions. Expansion on finite difference methods for turbulent flows; turbulent diffusion by continuous and discrete approximations; mixed subsonic-supersonic flows. Algorithm developments in computational fluid/thermal/structural mechanics. For departmental thesis students only. May be repeated.

657 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/structural mechanics. For departmental thesis students only. May be repeated.

581 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 581.)

651-52 Advanced Topics in Computational Fluid Dynamics (3) Approximation theory, analysis of accuracy, convergence, and stability for smooth and non-smooth solutions; shock, artificial dissipation; two- and three-dimensional, compressible viscous and inviscid flows; potential, Euler and complete Navier-Stokes equations; multi-dimensional, turbulent and reacting flows. Computer project. Prereq: 552.

600 Doctoral Research and Dissertation (3-15) P:NP only if approved by the student's advisor. Prereq: Consent of instructor. May be repeated with consent of department.

621 Analysis and Design of Thin Shell Structures (3) Geometry of surfaces, design of thin shell theory for arbitrary shell geometry; selected applications of theory in structural engineering. Prereq: 525 or Civil Engineering 562.

622 Viscoelasticity (3) Viscoelastic constitutive relations; isothermal boundary value problems; wave propagation in viscoelastic materials; stability problems; determinantal equation solutions. Prereq: 523 and 533 or Polymer Engineering 541.

625 Computational Plasticity and Creep (3) Theory and numerical algorithms used to describe plastic and creep behavior in finite element structural models. Perfect plasticity, kinematic and isotropic hardening; Mroz, mechanical subyield, and two-surface models; volumetric plasticity models; traditional creep models and unified creep-plasticity models. Numerical algorithms, including error maps, and plane stress plasticity algorithms in parallel. Prereq: 533 or 527 and 553.


641 Advanced Topics in Fluid Mechanics and Convective Heat Transfer (3) Convective momentum, heat and mass transfer; boundary layer analysis, stability, transition, turbulence, closure models; Navier-Stokes equations, closure procedures: time- and ensemble-averaging, large scale structures; high speed flow, reacting, nonequilibrium, ionization. Applications in propulsion, lasers, aerodynamics. Prereq: 542.

645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic turbulence, energy spectra. Kolmogorov's hypothesis, large and small eddy structures for turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq. 542. (Same as Aerospace Engineering 645.)

651-52 Advanced Topics in Computational Fluid Dynamics (3) Approximation theory, analysis of accuracy, convergence, and stability for smooth and non-smooth solutions; shock, artificial dissipation; two- and three-dimensional, compressible viscous and inviscid flows; potential, Euler and complete Navier-Stokes equations; multi-dimensional, turbulent and reacting flows. Computer project. Prereq: 552.

653-54 Advanced Topics in Computational Solid Mechanics (3,3) Fracture mechanics; singularity solutions; non-linear constitutive problems, variable stiffness, initial strain and initial stress methods, plasticity, creep; unified creep-plasticity theory; geometrically non-linear problems, large deflection, stability; shell structures, analysis of accuracy, convergence, adaptivity; grids; steady flows including second-order turbulence closure, Thin layer and parabolic Navier-Stokes equations; multi-dimensional, turbulent and reacting flows. Computer project. Prereq: 553.

577 Neural Networks in Engineering (3) (Same as Nuclear Engineering 576.)

525 Computational Plasticity and Creep (3) Theory and numerical algorithms used to describe plastic and creep behavior in finite element structural models. Perfect plasticity, kinematic and isotropic hardening; Mroz, mechanical subyield, and two-surface models; volumetric plasticity models; traditional creep models and unified creep-plasticity models. Numerical algorithms, including error maps, and plane stress plasticity algorithms in parallel. Prereq: 533 or 527 and 553.


641 Advanced Topics in Fluid Mechanics and Convective Heat Transfer (3) Convective momentum, heat and mass transfer; boundary layer analysis, stability, transition, turbulence, closure models; Navier-Stokes equations, closure procedures: time- and ensemble-averaging, large scale structures; high speed flow, reacting, nonequilibrium, ionization. Applications in propulsion, lasers, aerodynamics. Prereq: 542.

645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic turbulence, energy spectra. Kolmogorov's hypothesis, large and small eddy structures for turbulent flows; turbulent diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq. 542. (Same as Aerospace Engineering 645.)


