The program leading to the M.A. is a general curriculum that allows for concentration after completion of a core course sequence. Formal requirements include:

1. Selection of an M.A. advisor. This should be done as soon as possible in the student's program but must be done no later than the end of the first semester in residence. The departmental graduate secretary must be informed in writing of each student's advisor.
2. A minimum of 30 credit hours in graduate courses. Twenty-four hours must be in coursework graded A-F. Coursework must include at least three core classes taken in the first year:
   a. 510 Method and Theory in Cultural Anthropology
   b. 560 Theory in Archaeology
   c. 590 Method and Theory in Biological Anthropology

Additional coursework should be selected in consultation with the student's advisor and must include one additional course from two anthropology concentrations besides the student's primary concentration. At least 20 hours of coursework must be at the 500 level or higher.

3. During the first year, comprehensive Graduate Evaluation Examinations (GEEs) are required of all M.A. students and are based on the content of the core courses. These examinations are given as the final examination in each core class (during regularly-scheduled final periods) and are graded by all faculty within the appropriate subspecialty for each course. At the end of the first year, all M.A. students will be evaluated by the entire faculty and will either be retained or dropped from the program based on their first year's performance and GEE scores.

4. All M.A. students must attend the graduate section of the visiting lecturer program. To ensure compliance with this requirement, each student is required to register for one credit hour of Anthropology 501 in the Fall semester of each year and fulfill all requirements for the course defined by the instructor. Materials covered by visiting lecturers may appear on the GEE.
5. A graduate-level introductory statistics course, usually Statistics 537.
6. In the second year of the program, students pursue their concentration area and undertake thesis research. Coursework will be determined through consultation with the student's advisor and departmental committees (composed of the advisor and at least one other member of the Anthropology faculty along with another mutually-agreed-upon member).
7. Successful completion of the thesis and final oral examination. Normally, students will complete and defend their theses during the Spring semester of their second year.
8. Two copies of the thesis are required by The Graduate School. In addition, bound copies of the thesis are to be provided to the department and to all members of the student's M.A. committee.

THE DOCTORAL PROGRAM

An incoming student should possess an M.A. in Anthropology. Students with an M.A. in another discipline may be admitted after completing specific requirements outlined in the departmental brochure. In addition to the requirements prescribed by The Graduate 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 a 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. Students electing this alternative should consult with their advisor.
   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 or Mississippi (concentration in zoological/archaeological only), Virginia (concentration in zooarchaeology or cultural anthropology), or West Virginia. The Ph.D. program is available to residents of Alabama, Arkansas, Louisiana, Mississippi, or West Virginia. Admission requirements are obtained from the Admissions Specialist 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 ethnographies. 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 Linguistics 200. (Same as Linguistics 411.)
412 Folklore in Anthropology (3) Introduction to anthropological study of folklore, using folklore and folklife materials from various tribal, peasant, and complex societies. Prereq: 130 or consent of instructor.
413 Dynamics of Culture (3) Major forms of cultural change, ranging from evolution and diffusion to religious, cultural, and political revolt. Continuity and change in diverse cultural settings through use of anthropological, ethnographic, and contemporary cases. Prereq: 130.
414 Political Anthropology (3) Organization and dynamics of power and politics in both stateless and state-level societies. Role of symbols, rituals, and ideologies in producing and reproducing power relations. Prerequisite: 130.
431 Ethnographic Research (3) Conceptual and practical exploration of methods and techniques cultural anthropologists use in fieldwork. Prereq: Cultural Anthropology or consent of instructor.
435 Historical Archaeology Laboratory (3) Laboratory procedures for processing, identification, and interpretation of artifacts from prehistoric sites. Artifactual material from historic East Tennessee sites used for class projects. Recommended prereq: Historical Archaeology.
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, 140, or consent of instructor.
461 African Prehistory (3) African cultural history from earliest evidence of human activity to time of European contact. Stone age of Africa south of Sahara. Prereq: 120 or consent of instructor. (Same as Afro-American Studies 461.)
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 economic to rise of States. Mesolithic, Neolithic, and Metal Age lifeways in Africa, Europe, and Asia. Prereq: 120 or consent of instructor and consent of instructor.
464 Principles of Zooarchaeology (3) Basic osteological studies of major vertebrate groups; analysis of fauna and flora in subsistence and culture. Identification and interpretation of archaeologically defined mammalian and faunal remains; introduction to comparative collections. Prereq: 120 or consent of instructor.
465 Urban Archaeology (3) Field archaeology and interpretation of archaeological remains on historic urban sites in the U.S. Lectures and field and laboratory research on urban sites in East Tennessee. Recommended prereq: Historical Archaeology.
480 Human Osteology (4) Intensive examination of human skeleton. Prereq: 110 and consent of instructor. 3 hrs and 1 lab.
481 Museology I: Museums, Purpose and Function (3) (Same as Art 481.)
482 Museology II: Exhibition Planning and Installation (3) (Same as Art 482.)
484 Museology III: Field Projects (1-12) (Same as Art 484.)
494 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 ethology. Prereq: 110 or consent of instructor.
500 Thesis (1-15) P/NP only. E

501 Graduate Research (1-15) Independent investigation of special problems in anthropology. May be repeated. Maximum 18 hrs.

502 Registration for Use of Facilities (3-15) Required for students who are otherwise registered during any semester when students use 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

510 Method and Theory in Cultural Anthropology (3) Development of primary theoretical orientations by cultural anthropologists; formulation of research problems and methods of data organizing, and utilizing data. Prereq: Consent of instructor.

511 Special Topics in Cultural Anthropology (3) Seminars for advanced students on special interest: ethnolinguistic, psychological anthropology, 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 in nonacademic settings.

514 Anthropology of Development (3) Application of anthropological theory, methods, and findings to community and national development programs. Analysis of anthropological cases, issues, and ethics issues in selected case studies. Survey of anthropologists' work in non-academic settings.

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 prereq: Basic nutrition course.

517 Forms of Social Inequality (3) Anthropological perspectives on societies stratified along lines of rank, caste, race, class, and other social attributes. Emphasis on sex role structure. Construction of social distinctions before and after slave and integration of modern world systems. Intersections of race and ethnicity with class and gender.

520 Seminar in Zoosearchology (3) Approaches to and analysis of archaeological faunas. Intensive reading; evaluation and discussion of major faunal studies, guides to identification, methods of presenting faunal data. May be repeated. Maximum 6 hrs.

521 Laboratory Studies in Zoosearchology (3) Examination and comparison of skeletons of major vertebrate groups, shells of terrestrial and aquatic molluscs, in relation to understanding faunas from archaeological contexts. Basic osteology and shell characters of species encountered in archeological sites. Use of comparative collections. May be repeated. Maximum 8 hrs.