557 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/structural mechanics. For departmental thesis students only. May be repeated.
Dykeman, Wilma (Adjunct), B.A....... Northwestern
Ensor, Allison R. (Liaison), Ph.D. ...... Indiana
Finninan, Richard J. (Hodges Chair of Excellence), Ph.D. ...... North Carolina
Goslee, Nancy M., Ph.D. ...... Yale
Heffernan, Thomas J., Ph.D. ...... Cambridge
Kelly, Richard M. (Lindsay Young Prof.), Ph.D. ...... Duke
Leggett, B. J. (Distinguished Prof.), Ph.D. ...... Florida
Loefar, Michael A., Ph.D. ...... Maryland
Maland, Charles J., Ph.D. ...... Michigan
Penner, A. Richard, Ph.D. ...... Colorado
Reese, Jack E., Ph.D. ...... Kentucky
Sanders, Norman J. (Lindsay Young Prof.), Ph.D. ...... Shakespeare Institute
Scora, Dorothy M., Ph.D. ...... North Carolina
Shurr, William Ph.D. ...... North Carolina
Thomas, Joyce Carol, M.A. ...... Stanford
Trammell, Joseph B., Jr., Ph.D. ...... Princeton
Wheeler, Thomas V., Ph.D. ...... North Carolina
White, Jon M. (Lindsay Young Prof.), M.A. ...... Cambridge
Associate Professors:
Bensel-Myers, Linda D., Ph.D. ...... Oregon
Dumas, Bethany K., Ph.D. ...... Arkansas
Dunn, Allen, Ph.D. ...... Washington
Garnier, Stanton B., Jr., Ph.D. ...... Princeton
Gill, J. E., Ph.D. ...... North Carolina
Goslee, David F., Ph.D. ...... Yale
Hutchinson, George, Ph.D. ...... Indiana
Kallet, Marilyn, Ph.D. ...... Rutgers
Keene, Michael, Ph.D. ...... Texas
Leki, Illona, Ph.D. ...... Illinois
Robinson, Frank K., Ph.D. ...... Texas
Smith, Arthur, Ph.D. ...... Houston
Stillman, Robert, Ph.D. ...... Pennsylvania
Zomchick, John, Ph.D. ...... Columbia
Assistant Professors:
Atwill, Janet, Ph.D. ...... Purdue
Barton, Kerri, Ph.D. ...... Texas Christian
Brat, Rakesh, Ph.D. ...... Illinois
Hammond, Patsy G., M.A. ...... Tennessee
Hirst, Russell, Ph.D. ...... Rensselaer
Howes, Laura L., Ph.D. ...... Columbia
Hubbard, Dolan, Ph.D. ...... Illinois
Jennings, La Vinia, Ph.D. ...... North Carolina
Papke, Mary E., Ph.D. ...... McGill

The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. Thesis and non-thesis options are available for the M.A. as well as a special concentration in writing. Detailed information about the master's and doctoral programs, and about individual graduate courses, may be obtained by writing to the Director of Graduate Studies in English, 306 McClung Tower.

The Department of English does not accept students in non-degree or provisional status. A student who wishes to enter the department must apply in degree-seeking status for his/her application to receive consideration for admission to any graduate program in English.

THE MASTER'S PROGRAM

Requirements
Coursework: A minimum of 24 semester hours in English beyond the B.A., to include 6 hours at the 600 level; 12 additional hours at the 500-600 level (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 6 hours for graduate credit at any level, including the 400 level. In this coursework, students must maintain at least a 3.0 GPA.

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

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

Language Requirement: Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:

1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT Knoxville with a grade of B or better.
3. Passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.
4. Passing the Graduate School Foreign Language Test (GSFLT) as currently administered through the English Department.

Final Examination: A candidate presenting a thesis must pass a one-hour oral examination; a candidate presenting a creative project must pass a ninety-minute oral examination. The examination consists of a short thesis defense, but chiefly of questions covering the general history of English and American literature, not merely the coursework taken. A reading list of primary works designed to help the student prepare for these questions is available in the office of the Director of Graduate Studies in English.

A non-thesis student must pass a written examination, followed by a one-hour oral examination, both consisting of the same sort of questions as the examination taken by the thesis student.

Residence Requirement: There is no residence requirement for the M.A., but students should attempt to pursue a full-time program whenever possible.

WRITING CONCENTRATION

The Master's Program with writing concentration is intended for those students who plan to do free-lance writing, specialize in teaching writing courses at the college level, or work as professional writers in business or industry.

Requirements
The requirements for the writing concentration are the same as those for the thesis option above with the following exceptions:

Coursework: Writing students may substitute two 400-level writing courses for two 500-level courses. Students must take at least 9 hours in writing and 9 in literature, the remaining 6 to be selected from any English courses at the proper level. Of the courses in writing, at least 3 hours must be taken at the 500 level; at least 500-level courses are strongly recommended.

Writing Projects: One of the following writing projects for six hours of credit:

1. A thesis, using research to analyze some aspect of writing or rhetorical theory.
2. A creative project, such as a collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose.

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.

The reading list may be modified by the M.A. examining committee, meeting as a body with the student, to reflect the candidate's particular writing emphasis. However, most of the oral examination should focus upon the literature outlined in the original reading list.

THE DOCTORAL PROGRAM

Requirements
A student must successfully complete a program of study, normally 6 full semesters as outlined below, approved by the candidate's committee or the Director of Graduate Studies in English.

Coursework: At least 93 semester hours beyond the B.A. to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above (only 3 hours of 593 Independent Study may be applied toward the M.A. and 3 after the M.A.); a special three-hour course in teaching composition; and 12 additional hours at any level, including the 400 level. Up to 6 of these hours may be taken in any cognate field such as history, philosophy, French. These courses must be drawn from those approved for graduate credit. All other coursework must be in English. 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 with a grade of B or better; (b) completion at UT Knoxville of any two courses on the 300 level or above in the foreign language or literature with at least a grade of B in each course; (c) passing of the Graduate School Foreign Language Test (GSFLT) as currently administered at UT Knoxville; or (d) passing the Graduate School Foreign Language Test (GSFLT) as currently administered through the English Department.

2. One modern language approved by the Director of Graduate Studies in English. This requirement must be fulfilled by a passing grade on the language examination given by UT Knoxville and completion of two courses given in the foreign language at the 400 level or above, at least one course to be at the 500 or 600 level. A minimum grade of B must be received in each course.

3. One modern language approved by the Director of Graduate Studies in English and intensive study of the English language. This requirement must be fulfilled by completion of (a), (b), or (c) 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.

Residence Requirement: Two consecutive semesters as a full-time student. For students not on teaching assistantships, full-time consists of 9 or more hours of coursework for 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 Chryseile in Middle English.
404 Shakespeare I: Early Plays (3) Shakespeare's dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night, English histories, including Henry IV, and early tragedy, including Othello; problem plays, including Measure for Measure; and dramatic romances, including The Tempest.
406 Renaissance Drama (3) English theatre between 1590 and 1640 through reading of representative plays by Shakespeare's contemporaries: Marlowe, Webster, Jonson.
409 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of sixteenth century authors; Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.
410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of seventeenth century: poetry of Milton, Donne, Marvell; and prose of Browne, Bacon, and Walton.
412 British Drama from 1660 to 1800 (3) Playwrights from Dryden and Wycherley to Goldsmith and Sheridan; formal developments: heroic play, cynical comedy, affective tragedy, and exemplary drama.
413 The Eighteenth-Century British Novel (3) Defoe to Austen.
414 Romantic Poetry and Prose I (3) Wordsworth, Coleridge, and Blake; readings from Lamb, De Quincey, and other prose writers.
415 Romantic Poetry and Prose II (3) Keats, Shelley and Byron; readings from Hazlitt, Peacock, and other prose writers.
416 Victorian Poetry and Prose I (3) Tennyson, Pre-Raphaelites, Carlyle, Newman, and Mill.
419 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskins, Darwin, and Wilde.
420 The Nineteenth-Century British Novel (3) Scott to Hardy.
421 Modern British Novel (3) Lawrence, Joyce, and Woolf.
422 Women Writers in Britain (3) Literary consciousness and works of women writers in Britain. (Same as Women's Studies 422.)
431 Colonial, Federal, and Early National American Literature (3) From Columbus to Washington Irving.
432 American Romanticism and Transcendentalism (3)
433 American Realism and Naturalism (3)
434 Modern American Literature (3) World War I to present.
435 American Novel before 1900 (3) From earliest sentimental novels through Brown and Cooper, and major figures to 1900: Hawthorne, Melville, Stowe, Clemens, and James.
441 Southern Literature (3) Southern writing from colonial period into twentieth century: frontier humorists, local color writers, and Southern literary renaisssance.
442 American Humor (3) Early nineteenth century into twentieth century: Mark Twain.
443 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 British and American Drama (3) O'Neill's works as precursors to modern dramatists: Williams, Miller, Albee, and representativest of Black theater, Bulbs and Bank, and other plays.
453 Continental Drama (3) Selection of plays in English translation by major European writers from late Renaissance to present; twentieth-century achievement.
454 Twentieth-Century International Novel (3) Joyce, Camus, Kafka, Nabokov.
455 Persuasive Writing (3) Persuasive strategies in both student and professional writing. Practice in mastering effective logical and emotional appeals.
460 Technical Editing (3) Editing technical material for publication. Principles of style, format, graphics, layout, and production management. Prereq: 456 and 459, or consent of instructor.
461 Advanced Technical and Professional Writing (3) For students in industry, education, and government who need technical writing skills. Writing of definitions, process descriptions, sets of instructions, descriptions of mechanisms, recommendation reports, abstracts, proposals, and major reports. Prereq: Junior standing in student's major or consent of instructor.
462 Writing for Publication (3) Principles and practices of writing for publication. Dissertations, theses, articles, and reports in science and technology. Prereq: 459 or consent of instructor.
463 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 363 or consent of instructor.
464 Advanced Fiction Writing (3) Further development of skills acquired in basic writing fiction course. Prereq: 365 or consent of instructor.
471 Sociolinguistics (3) Study of language in relation to society: Sociolinguistic and theoretical focus: large-scale language units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 471 and Sociology 471.)
472 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 230 or consent of instructor. (Same as Linguistics 472.)
474 Teaching English as a Second or Foreign Language (3) Grammatical structures of English: particular grammatical difficulties of non-native learners of English. Basic phonological structures of English. Teaching grammar and phonology to non-native speakers; contrastive analysis of English with other languages. Prereq: Second year of a foreign language. (Same as Linguistics 474.)
475 Teaching English as a Second or Foreign Language II (3) Second language acquisition theory. Issues in teaching four language skills to learners of English. Materials and methods of teaching and testing: preparation of materials. Observations of and teaching with experienced staff member. Prereq: English 474. (Same as Linguistics 475.)
481 Studies in Folklore (3) Topics vary. May be repeated with different topic. Maximum 6 hrs.
482 Major Authors (3) Content varies. Concentrated study of at least one of most influential writers in British or American literary history: e.g., Donne, Tennyson, Jane Austen, Whitman, F. Scott, Faulkner, Baldwin or Lawrence.
483 Special Topics in Literature (3) Topics vary. May be repeated. Maximum 6 hrs.
484 Special Topics in Writing (3) Original writing integrated with reading, usually taught by professional author. Topics vary. May be repeated. Maximum 6 hrs.
485 Special Topics in Language (3) May be repeated. Maximum 6 hrs with consent of department. (Same as Linguistics 485.)
486 Special Topics in Criticism (3) Content varies. Theoretical and practical approaches to British and American literature. May be repeated with consent of department. Maximum 6 hrs.
489 Special Topics in Film (3) Content varies. Particular directors, film genres, national cinema movements, or other topics. May be repeated with consent of department. Maximum 6 hrs. (Same as Cinema Studies 489.)
495 Introduction to Rhetoric and Composition (3) Historical, theoretical, and empirical modes of inquiry in rhetoric and composition and implications for teaching of composition.
500 Thesis (1-15) IPN only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E
505 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 teacher, 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.
Entomology and Plant Pathology