522 Seminar in Archaeology (3) Theoretical and practical issues in comparative archaeology: ethnoarchaeology, paleoethnobotany, taphonomy, ceramic analysis, agricultural origins, and regional archaeological cultures. May be repeated. Maximum 8 hrs.

530 Fieldwork in Archaeology (3-9) Practicum in surveying, excavating, processing, and analyzing archaeological data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

531 Quantitative Methods in Archaeology (3) Application of quantitative techniques to archaeological data critically examined through literature and problem solving. Basic and advanced statistical analyses and other mathematical methods. Prereq: Consent of instructor.

540 Theory in Archaeology (3) Detailed consideration of theories of theory in contemporary archaeology: models of scientific explanation, research design, archaeological formation processes, and methods of analysis and interpretation.

541 Archaeological Resource Management (3) Federal legislation and regulations affecting identification, protection, and management of archaeological resources. Professional ethics and responsibilities and relationship to federal and state agencies, public interest groups, and professional archaeologists in conduct of federally sponsored archaeology. Prereq: May be repeated. Maximum 8 hrs.

542 Problems in Old World Archaeology (3) (Same as Classics 562.)

543 Lithic Artifact Analysis (3) Methods for analyzing prehistoric stone tools in practical laboratory format. Stone tool production, use, stylistic variability, and discard processes.

544 Archaeology of Southeastern United States (3) Archaeological research on prehistoric Indian cultures in Southeastern United States; Tennessee prehistory.

545 Advanced Human Variation (3) Genetic and morphological variation among extant human groups; relationships of variation to geography, ecology and subsistence.


548 Skeletal Biology (3) Practical and theoretical approaches to analysis of prehistoric human skeletal remains. Osteology, vital statistics, pathology, nutrition, and measures of biological relationships as related to population as adaptive unit. Prereq: 480.

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

550 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.

551 Laboratory in Forensic Anthropology (3) Discussion of 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.

552 Anthropological Genetics (3) Application of population genetics and quantitative genetic theory to study of human and nonhuman primate populations. Prereq: Consent of instructor.

553 Method and Theory in Biological Anthropology (3) Current methods of analysis in biological anthropology and of past and current history of theoretical perspectives. Paleoanthropology, human osteology, and human variation and population structure. Prereq: Consent of instructor.

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

555 Off-Campus Study (1-18) See College of Arts and Sciences.

556 Independent Study (1-15) P/NP only. E

601 Advanced Graduate Research (1-5) 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.

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 Paleopathology (3) May be repeated. Maximum 6 hrs.

695 Gross Human Anatomy (3) Skeletal, muscular, 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

Marleen K. Davis, Dean
William J. Lauer, Associate Dean
Jon P. Coddington, Graduate Program Head

Professors:
Anderson, G. I., M.Arch......................... Illinois
Coppola, G. (Emeritus), B.Arch............... Harvard
Davis, Marleen, M.Arch......................... Pennsylvania
Greig, F., M.Arch............................... Pennsylvania
Kelso, R., M.S................................. Tennessee
Kerns, J. A., M.S................................. California
Kinzy, S. P., Ph.D.............................. SUNY (Buffalo)
Lauer, W. J. (Liaison), M.Arch.Engr......... Iowa State
Leser, A. J., M.Arch............................. Virginia
Lizon, Ph. D................................... Pennsylvania
Moffett, M. S., Ph.D............................. MIT
Robinson, M. A., M.Arch....................... Pennsylvania
Rudd, J. W. M. A............................... Northwestern
Shel, W. S., M.S.Arch......................... Columbia
Watson, J. S., M.Arch........................... Pennsylvania

Associate Professors:
Coddington, J. M., M.Arch..................... Pennsylvania
Davis, T. K., M.Arch........................... Cornell
Herz, M. D., B.Arch............................ Columbia
Kaplan, M., M.Arch............................ Harvard
Martella, W. E., B.Arch....................... California
Reabon, J. S., M.A............................. Texas
Yates, S., M.F.A............................... North Carolina (Greensboro)

Assistant Professors:
Fox, L. D., M.Arch............................... Cranbook
French, R. C., B.Arch......................... Tennessee
Livingston, M., M.F.A............................ Wisconsin
Moore-Cleary, T. W., M.Arch................. Michigan
Morton, P., Ph.D............................... Pennsylvania
Ware, M., M.F.A............................... Tennessee

MARTER 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 first-professional degree who seek to develop an area of specialization.

Admission Requirements

In addition to meeting the Graduate School's minimum requirements, the following specific admission requirements to the Master of Architecture program must be met.

For Track 1 applicants, a bachelor's degree with a 3.0 GPA from a regionally accredited college of university is required. International applicants must have an equivalent 4-year degree and a 3.0 GPA. Candidates with a GPA less than 3.0 may be considered for conditional admission when evidence of exceptional promise is identified. Undergraduate work must include at least twelve semester hours of humanities, a basic understanding of physical principles, systems and analytical procedures and an understanding of mathematical principles and analytical procedures, as well as a general understanding of the use of computers. 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 those applicants from accredited 4+2 architecture programs, a portfolio is required in addition to the above requirements.

For Track 2 applicants, a Bachelor of Architecture degree from an NAAB accredited program, or foreign equivalent. Candidates with a GPA less than 3.0 may be considered for conditional admission when evidence of exceptional promise is identified. Submission of a portfolio with a separate application to Architecture to include an essay and three letters of recommendation are also required. A personal on-site interview is desirable but not mandatory.

The general portion of the Graduate Record Examination is required of all applicants. Applicants should take the GRE at least one semester in advance of application for admission.

Degree Requirements

Track 1 requires a minimum of 42 semester hours of undergraduate preparation and 60 semester hours of graduate coursework, taking approximately 3 1/2 years of full-time study. A minimum of 40 semester hours of architecture electives or approved electives from another discipline must be taken at the 500 level or above.

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 Graduate Program Head. 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 M.Arch degree in Architecture is available to residents of the state of Kentucky. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

403 Introduction to Preservation (3) History, theory, and social 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.

406 Ideas in Architecture (3) Historical and critical review of major ideas of architecture through the ages. Open to all students.

409 Cultural Comparison of Housing Patterns (3) Patterns of spatial organization and design elements of design for specific cultures with emphasis on housing, cultural, social, economic, climatic, and technical forces influencing forms.

410 History and Theory of Urban Form (3) Patterns of community development and design. Selection of historical and contemporary examples. Basic urban issues and exemplary design approaches through lectures, readings, essays, and sketch. Historical change in urban form and design.

412 Non-Western and Indigenous Architecture (3) Building responsive to climate, material availability, and economic level, as designed by anonymous builders. Prehistoric times to present. Eastern Places; East Asia; East Indies; India; Egypt; Greece; Rome; Byzantine; Islam; Islamic architecture.