(College of Agricultural Sciences and Natural Resources)

MAJOR
Entomology and Plant Pathology

DEGREE
M.S.

Carroll J. Southards, Head

Professors:
Bernard, Ernest C., Ph.D. Georgia
Gerhardt, Reid R. (Laison), Ph.D. NC State
Hilty, James W., Ph.D. Ohio State
Johnson, Leander F. (Emeritus).
Ph.D. Louisiana State
Lambdin, Paris L., Ph.D. VPI
Ples, Charles D., Ph.D. Clemson
Southards, Carroll J., Ph.D. NC State

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

Assistant Professor:
Owley, Bonnie H., Ph.D. NC State

THE MASTER'S PROGRAM

Admission Requirements

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

Degree Requirements

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

GRADUATE COURSES

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

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

510 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant pathogens; fungistasis and identification of plant pathogenic fungi. Prereq: 313 or consent of instructor. 2 hrs and 2 labs. F.A

511 Plant Disease Diagnosis (3) Diagnosis of plant diseases, disease symptoms, causal agents and control measures. Prereq: 510 or consent of instructor. 1 hr and 2 labs. Su.A

512 Soil-Borne Plant Diseases (3) Causal agents, host-parasite-soil environment interactions, epidemiology, and control of soil-borne plant diseases. Prereq: 313. 2 hrs and 1 lab. F.A

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

520 Plant Parasitic Nematodes (4) Morphology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships. Pre
Environmental Practice

See Civil Engineering

Environmental Engineering

See Civil Engineering

Environmental Practice

(College of Veterinary Medicine)

MAJOR DEGREE

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

L. N. D. Potgieter, Head

Professors:

Farkas, W. R., Ph.D. ......................... Duke
Oliver, J. W., D.V.M., Ph.D. ................ Purdue
Potgieter, L. N. D., Ph.D. ................. Iowa State
Reed, C. F. (Emeritus), D.V.M. .......... Ohio State

Associate Professors:

New, J. C., D.V.M. ......................... Texas A&M
Patterson-Mccord, S., Ph.D. ............ Kentucky
Reinemeyer, C., D.V.M., Ph.D. .......... Ohio State
Rohrbach, B. W., V.M.D. ................. Johns Hopkins
Schroeder, E. C., D.V.M. ................. Michigan State
Schultz, T., Ph.D. ........................ Tennessee

Assistant Professors:

Frazier, D., D.V.M., Ph.D. .............. NC State

Hahn, K. A., D.V.M. ....................... Purdue
Orozco, S. E., D.V.M., Ph.D. .......... Ohio State
Ramsay, E. C., D.V.M. ................. California (Davis)

Clinical Associate:

Clyde, V. L., D.V.M. ..................... NC State

Post-Doctoral Research Associate:

Alansari, H. M., Ph.D. .................... Kansas State
Kania, S., Ph.D. ............................. Florida
Kelle, W. J., D.V.M. ...................... Michigan State
Kennedy, M. A., D.V.M., Ph.D. ....... Tennessee

Pathologist:

Petersen, M. G., D.V.M. ................. Colorado State

See Veterinary Medicine for program description.

GRADUATE COURSES

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

501 Special Topics in Environmental Medicine (1-3)

Aberrant metabolism, pharmacokinetic studies, toxicokinetic studies, epidemiology and techniques in molecular biology: atomic absorption, gas chromatography, ultra centrifugation, extractive techniques and radio immunoassay. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

503 In Vitro Evaluation of Toxicity (3) Principles and techniques of in vitro evaluation of toxicity, mutagenesis, carcinogenesis, and teratogenesis. Prereq: Biochemistry 561 and consent of instructor. Sp.A

505 Laboratory Animal Care and Use (2) Review of basic laboratory animal care and use as prerequisite to conducting research using animal subjects. Compliance issues and techniques.

506 Experimental Animal Surgery (3) Competence in performing human surgical modifications of experimental animals. Techniques of anesthesia. Drug administration and postoperative care. Prereq: Embryology, parasitology, physiology and/or consent of instructor. 1 hr and 2 labs. F

530 Wildlife Diseases (2) (Same as Wildlife and Fisheries 530)

561 Pharmacology (4) Principles of pharmacokinetics and pharmacodynamics properties of drugs; mode of action, pharmacologic effects, chemical and physical properties, metabolism, toxicities, important idiosyncrasies and clinical applications. Prereq: Consent of instructor. F

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

607 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (3) Advanced study of virus diseases important to domestic animals: virus biology, pathogenesis, pathology and diagnosis technical training in virus diseases diagnosis. Prereq: Cellular and Comparative Biochemistry, and Advanced Topics in Biochemistry, Virology, and Veterinary Medicine 811-812. 2 hrs and 1 lab. Sp.A

610 Advanced Topics in Environmental Medicine (1-3) Current and future research methodology, laboratory situation, recent advances in instrumentation in analytical techniques for environmental medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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 Contemporary Issues in Corporate Finance (3) Selected topics in financial management, recent developments that have significant impact on strategic issues in financial management. Capital budgeting, financial and ownership structure, dividend policy and corporate growth and control. Prereq: Business Administration 504 and 505 or consent of instructor.

512 Problems in Financial Management (3) Readings and case studies that apply finance theory to real-world investment, financing, and asset management problems. Prereq: Business Administration 504 and 505 or consent of instructor.
521 Investment Analysis (3) Principles and concepts of asset valuation in competitive and efficient financial markets. Basics of investment analysis of various securities. Prereq: Business Administration 504 and 505 or consent of instructor.

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


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

551 Financial Management of a New Enterprise (3) Financial issues associated with formation, control, and long-range 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 variety of financing options on rate of return on income-producing properties. Effect of various financing options on consumer’s decisions to purchase. 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: 501 or consent of instructor. May be repeated. Maximum 6 hrs.

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


642 Seminar in Finance II: Theory of the Firm (3) Financial theory of firm and financial decision making under conditions of uncertainty, equilibrium models of firm. Option pricing, agency theory, capital structure, economics of information, and dividend policy.

651 Advanced Seminar in Finance I (3) Recent theoretical and empirical developments in macro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

652 Advanced Seminar in Finance II (3) Recent theoretical and empirical developments in macro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

Professors:

Collins, J. L., Ph.D. .............. Maryland
Draughon, F. A., Ph.D. .............. Georgia
Jaynes, H. O. (Liaison), Ph.D. .............. Illinois
Miles, J. T. (Emeritus), Ph.D. .............. Wisconsin
Milton, S. L., Ph.D. .............. Tennessee
Overcast, W. W. (Emeritus), Ph.D. .............. Iowa State
Penfield, M. P., Ph.D. .............. Tennessee

Associate Professors:

Blawal, R. N., Ph.D. .............. Massachusetts
Christen, G. E., Ph.D. .............. Maine
Lawday, H. D., Ph.D. .............. Kansas State
Mount, J. R., Ph.D. .............. Ohio State

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 area of food products, food chemistry, food microbiology, or sensory evaluation of foods. Commodity interests (meats, dairy, fruits, vegetables, bakery products) can be emphasized in any of the areas by careful selection of courses and the research topic. Minors are available in cognate fields. For detailed information, contact the department head. Graduate School rating forms or letters of recommendation from at least three people are required. Respondents should be familiar with the applicant's scholastic ability and professional potential.

THE MASTER'S PROGRAM

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

Thesis Option
1. Prior to research for the thesis, the student must develop a detailed written research plan. Registration for 6 hours of 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 write a comprehensive examination covering their coursework. In addition, an oral, final examination covering the problem and coursework is required. The oral examination will be held on the Knoxville campus.

THE DOCTORAL PROGRAM

1. Completion of a Master's degree in the field, or a closely related field, or passing a special qualifying examination is required for admission. Scores on the GRE aptitude test are also required.
3. A minimum of 72 hours beyond the Bachelor's degree, excluding credit for the Master's thesis, is required. Of this, 24 semester hours must be 600 Doctoral Research and Dissertation.
4. At least 24 hours of coursework numbered above 500 are required exclusive of doctoral research and dissertation. At least 6 of the 24 hours must be courses numbered above 600.
5. A minimum of 6 hours of courses for graduate credit must be taken outside the Department of Food Science and Technology.
6. All candidates must complete 501 (2 hrs.) and are expected to attend 601 during their Ph.D. program.

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

GRADUATE COURSES

410 Food Chemistry I (3) Reactions of proteins, enzymes, and additives in foods. Physical, chemical, and environmental factors moderating growth and survival of foodborne microorganisms, pathogenic and spoilage microorganisms affecting quality of foods and their control. Prereq: Chemistry 110 or equivalent. 2 hrs. and 1 lab. F.

411 Food Chemistry II (3) Reactions of inorganic compounds, carbohydrates, lipids and vitamins in foods. Prereq: Chemistry 110 or equivalent. 2 hrs. and 1 lab. Sp.