413 Tennessee Architecture (3) History of settlement patterns and building in Tennessee. Reading assignments, lectures, discussions, and field trips. Historical change in urban form and design.

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

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


417 The International Style (3) Survey of architecture of early modern movement, primarily in Europe and America, 1900-1940.


420 American Architecture II (3) Stylistic periods from Gothic Revival through thirteenth 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 European Architecture (3) Twentieth century architecture in Russia, Czechoslovakia, Poland, Hungary, East Germany, Romania, Bulgaria, Yugoslavia.

423 Special Topics in Architecture (1-4) Individual projects under faculty direction. Credit may be repeated for a maximum of 6 hours. E

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


445 Advanced Lighting (3) Analysis and application of systems for the control of lighting. Prereq: 444.

451 Thesis (1-15) Required only. E

502 Registration for Use of Facilities (3-15) Required only. E


562 Professional Practice (3) Management and organization of architectural work. Readings and discussions related to management of architectural enterprises.

591 Graduate Seminar: Ethics (3) Professional ethics and responsibilities. Attitudes, values, and ideas that address formation of professional ethics.

592 Architectural Theory and Practice (3) Historical and contemporary critical theory. Readings and related examples. Methods and techniques of architectural theory.


Art (College of Arts and Sciences)

MAJOR DEGREE
Art ........................................ M.F.A.

Norman Magden, Head
William C. Associate Head

Professors:
Blain, Sandra J., M.F.A. ..................... Wisconsin
Brakke, P. M., M.F.A. ............... Yale, M.F.A.
Clarke, R. A. (Emeritus), M.S. ............. Wisconsin
Cleaver, Dale G. (Emeritus), Ph.D........... Chicago
Daehnert, R. H., M.F.A. .................. Wisconsin
Fallsetti, Joseph S., M.S. ................. Ohio State
Goldenstein, M. B., M.F.A. .......... Nebraska
Kennedy, William C., M.F.A. .......... Wisconsin
Lee, B., M.F.A. ....... Yale
Leland, W., E, M.F.A. .................. Tennessee
Livingston, P. R., M.F.A. ............. Wisconsin
Magden, Norman, Ph.D. Case Western Reserve
Martinson, Fred, Ph.D. ......... Chicago
Nichols, P. G., 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:
Darrow, J. F., Ed.D. ............. Illinois State
Habel, Dorothy, Ph.D. ............. Michigan
LeFevre, Richard, M.F.A. .......... Rochester IT
Longobardi, Pam (Liaison), M.F.A. ....... Montana State
Lyons, B., M.F.A. ................... Arizona State
Metros, Susan E., M.F.A. .......... Michigan State
Moffatt, F., Ph.D. ............ Chicago
Neff, A., Ph.D. .......... Pennsylvania
Saucé, Ted C., M.F.A. ......... Georgia State
Staples, Carolyn, M.F.A. ........... Michigan State
Wilson, D., M.F.A. .......... California (San Diego)

Assistant Professor:
Brogdan, Sally B., M.A. ....... Penn 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 may petition to take 3 hours of outside academics as a substitute for 3 hours of art history or 3 hours of concentration area. The petition will be presented to the graduate committee for final approval and should directly address the need and relevance of the substitution to the student's concentration.
6. Four semesters (normally the first 40 hours) beyond the Bachelor's degree are required in residence. An exception is made for working professional designers who may complete their first 20 hours, with the permission of the faculty, on a part-time basis at home, 6 hours per semester, or dismissal. 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 Admissions Specialist 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 technological innovations. Prereq: 426. May be repeated. Maximum 6 hrs.
411 Drawing IV (6) Individualized pursuit of personal drawing techniques and concepts, supplemented by individual and group critique. Prereq: 211. 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.
422 Ceramics: Advanced Projects (3-6) Development of a personal project using specific material or technique. Prereq: 421. May be repeated. Maximum 12 hrs.
425 History of Ceramics Seminar (3) Ceramics from ancient through contemporary; Ceramics sculpture, and...
vessel aesthetic. Slide lectures and individual presentations. May not be used toward art history requirement. Prereq: 231 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.

448 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.


452 Advanced Graphic Design II (3) Advanced investigation into visual systems and their impact on visual designs. Prereq: 451.

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 experience with design or illustration field. Only by prearrangement with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hrs.

457 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.

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

461 Intaglio II (3-6) Individual projects through advanced color printing methods and techniques. Prereq: 362. May be repeated. Maximum 12 hrs.

462 Intaglio III (3-6) Individual projects through advanced color printing methods and techniques. Prereq: 362. May be repeated. Maximum 12 hrs.

463 Lithography III (3-6) Individual projects through advanced color printing methods and techniques. Prereq: 362. 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 1900.

472 History of 20th-Century American Art (3) Development in architecture, painting, and design from 1900.

473 19th-Century American Painting (3) From West and Copley to emergence of "The Eight."


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, making and framing, shipping and storage. Prereq: 481 or consent of instructor. (Same as Anthropology 482.)

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

486 History of Printmaking (3) 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 (Concentration in individually selected areas. Art history and consent of instructor. May be repeated. Maximum 6 hrs.

494 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 not otherwise registered during any semester when the student uses University facilities and/or expects to be on campus before degree is completed. May not be used toward degree requirements. May be repeated. S/C only. E

511 Graduate Drawing I (2-6) May be repeated. Maximum 10 hrs.

512 Graduate Drawing II (2-6) May be repeated. Maximum 10 hrs.

513 Graduate Painting I (2-6) May be repeated. Maximum 10 hrs.

514 Graduate Painting II (2-6) May be repeated. Maximum 10 hrs.

515 Graduate Watercolor I (2-6) May be repeated. Maximum 10 hrs.

516 Graduate Watercolor II (2-6) May be repeated. Maximum 10 hrs.

521 Graduate Ceramics (2-6) May be repeated. Maximum 10 hrs.

525 Graduate Ceramics II (2-6) May be repeated. Maximum 10 hrs.

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

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

550 Studies in Graphic Design/Illustration History (3) Design and illustration history: 1850 to present. Prereq: M.F.A. candidate or consent of department. May be repeated. Maximum 6 hrs.