420 Food Microbiology (2) Physical, chemical, and environmental factors moderating growth and survival of foodborne microorganisms, pathogenic and spoilage microorganisms affecting quality of foods and their control. Prereq: Microbiology 210. Coreq: 429. F.


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


451 Dairy Products II (3) Science and technology of processing dairy products. Chemical, physical, and microbiological changes that occur during manufacture. Prereq: Principles of Chemistry, Introduction to Organic and Biochemistry, General Microbiology, 2 hrs. and 1 lab. F.

460 Meat Products Technology (4) Processing methods for making cured, smoked, fresh, frozen and formed products. Effect of processing methods on product char-
Forestry, Wildlife and Fisheries

(College of Agricultural Sciences and Natural Resources)

MAJORS DEGREES

Forestry ........................................... M.S.
Wildlife and Fisheries Science ............... M.S.

George T. Weaver, Head

Professors:
Barrett, J. W. (Emeritus), Ph.D. .......... Syracuse
Buckner, E. R., Ph.D. ......................... NC State
Core, H. A. (Emeritus), Ph.D. ............ Syracuse
Dimmick, R. W., Ph.D. ....................... Wyoming
Hill, T. K., Ph.D. ............................... Auburn
Little, R. L., Ph.D. ............................. NC State
McCoy, C. E. (Adjunct), D.F. ............ Duke
Ostermeier, D. M., Ph.D. .................. Syracuse
Pelton, M. R., Ph.D. ........................... Georgia
Schneider, G. Ph., Ph.D. ..................... Michigan State
Sharp, J. B. (Emeritus), D.P.A. .......... Harvard
Smalley, G. (Adjunct), Ph.D. .............. Tennessee
Strange, R. J., Ph.D. ........................... Oregon State
Stumbo, D.A., Ph.D. ......................... Minnesota
Thor, E. (Emeritus), Ph.D. ................. NC State
Weaver, G. T. (Liaison), Ph.D. .......... Tennessee
Wilson, J. L., Ph.D. ............................. Tennessee

Associate Professors:
Deardenter, B. L., Ph.D. .................... Colorado State
Hay, R. L., Ph.D. ................................. Duke
Hopper, G. M., Ph.D. ........................... VPI
King, M. M., Ph.D. .............................. Utah State
Nodvin, S. C. (Adjunct), Ph.D. ............ Cornell
Rennie, J.C., Ph.D. ............................. NC State
Scharbaum, S. E., Ph.D. ..................... Colorado State
Smith, K. G. (Adjunct), Ph.D. ............ Utah State
Wells, G. R., D.F. ................................. Duke
Winistorfer, P. M., Ph.D. .................. Iowa State

Assistant Professors:
Buehler, D. A., Ph.D. .......................... VPI
Clark, J. D. (Adjunct), Ph.D. ............. Arkansas
Fly, J. H., Ph.D. ................................. Michigan
Smith, E. R. (Adjunct), Ph.D. ............ Tennessee
VanMiegroet, H. (Adjunct), Ph.D. ...... Washington
WalDROP, T. A. (Adjunct), Ph.D. ........ Tennessee

Graduate study leading to the Master of Science with majors in Forestry and in Wildlife and Fisheries Science is offered by the Department of Forestry, Wildlife and Fisheries. The Master of Science in Administration, with a concentration in forest industries management, is available for qualified students. This degree program is offered by the College of Business Administration with participation by the Department of Forestry, Wildlife and Fisheries. The Doctor of Philosophy with a specialization in forest biology, wildlife science, or fisheries science can be achieved through the University's intercollegiate graduate program in Ecology.

THE MASTER'S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor's degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must also have taken the General Educational Record Examination (GRE). Graduate School rating forms or letters of recommendation from three individuals familiar with the applicant's academic ability are required. The department also has an application that must be submitted at the time of application to The Graduate School.

Thesis Option

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

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

3. All students are required to include Forestry 512 or Wildlife and Fisheries 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 upon completion of no fewer than 28 hours of approved study.

A concentration in managing natural resource organizations is available under the non-thesis option with a major in Forestry. The minimum core requirements include: Forestry 511, 570, and 6 additional hours of Forestry courses to be selected in consultation with the student's committee; Political Science 564, Management 504, and Planning 560. Fourteen hours of elective coursework are selected with the faculty advisor.

Forestry

GRADUATE COURSES

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

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, site
design projects; management strategies, methods of visitor and recreation site management; case studies. Weekend field trips. Prereq: 321, 323, Ornamental Horticulture and Landscape Design 280, or consent of instructor. 2 hrs and 1 lab. F,A

433 Wood Composites and Gluing (3) Principles of adhesion; wood adhesives; fundamentals of plywood and composite panel manufacture. Evaluation resin properties; testing bond strength and durability. Prereq: 351 and 332, or consent of instructor. 2 hrs and 1 lab. F,A

434 Measurement and Marketing of Wood Products (3) Measurement systems used for sale and transfer of wood products. Application of market principles and analysis to wood products markets and economic structures of wood products industry. Prereq: 431, 433 and 435 and Forestry, Wildlife and Fisheries 313, 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

511 Problem Analysis in Forest Resources (3) Problem identification, problem solution, and evaluation of 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/NC only. F