551 Graduate Graphic Design/Illustration I (2-6) May be repeated. Maximum 10 hrs.

552 Graduate Graphic Design/Illustration II (2-6) May be repeated. Maximum 10 hrs.

553 Graduate Graphic Design/Illustration III (2-6) May be repeated. Maximum 10 hrs.

555 Graduate Graphic Design/Illustration IV (2-6) May be repeated. Maximum 10 hrs.

556 Studies in Asian Art (3) Selected topics in Asian art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

571 Studies in Medieval Art (3) Art and architecture of Middle Ages: major monasteries from Byzantium or western Europe. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

572 Studies in Italian Renaissance Art (3) Art and architecture of 14th- and 15th-century Italy. Early High Renaissance or Mannerist periods. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

573 Studies in Baroque Art (3) 17th-century art and architecture: major artists and works from southern or northern Europe. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

574 Studies in Modern Western Art (3) Selected topics in 19th- and 20th-century western art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

575 Studies in Modern American Art (3) Selected topics in 19th- and 20th-century American art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

576 Studies in Asian Art (3) Selected topics in Japanese or Chinese art. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

579 Special Topics in Art History (3) Student- or instructor-initiated course offered at convenience of department. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

490 Wood (2-4) Intermediate to advanced. May be repeated.
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 pathology, audiology, speech science, or hearing science. This degree program is research oriented, with primary emphasis upon developing the scientific and cognitive skills which allow individuals to identify and independently study important questions concerning the human act of oral and aural communication. Students will be expected to demonstrate their knowledge in the areas of:

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

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

The total program is a minimum of 60 semester hours, including a minimum of:

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
e. 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, Kansas, Kentucky, or West Virginia. Additional information may be obtained from the Admissions Specialist 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 (1-15) Prereq: Speech and Language Development, Articulation Disorders, or consent of instructor.

434 Clinical Practice in Speech-Language Pathology II (1-14) Prereq: 433 and consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval.


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

461 Introduction to Language Pathology in Children (3) Nature, etiology and treatment of language retardation in children; observations of language therapy. Prereq: 320 or consent of instructor.

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

473 Audiology II (3) Basic principles of clinical audiology; pure tones, speech, masking and overview of special auditory tests. Prereq: 371.

494 Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification components, auditory training, auditory feedback, auditory perception, speech reading, parent-child, preschool school years of children, communication impairment/mediation/remediation of adults, effects of aging/rehabitation on the elderly, case studies. Prereq: Phonetics and Acoustics of Speech and 473, or equivalents or consent of instructor.

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

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

504 Appraisal of Speech and Language Disorders (3) Diagnostic procedures for childhood and adult speech and language problems including observation and practical with diagnostic tests. Prereq: Communication Disorders, Phonetics and Audiology of Speech, and 433, or equivalents or consent of instructor.

506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role in speech and language. Prereq: 305.

507 Anatomy and Physiology of Hearing (3) Structure and function of the peripheral and central auditory system and their roles in mediating auditory processes. Prereq: 473 or equivalent or consent of instructor.

511 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, fundamentals of statistics, application of statistics, and completion of a proposal and hypothetical pilot research project.

512 Clinical Practice in Audiology (1-4) Prereq: 473 and 494. May be repeated. Maximum 9 hrs.

513 Clinical Practice in Audiology: Off-Campus Sites. (1-4) Prereq: Consent of instructor.

514 Practicum in Verbo-Tonal Habilitation (1-4) Prereq: 494, 595, or consent of instructor. May be repeated. Maximum 6 hrs.

515 Practicum in Aural Rehabilitation (1-4) Prereq: 473 and 494. May be repeated. Maximum 6 hrs.

517 Instrumentation in Audiology and Speech Pathology (3) Principles of instrumentation in audiology and speech pathology, laboratory assignments for familiarization of students with instrumentation for measuring speech and hearing processes.

520 Aphasia (3) Historical review of aphasia literature, theories of brain functioning, aphasic classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 306 or equivalent or consent of instructor.

522 Seminar: Articulation and Voice Disorders (3) Current research in diagnosis and management of articulation and voice disorders. Prereq: Undergraduate courses in articulation and voice disorders or consent of instructor.
531 Seminar on Stuttering (3) Current significant research in stuttering. Prereq: 431 or consent of instructor.

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

535-36-37 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-4, 1-4, 1-4) Prereq: 433 or equivalent experience, consent of instructor. May be repeated. Maximum 6 hrs each. Enrollment for less than 2 semesters must have prior departmental approval.

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

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

540 Structural Speech Disorders (3) Etiology, diagnosis and management of cranial facial speech disorders and laryngology. Prereq: 506, 531.

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

543 Amplification Technology (3) Description of hearing aid components, circuits, components and performance characteristics. Electroacoustical and real ear analysis of hearing aids. Prereq: 473 or equivalent or consent of instructor.

544 Amplification for the Hearing-Impaired (3) Speech audiometry/psychoacoustics, influence of noise, reverberation and auditory pathology on speech perception. Strategies for selecting amplification. Psychological considerations in orientation and counseling. Dispensing models. Prereq: 473, 507, and 543 or equivalents or consent of instructor.

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

546 Advanced Audiology (3) Theoretical bases for behavioral audiometry and acoustic immittance measurement. Prereq: 473 or equivalent or consent of instructor.

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

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

549 Hearing Science (3) Study of psychoacoustic phenomena and their relation to perception and diagnostic audiology. Prereq: 473, 507, and 548 or equivalents or consent of instructor.

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

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

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

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

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

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

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

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

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

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

582 Speech and Language Services in School (3) Organization and utilization of speech and language programs in schools. Prereq: Consent of instructor.

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

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

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

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

595 The Verbotonai System: Auditory/Speech Perception (3) Innovative theory, therapy procedures, and SUIAVG amplification/filters for diagnosis/evaluation/remediation of spoken language/listening skills of hearing-impaired children/adults; use of NCTM; movements and suprasegmentals; special audiometric tests, acoustic filters, correcting misarticulations through optimal listening/central auditory treatment; second foreign language through learning/spoken language; clinical application of concepts to conventional practice; student research reports. Prereq: Phonetics and Acoustics of Speech, 473 and 494 or equivalents or consent of instructor.

596 Doctoral Research and Dissertation (3-15) F/N only. E

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


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

607 Advanced Anatomy and Physiology of the Ear (3) Anatomy and physiology of the ear and the nervous system. Prereq: Consent of instructor.

609 Seminar in Hearing Science (2) Advanced study of perception of non-speech acoustic signal, detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 462 or consent of instructor. May be repeated. Maximum 6 hrs.

610 Seminar in Hearing Science (2) Advanced study of perception of non-speech acoustic signal, detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 462 or consent of instructor. May be repeated. Maximum 6 hrs.

611 Experimental Design in Speech and Hearing (2) Analysis of experimental design in research on speech and hearing. Prereq: Consent of instructor.

650 Advanced Seminar in Audiology (2) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

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

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

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

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

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

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

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

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**Aviation Systems**

**MAJOR**

**DEGREE**

**AVIATION SYSTEMS**

**M.S.**

**R. D. Kimberlin, Program Chair**

**Professors:**

Collins, F. G., Ph.D. .................................. California

Harrison, A. A., Ph.D. .......................... Tennessee

Wu, J. M., Ph.D. .............................................. Cal Tech

Young, R. L. (Emeritus), Ph.D. ................. Northwestern

**Associate Professors:**

Kimberlin, R. D. (Liaison), Ph.D. .......................... RWTH (Germany)

Soles, U. P., Ph.D. ............................... Tennessee

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The University of Tennessee Space Institute offers a program leading to the Master of Science degree with a major in Aviation Systems. The Aviation Systems program is designed for those who possess a Bachelor’s degree in engineering or science and wish to study under a “system philosophy” toward careers in research and development or administration in areas pertinent to aviation. Curriculum emphasis includes flight testing, aircraft design, aviation meteorology, air traffic control, and airport management.

To qualify for admission to the program, the applicant must possess a Bachelor’s degree in engineering or science from an accredited institution, show evidence of aptitude to pursue and benefit from the program, and fulfill The University of Tennessee Graduate School admission procedures and grade-point standards. It is expected that the student will have a basic knowledge of computer utilization and statistics; an understanding of aerodynamic fundamentals, aircraft propulsion, and performance; and some understanding of economics. Both thesis and non-thesis programs are available. The thesis program involves a minimum of 30 semester hours credit while the
non-thesis program involves a minimum of 33 semester hours credit.

**THESS OPTION**

The thesis program involves satisfactory completion of the following requirements:

**Research and Development Specialization**
1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering (engineering management).
3. Six hours in economics or finance.
4. Six hours of electives 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.

**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. Twelve 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.

**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. 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.

**Biochemistry**

**THEss 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 physiologgy.
3. Biochemistry 511-12 and 515-16.
4. At least 8 hours of advanced seminar courses from the following: 601, 603, 604, 605, 606.
5. Six hours of master's research and a thesis.
6. A final examination that covers both the thesis endeavor and the subject matter of the course requirements.

**THE DOCTORAL PROGRAM**

1. Introductory Organic Chemistry*, Introductory Physics*, Differential and Integral Calculus*, approved physical chemistry, and at least 12 hours of biology beyond the introductory level and including the subject areas of genetics and physiology.
2. Biochemistry 511-12 and 515-16.
3. At least 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 8 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.

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 Biochemistry is available to residents of the state of Kentucky. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

410 Cellular and Comparative Biochemistry
- Electrophoretic behavior; chemistry and structure of proteins; enzyme activity; and function; cell energy capture; synthetic metabolism; nucleic acid function; protein synthesis; and biochemical genetics; regulation of biochemical processes. Prereq: Chemistry 500-506 and Biology 110-20. 3 hrs and 1 discussion. F, Sp

411 Advanced Concepts in Protein Structure, Protein Function and Intermediary Metabolism
- Protein structure and dynamics; regulation of enzyme activity; intermediary metabolism; membrane structure and function. Prereq: 410, 420 or consent of instructor. May be repeated. Maximum 9 hrs. F, Sp

500 Thesis
- May be repeated. Maximum 12 hrs. E

502 Registration for Use of Facilities
- 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. Maximum 12 hrs. E

511 Advanced Concepts in Protein Structure, Protein Function and Intermediary Metabolism
- Protein structure and dynamics; regulation of enzyme activity; intermediary metabolism; membrane structure and function. Prereq: 410, 420 or consent of instructor. 3 hrs and 1 discussion. F

512 Advanced Molecular Biology
- Replication, repair, transcription, translation and control mechanisms. Prereq: 511 or Life Sciences 511. 3 hrs and discussion. (Same as Life Sciences 512.) Sp

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

516 Experimental Techniques II (3) Laboratory rotations. Student works in laboratory of faculty member on clearly defined research project. Prereq: consent of instructor. 3 hrs and discussion. (Same as Life Sciences 515.) Sp

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

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

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

601 Advanced Biochemistry Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. Prereq or coreq: Consent of instructor. F, Sp

603 Current Topics in Biochemistry (1) Seminars and lectures dealing with current advances in field of chemical biology. Required every semester in residence. Prereq or coreq: Consent of instructor. 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. Prereq: 511 or consent of instructor. May be repeated. Maximum 12 hrs. F, Sp

605 Current Topics in Research on Protein Function (1) Covalent modifications of proteins by phosphorylation-dephosphorylation allosteric interactions. Prereq: 410 or equivalent. Maximum 12 hrs. F, Sp

606 Current Topics in Biological Membrane Research (1) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. F, Sp

621 Advanced Topics (1-3) Ecological, biochemical and biophysical mechanisms of membranes, membrane structure and function, metabolic regulation, physical biochemistry. Prereq: 511-12 or consent of instructor. Maximum 9 hrs. F, Sp

622 Advanced Topics in Biochemical and Biophysical Methods (1-3) Biochemical and biophysical techniques. Prereq: 511-12 or consent of instructor. Maximum 9 hrs. F, Sp

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

Assistant Research Professor:

Hauser, Loren, Ph.D. Califormia (Irvine)

Shared faculty are drawn from the Oak Ridge National Laboratory.

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

The program of study, which incorporates a high faculty-to-student ratio, is based on intensive graduate courses supplemented by tutorial instruction, participation in a wide variety of seminars, and a heavy emphasis on communication 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 biomedical sciences as a whole; and (3) experience and training in a chosen specialty.

The concentration areas available for master's thesis and Ph.D. dissertation are biochemistry, biophysics, carcinogenesis, genetics, cellular, developmental, and mammalian genetics, and radiation biology. Included are subjects such as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation and environmental biology, virology, development, experimental pathology, microbial and mammalian genetics, mutagenesis, structural biology, and genomic analysis.

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, chemistry, 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 the Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, 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); Calculus for the Life Sciences (525); and Statistics for Biologists (574).

2. Three semesters of Biomedical Sciences Laboratory (531-32-33).

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 qualified and as space is available. The requirements for the degree are:

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

Additional credits may be obtained (5 to 15 hours) with electives.

2. Thirty hours of approved graduate courses including 6 hours for thesis.

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

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

5. A thesis reporting results of original and significant scientific research.

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. S/NC only. E

507 Physical Chemistry (3) Thermo-dynamics; phase equilibria; chemical equilibria; electrostatic forces; surface chemistry; electrolyte solutions; kinetics; conductance; viscosity; diffusion.


514 Biophysical Biochemistry (3) Chemistry; metabolism and biosynthesis of purines, pyrimidines and nucleic acids; biosynthesis of DNA, RNA, and proteins. Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecules in solutions; molecular solution; molecular conformations; inter- and intramolecular forces; principles of microscopy. Prereq: 511.