520 Advanced Forest Tree Biology (3) Growth, reproduction, and physiology of trees; forest ecology; variability and taxonomy of forest trees. Prereq: Graduation standing in forestry or biological science, or consent of instructor. Sp,A

530 Advanced Forest Resource Management (3) Analysis of forest management problems as exemplified in public agencies and integrated forest resource management. Prereq: Senior-level forest management or consent of instructor. Sp,A

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

550 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development 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

555 Forest Recreation Research Methods (3) Evaluation of research methodologies through readings and case studies; techniques of research resource monitoring and research investigation; current research trends in wildlife recreation. Prereq: 321 or equivalent and statistics. F,A

560 Industrial Forestry I (3) Economic structure of forest products industry. Identification and analysis of industry structure and markets, domestic and foreign. Current trends and rapid industrial structure; impacts on short term and strategic planning. Prereq: Senior-level forest management or consent of instructor. F,A

565 Industrial Forestry II (3) Evaluation of alternative strategies for firms in industry. Role of timber and timberland in integrated firm from standpoint of financial and strategic evaluations for different levels of self-sufficiency in auxiliary production. Topics include forest management and institutional arrangements affecting forest management and marketing strategies for private, industrial firms. Prereq: Senior-level forest management or consent of instructor. Sp,A

570 Management & Policy of Forest Resource Organization (3) Theory and application of management as applied to natural resource organizations: institutional direction and culture, and strategic management. Development of policy as planning tool and as results from conflict resolution. Linkage between policy development and execution, and structure and management of organizations. Prereq: Senior-level 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 analysis of silvicultural principles involved and tools used, prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, structure, growth yield. Prereq: Undergraduate silviculture or graduate course in silviculture or consent of instructor. 2 hrs and 1 lab. Sp,A

581 Cytogenetics (3) Chromosome structure and behavior during mitotic and meiotic divisions in relation to structural changes, genetic controls, hybridization, speciation, and polyploidy. Laboratory: normal and aberrant meiotic sequences and somatic chromosomes from plants and animals. Prereq: Biology 220 and at least 6 additional hrs in biological sciences. (Same as Botany 591.) Sp,A

585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory; fixed and variable plot sampling; list sampling; Poisson sampling; regression estimators; multistage and multiphase sampling. Growth and yield predictors for even-aged and uneven-aged stands. Prereq: Consent of instructor. F,A

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

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

Forestry, Wildlife & Fisheries

GRADUATE COURSES

410 Wildlife Habitat Evaluation and Management (3) Ecological relationships between wildlife and habitat. Evaluation, modeling, and management of wildlife habitat. Effects of land-use practices on wildlife habitat. Weekend field trips. Prereq: Principles of Wildlife and Fisheries Management or General Ecology. 2 hrs and 1 lab. F

416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildlife resource management. Emphasis on land management plans and analyzing case studies including conflict resolution. Applicable to majors in Forestry and in Wildlife and Fisheries Management. Prereq: Senior standing 1 hr and 2 labs. Sp

525 Management of Forestry, Wildlife and Fisheries Resources (2) Current technologies and management strategies concerning wise use of forestry, wildlife, and fisheries resources necessary for decision making and implementation. Prereq: 6 hrs of biological sciences or consent of instructor. Not available to students in forestry or wildlife and fisheries science. 4 hrs and 1 lab for six weeks. Sp

535 Environmental Impacts to Natural Ecosystems (3) Current environmental problems impacting natural ecosystems: climatic change, acidic deposition, air pollution, species declines, and introduction of exotic species. Management methodologies to mitigate environmental problems. Overnight field trips. Prereq: 416 or equivalent or consent of instructor. Sp

540 Seminar on Integrated Resources Management in Biosphere Reserves (2) MAB program, UNESCO-sanctioned global conservation initiative. Analysis of integrated resources management practices that demonstrate concept of sustainable development. Environmental policy and application of science to management practice. Sp

545 Population and Habitat Analysis (2) Detailed characterization, assumptions, and current technologies for wildlife and fisheries science

440 Wildlife Techniques (2) Methods of wildlife damage control, forest, farmland, wetland wildlife habitat management, identification of wildlife field sign, wildlife capturing techniques and management plan preparation. Weekend field trips. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

442 Fisheries Techniques (2) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques; age determination and incremental growth analysis; stream assessment; equipment and instrumentation usage and maintenance; and 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: Forestry, Wildlife and Fisheries 317 or Biology 230, and 6 hrs of mathematics. 2 hrs and 1 lab. Sp

444 Ecology and Management of Wild Mammals (3) Biology, behavior, and ecological characteristics of game mammals and endangered mammals. Current principles and practices of wild mammal management. Prereq: Forestry, Wildlife and Fisheries 317 or Biology 230. 2 hrs and 1 lab. One weekend field trip. Sp

445 Ecology and Management of Wild Birds (3) Biological and ecological characteristics of game birds, endangered birds, and bird pests. Current principles and practices of wild bird management. Prereq: Forestry, Wildlife and Fisheries 317 or Biology 230. 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 student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