515 Genetics (3) Mendelian genetics, mitosis and meiosis; transmission genetics; mapping and linkage; genetics of phage, bacteria, protozoa; mapping, linkage, mutant crosses; cytoplasmic inheritance. Mechanisms of recombination, chromosome structure and replication.

518 Cell Biology I (Structure and composition of major nuclear and cytoplasmic organelles of eukaryotic cells. Pertinent instruments and techniques; meiosis and mitosis; cell cycle; nucleoprotein structure; nuclear RNA metabolism; nucleic acid and ribosome biogenesis; survey of specialized cells. Non-classical transcription and translation in bacteria. Coreqs: 511.

525 Computing for the Life Sciences (3) Interactive computing. Mini- and micro-computing environments. Basic Fortran, and/or Pascal languages; application of statistics, graphics, text manipulation and computer communications.

531-32-33 Biomedical Sciences Laboratory (3,3,3) Approaches and technologies in various areas of modern biology. Students spend a semester in each of three laboratories conducting research in different areas of biomedical science. Required of all first-year students.

543-46-49 Graduate Research Participation (3,6,9) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

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

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

651-52-53 Advanced Topics in Biomedical Sciences (3,3,3) Current and future research developments: protein synthesis, protein chemistry and enzyme mechanisms; cryobiology, and special topics. Either as tutorial or literature survey requiring substantial student preparation. May be repeated.

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


Botany

(College of Arts and Sciences)

MAJOR

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

Education

Edward E. Schilling, Head

Professors:

Caponetti, J. D., Ph.D. .......... Harvard

Clebsch, E., E.C. (Emeritus), Ph.D., Duke

DeSelms, H. R. (Emeritus), Ph.D., Duke

Evans, A. M. (Emeritus), Ph.D., Michigan

Herndon, W. R. (Emeritus), Ph.D., Vanderbilt

Hickok, L. G., Ph.D. ................. Massachusetts

Holton, R. W., Ph.D. ................. Michigan

Hughes, K. W., Ph.D. ............... Utah

Jones, L. W., Ph.D. ................. Texas

Mullin, B., Ph.D. ...................... NC State

Norris, F. H. (Emeritus), Ph.D., Ohio State

Petersen, R. H. (Distinguished Prof.), Ph.D.

Schilling, E. E. (Liaison), Ph.D. ........ Indiana

Sharp, A. J. (Emeritus), (Distinguished Prof.), Ph.D.

Smith, W. O., Ph.D. ............... Duke

Wulhe, P. L. (Distinguished Prof.), Ph.D.

Associate Professors:

Amundsen, C. G., Ph.D. .......... Colorado

Halm, A. S., Ph.D. ............... Ohio State

Schwarz, O. J., Ph.D. ........... NC State

Smith, D. K., Ph.D. ............... Pennsylvania

Wofford, B. E. (Curator), Ph.D. ....... Tennessee

Assistant Professor:

Cruzan, M. B. C., Ph.D. .......... SUNY (Stony Brook)

Lecturer:

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

The Department of Botany offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, physiology, cytology, cytogenetics, ecology, genetics, horticulture, morphogenesis, mycology, phycology, physiology, pteridology, and taxonomy.

Educational service is required of each graduate degree candidate and such service will include teaching and/or ancillary services performed in the department related to the instruction of courses.

For further information, contact the Department Head or the Graduate Coordinator.

ADMISSION REQUIREMENTS

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

1. Bachelor's degree: a B.A. or B.S. from an accredited college or university and a cumulative grade-point average of 3.0 or better (on a 4.0 scale), with evidence of ability to do work of graduate quality.

2. General botany or general biology: 8 semester hours.

3. Advanced botany or closely allied biological sciences: 12 semester hours.


5. College mathematics: 6 semester hours including 1 term of calculus.

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

THE MASTER'S PROGRAM

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

Thesis Option

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

1. Satisfactory preparation of a written formulation and an oral defense to the student's committee of a research proposal suitable for a thesis. This thesis must be completed before enrollment in Botany 500.

2. Successful completion of 30 hours of graduate credit, at least two-thirds of which must be at the 600 level or higher.

3. Satisfactory completion of two hours at the 600 level.


5. Presentation of a 30-minute departmental seminar.
6. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.

Non-Thesis Option
1. Satisfactory completion of 34 semester hours of approved graduate courses of which 30 semester hours must be in Botany including Botany 503. At least two-thirds of the hours must be at the 500 level or higher.
2. Satisfactory completion of two hours at the 600 level.
3. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.
4. Satisfactory performance on a final written examination on all work offered for the degree.

The student's committee may also require that an oral examination follow the written examination.

THE DOCTORAL PROGRAM

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

Requirements for successful completion of the Ph.D. are as follows:
1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive examination.
3. Presentation of one or more cognate areas outside of the department totaling 6 hours of graduate credit with at least a B average.
4. Satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 302 or German 332.
5. Satisfactory completion of 6 hours at the 600 level (excluding dissertation).
7. Presentation of a departmental seminar near the end of the doctoral program.

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

GRADUATE COURSES

401-02 Field Studies in Botany (1-3, 1-3) Field experience and taxonomy of special plant groups. Topics: bryology, lichenology, petrology, agrostology, mycology, phycology, botany, vascular plants, taxonomy, botany, mycology, molecular, botanical. May be repeated under different topics. Maximum 9 hrs.


404 Plant Molecular Biology (4) Current research in plant molecular biology: techniques and procedures. Genome structure, gene expression, and regulation, transformation, transposable elements, plant development. Labs: isolation of DNA and RNA, molecular hybridization, isolation and preparation of plasmids, PCR amplification of specific sequences, DNA sequencing and transformation. Prereq: General genetics with grade of B or better and consent of instructor. 2 hrs and 4 labs.

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

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

451 Plant Tissue Culture (3) Methods for culture of cells, tissues and organs; media preparation and maintenance of cultures. Prereqs: 110-20 or Biology 110-20 or equivalent and Chemistry 110-20 or equivalent. Recommended prereqs: 310-30, 521, 412; Microbiology 310 or 311; Ornamental Horticulture and Landscape Design 330; and Plant and Soil Science 351.

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

501 Mycology (4) Intensive survey of fungi, all major classes. Lecture, laboratory and field information. Occasional field trips. Prereqs: 310, 3 hrs and 1 lab. Su-A.

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

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

506 Physiology (4) Comparative study of major animal phyla, both freshwater and marine: morphological, developmental, ecological, taxonomic and phylogenetic aspects. Prereqs: 310, consent of instructor. 3 hrs and 1 lab. F-A.

507 Biological Illustration (3) Principles and applications of photography (B&W and Color) microphotography, histology, drawing, drafting, and video for presentation and publication of data in pictorial and graphic form.

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


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

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

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

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

580 Bryophytes and Pteridophytes (4) Taxonomy, phycology, evolution and development of bryophytes; field studies and specific problems. Prereqs: 310-20 or consent of instructor. 2 hrs and 2 labs. F-A.

582 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various research methods, instrumentation and techniques. Prereqs: 310-20 or consent of instructor. 2 hrs and 4 labs. F-A.

585 Methods and Instrumentation in Field Investigation (1) Appropriate methods and instrumentation.

Topics vary. May be repeated with consent of instructor. Maximum 5 hrs. S/N/C only.

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

600-07 Advanced Topics in Botanical Science (1-3, 1-3) Experimental botany: cell biology; molecular biology, genetics, plant morphology and physiology. Prereqs: 310, consent of instructor. 12 hrs.

635 Environmental Assessment and Sustainable Development in Third World Countries (3) (Same as Ecology and Planning 635.)

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

GRADUATE COURSES

410 Television News (3) Writing, reporting, performing, and producing news for television. Experience as reporter, producer, or news director for television news program. Prereqs: 310, 311, 319, 321, 412, 413; Microbiology 310; Ornamental Horticulture and Landscape Design 330; and Plant and Soil Science 351.

411 Advanced Topics in Botanical Science (1-8) May be repeated under different topics. Maximum 12 hrs.


430 Electronic Field Production (3) Principles of video production and location. Concepts relating to shooting, directing, writing, and editing. Prereqs: Audio-Video Production or consent of instructor. E

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

470 Cable Television and Emerging Technologies (3) History and structure of cable television industry. Cable regulations and programming. Entry of telephone companies in distribution video. Analysis of all relevant technologies: direct broadcast satellite, cable television, high definition television, and other. Prereq: Introductory to Radio and Television or consent of instructor.

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

510 Broadcast News Management (3) Production of daily news programs. News packages and full-length programs. Prereq: 410. F

520 International Broadcasting (3) Current systems in other countries. Analysis of international broadcasting organizations. Inter-cultural communication and international broadcasting. Development communication and international broadcasting. Prereq: consent of instructor.

560 Radio & Television Law and Regulations (3) Legal problems faced by broadcast managers. Philosophy of regulatory policy formation. Efforts at self-regulation and international broadcasting. Prereq: consent of instructor. F

580 Seminar in Radio & Television (3) Various techniques used by stations and consultants in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq: Communications 512 or 513, or consent of instructor. Sp

570 Radio & Television Research (3) Various techniques used by stations and consultants in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq: Communications 512 or 513, or consent of instructor. Sp

590 Advanced Radio & Television Management (3) Financial management of broadcast operations: budgeting, financial planning, accounting, and related techniques. Theoretical perspectives in broadcast management, organization and management of commercial and non-commercial operations from perspective of general manager. Prereq: 490. Sp

550 International Broadcasting (3) Current systems in other countries. Analysis of international broadcasting organizations. Inter-cultural communication and international broadcasting. Development communication and international broadcasting. Prereq: consent of instructor.

560 Radio & Television Law and Regulations (3) Legal problems faced by broadcast managers. Philosophy of regulatory policy formation. Efforts at self-regulation and international broadcasting. Prereq: consent of instructor. F

580 Seminar in Radio & Television (3) Various techniques used by stations and consultants in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq: Communications 512 or 513, or consent of instructor. Sp

570 Radio & Television Research (3) Various techniques used by stations and consultants in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq: Communications 512 or 513, or consent of instructor. Sp

590 Advanced Radio & Television Management (3) Financial management of broadcast operations: budgeting, financial planning, accounting, and related techniques. Theoretical perspectives in broadcast management, organization and management of commercial and non-commercial operations from perspective of general manager. Prereq: 490. Sp

Independent Study (3) Prereq: Consent of instructor. May be repeated in the same term. Sp

Internship (3) Full-time (30-40 hrs per week) work experience in news, production, or sales and management with non-university professional organization. Educational experience beyond that available at university. Final term paper. No retroactive credit for previous work experience. Prereq: Senior or graduate standing, completion of at least 15 hrs of broadcasting courses, GPA 3.0 or better, and consent of department head.

Business Administration
(College of Business Administration)

MAJOR DEGREES

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

The College of Business Administration offers two college-wide programs, the MBA and the Ph.D., with a major in Business Administration. Two tracks are available for the MBA: the regular, full-time program and the executive program. A dual degree program is also available with the College of Law leading to the J.D.-MBA.

To obtain application materials, write or call: Office of Graduate Business Programs, Suite 527, Stokely Management Center, College of Business Administration, The University of Tennessee, Knoxville, TN 37996-0552.

Phone: (615) 974-5033. For the executive program, telephone (615) 974-1660.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state basis. The Ph.D. in Business Administration is available to residents of Alabama, Florida, Kentucky, Louisiana, and West Virginia; the MBA is available to residents of Arkansas, Florida (concentration in forest industries management or logistics and transportation), and West Virginia. Additional information may be obtained from the Admissions Specialist 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 the cumulative grade-point average is 3.0 or higher at the end of the probationary term. The probationary period is defined as the next semester's coursework as established by the degree program.

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, two years hence. During the summer between the first and second year, students must complete an internship with a company using those skills acquired during the first year of the MBA program.

The 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.

Students in the first-year core undertake active learning within a team-based environment. Many core requirements are experiential exercises in which self discovery within a team setting is an important element of the learning process. Individualized support is 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 the major is declared. In any event, selection must be made after completion of the first year. Requests for changes in concentration area must be submitted for 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 for the fall term. 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. In any event, the admission 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 element of the learning process. Individualized support is provided for developing both written and oral communication skills.
approval to the Office of Graduate Business Programs.

Among the 24 credit hours in the concentra-
tion/electives block, at least 9 but not more than 12 must be in one of the following concentration areas. From specific courses required in concentration areas, see the appropriate field of instruction.

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

The remaining elective courses 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 from the Office of Graduate Business Programs.

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

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

Because of the fully integrated nature of the first-year curriculum, no credit hours are transferred into this core curriculum. The maximum number of hours that may be transferred to elective and concentration areas is 6 semester hours. Transfer credit will be considered upon formal petition to the Director of Graduate Business Programs.

Other Requirements
The Application for Admission to Candidacy must be approved by two faculty members and the department head in the student's area of concentration and the Associate Dean 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 is the first 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 CONCENTRATIONS

For complete listing of MBA program requirements, see above.