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

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

530 Wildlife Diseases (2) Necropsy of birds and mammals. Description of various diseases and techniques of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr biology, 444 or 445, or consent of instructor. (Same as Environmental Practice 530.) Sp

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

99 Forestry, Wildlife and Fisheries
Geography

(College of Liberal Arts)

MAJOR

DEGREES

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

Sidney R. Jumper, Head

Professors:

Aiken, Charles S., Ph.D........................................ Georgia

Bell, Thomas L., Ph.D........................................ Iowa

Forest, Ronald, Ph.D......................................... Rutgers

Hammond, E. H. (Emeritus), Ph.D........................ California

Jumper, Sidney R. (Liaison), Ph.D. .......... Tennessee

Long, Robert G. (Emeritus), Ph.D. ......... Northwestern

Minkel, C. W., Ph.D........................................ Syracuse

Paladun, C. T. (UTSI), Ph.D............................... Denver

Ralston, Bruce, Ph.D........................................ Northwestern

Schmudder, Theodore H., Ph.D. ............ Wisconsin

Wilbanks, T. J. (Adjunct), Ph.D..................... Syracuse

Associate Professors:

Blasing, T. J. (Adjunct), Ph.D....................... Wisconsin

Brinkman, Leonard W., Jr., Ph.D. .......... Wisconsin

Brown, Marilyn (Adjunct), Ph.D.............. Ohio State

Pulsipher, Lyda, Ph.D................................. Southern Illinois

Rehder, John B., Ph.D................................. Louisiana State

Assistant Professors:

Harden, Carol P., Ph.D................................. Colorado

Horn, Sally P., Ph.D..................................... California

Liu, Cheng (Adjunct), Ph.D......................... Tennessee

McKown-Ice, Rosalyn (Adjunct), Ph.D. .... Oregon

The department offers the Master of Science and Doctor of Philosophy degrees. The Master's degree emphasizes development of professional competence as a geographer and offers opportunities to gain substantial depth in a concentration or a major technique. An emphasis in geographic information systems is available for students who have appropriate backgrounds in mathematics and computer science. The doctoral program is for those who have demonstrated proficiency in conducting independent research. The department is particularly well-qualified to direct research in geography of the natural environment (biogeography, biological conservation, geomorphology, spatial analysis (especially transportation and location analysis), Latin America, the American South, and urban geography. Graduation requirements include nonmetropolitan areas, land use, urban geography, transportation geography, geography of resources, geography of development, and regional and historical geography of the United States.

THE MASTER'S PROGRAM

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

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those who demonstrate proficiency in conducting independent research. Students must have a broad foundation and understanding of the discipline; these should have been achieved in a comprehensive Master's program. Course requirements for the degree shall be determined by the student's faculty committee in accordance with specific interests and needs. The program must include 504, 515, 599, 9 hours of 600-level seminars, and (at each offering during residency) 501. A minimum of 12 hours must be earned in related fields outside the department. Competence in cartography and quantitative techniques is required. Additional tools, including languages, will be required as appropriate to the student's areas of research specialization. Examinations required for admission to candidacy include a written comprehensive; written examinations on two special fields; and an oral examination on the student's program, the special fields, and the dissertation proposal. Also required is a final oral examination on the dissertation and on other aspects of the program as determined by the student's doctoral committee.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

411 Computer Mapping and Geographic Information Systems (3) Concepts, management, and presentation of digital data for spatial analysis, cartographic data structures. Prereq: 310 and knowledge of computer language or consent of instructor. 2 hrs and 1 2-hr lab.

412 Cartographic (3) Cartographic techniques applied to design, compilation, and reproduction of maps and other graphics. Prereq: 310 or consent of instructor. 2 hrs and 1 2-hr lab.

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

415 Quantitative Methods in Geography (3) Geographical application of statistical techniques, point pattern analysis, and analysis of areal units. Prereq: Mathematics 115 or two semesters of calculus or consent of instructor.

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

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

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

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

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

436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues from physical and economic geographical perspectives. Prereq: Geography of the Natural Environment or Meteorology or consent of instructor.

439 Plant Geography of North America (3) Characteristics and distribution of major plant communities of Canada, the U.S., Mexico, and Central America. Relationships to climate, soil, fire, and human disturbance. Long-term history and future prospects. Prereq: Coursework in geography or botany or consent of instructor.

441 Urban Geography (3) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities. Prereq: 101-02 or 141 or 340 or consent of instructor. (Same as Urban Studies 441.)

443 Rural Geography (3) Geographical appraisal of rural areas of the United States: small towns and urban fringes. Problems and potentials of rural America. Prereq: 101-02 or 141 or 340 or consent of instructor.

445 Geography of Resources (3) Study of factors related to variations in resource availability from time to time and place to place; energy and metallic resources. Prereq: 101-02 or 141 or 340 or consent of instructor.

449 Geography of Transportation (3) Examination of transportation systems, their effects on trade patterns, land use, location problems, and development. Prereq: 141 or 340 or consent of instructor.

500 Process Geomorphology (Same as Geology 450.)

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

501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and general topics. Registration required of resident graduate students whenever offered. May be repeated. Maximum 4 hrs. May be applied toward graduate degree. S/NC only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or