In recognition of the growing globalization of business activity and the importance of the international environment to successful management of every firm, the MBA program offers a concentration in global business. The concentration comprises at least two courses taken from Economics 424, Logistics 507, Management 571, and departmental special topics courses with international content; and at least one but not more than two additional courses from the previous list, or from a list of electives as approved by the Director of Business Programs. Students pursuing a concentration in global business are strongly encouraged to pursue it as a second concentration in addition to one of the traditional departmental concentrations. Students pursuing this concentration are also strongly encouraged to pursue an international or internationally related internship for the summer between their first and second years in the MBA program. Students are expected to participate in a foreign exchange or field experience if at all possible, especially for those with no previous foreign experience. Language training is advised but not required, and beginning language courses are not typically available for graduate credit.

The concentration in new venture analysis and entrepreneurship 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 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, finance, etc.) to achieve a dual concentration.

Minimum course requirements are Finance 551, Management 551, and Marketing 560. 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 Arts and Sciences. Students in this program take their first three years of coursework in Arts and Sciences, 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 Arts and Sciences 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 at least a 3.4 GPA and a GMAT score of 600 or higher.

Students interested in the program are counseled initially in the Arts and Sciences Advising Center regarding admission standards and Arts and Sciences requirements. At the end of their second year, they have a conference with the Director of Graduate Business Programs and 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 third 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 saves the student approximately one semester over the time that would be required to earn both degrees independently.

The establishment of the dual program recognizes the increasingly complex body of knowledge necessary to the creative conduct of business and business-related law practice, the complementary nature of many aspects of the graduate programs of the College of Law and the College of Business Administration, and the intellectual benefits inherent in the concurrent study of both business and business-related law. The program is designed to accommodate the interests of students who (a) contemplate a career in public service and want to acquire the skills and perspective of the lawyer and the business-oriented manager, (b) contemplate a career in public service and want to acquire the skills and perspective of a lawyer, or (c) contemplate a career as a lawyer specializing in business-related law and want to acquire the skills and perspective of the business-oriented manager.

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 last 28 semester hours of J.D. coursework and prior to entry into the second year of the MBA program. Students interested in entering the dual degree program should submit a letter of application to the Dual Program Committee.

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

Curriculum

A dual program candidate must satisfy the graduation requirements of each college. Students withdrawing from the dual program before completion of both degrees will not receive credit toward graduation from either college 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
Admission 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 advisor.

Students may begin their studies either in 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 Director of Graduate Business Programs.

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

Approved Dual Credit
MBA courses to be counted toward the J.D. program must include 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 professionals holding middle and upper level positions in organizations that wish to support their attainment of an MBA degree. The objective of the program is to provide advanced management skills to individuals who play key roles in leading their organizations. The executive track of the MBA is three consecutive terms completed in one year. Each term requires two residence periods on campus, alternating with a continuous program of reading, study, and on-the-job applications off campus. The off-campus work requires substantial and regular contact with program faculty and other participants and includes scheduled assignments to be carried out.

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 begin in January of each year. Final deadline for applications is October 10 of the preceding calendar year. For applicants who wish to make plans early in the preceding year, there is an advance reservation deadline of August 1. 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 program application deadline.

To be considered for admission, the applicant must have a bachelor's degree and 10 or more years of work experience. Applicants must submit a complete application file including the Graduate School Application, official transcripts of prior college work, the executive MBA program application with evaluations from his/her company, and the Graduate Management Admissions Test (GMAT) score report. Transcripts from other institutions often take four to six weeks to arrive, so applicants should request these far in advance.

For admission to this program, primary consideration is given to the applicant's work history and the recommendation from the sponsoring organization and the GMAT. There is no cut-off for either grade-point average or GMAT scores, however, admission to the program is competitive, and applicants will be evaluated on their ability to operate on a par with other high achieving participants.

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 first of which will be in early January. The third term is comprised of Executive Core III and Management Project III. It includes two residence sessions.

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); continuous improvement from a systems-thinking perspective; the role of the firm in the global environment; organizational culture and change management; and personal and team development.

The management project is carried out as an independent project with faculty advisor. It involves the diagnosis and analysis of some significant aspect in the sponsoring organization and is based on applying major themes in the core courses. The written project and presentation to senior management and faculty serves as the comprehensive examination.

The off-campus work requires substantial and regular contact with faculty.

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.

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 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, doctoral seminars, and independent study and research. Students are also encouraged to attend lectures and discussions by visiting scholars throughout the year.

There are five concentrations offered in the Ph.D. program:
Accounting
Finance
Logistics and Transportation Management (Operations Management and Strategic Management)
Marketing

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 by the end of the first semester of coursework. At least 50% of coursework, beyond the baccalaureate degree, with two years of residence on the Knoxville campus.

1. Students must complete at least three years of full-time coursework beyond the baccalaureate degree, with two years of residence on the Knoxville campus.
2. Students must complete appropriate courses at the graduate level, or other approved concentrations of coursework, in the following areas:
   - Accounting
   - Behavioral Science
   - 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 Director of Graduate Business Programs. Specific majors may have prerequisites not listed above.

3. Basic Core: Economics 510 (or approved substitute) is required, except that Management 567 (or equivalent) may be substituted with prior approval.
4. Research Tools: A minimum of 9 semester hours of graduate research methods must be completed. At least 6 semester hours in statistics courses beyond Statistics 531 are required. The remaining 3 semester hours may be completed in additional statistics courses (not to include Statistics 531) or in other areas such as research methodology, management science, computer science, economics, 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 full-time coursework is required, including at least 9 hours of doctoral seminars. Graduate work taken in the concentration area is subject to the temporary doctoral advisory committee and the Director of Graduate Business Programs. Specific majors may have prerequisites not listed above.

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 at another school or college of the University.

Comprehensive Examinations

Comprehensive written examinations over the concentration and cognate areas are 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 by 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 or 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 must be indicated. The application must be approved by the student's doctoral committee and the Associate Dean before submission to The Graduate School.

Dissertation

Minimum of 24 semester hours. The student must complete an approved plan, reviewing 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. 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, human resource management) through year-long case in which knowledge is applied to solution of simulated real-world enterprise. Continuous systems improvement and delivery of customer value. Role of firm in society (with attention to stakeholder value, economics, and the ethical and legal environment of firm). Functional and interfunctional 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 course in business decision making. 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 base design principles, view diagrams and CASE (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 analysis during off periods. Integration of major business functions through strategic perspective, applications of functional knowledge to tactical and strategic issues. Role of firm in society as it faces economic/legal environment and develops purposes of firm as delivering value to customers and other stakeholders. Personal issues. Leadership development: individual interpersonal skills of communication, negotiation, leadership and motivation. Customer value and systems management: determination and delivery of customer value. Cases, simulations and exercises. Prereq: Admission to executive program of MBA. Coreq: 561.


553 Executive Core III (12) Continuation of 552. One 11-day period and one two-week period of residence at international site. Reading and study, analyses and applications within sponsoring organization. Role of firm in environment: trends in economic, legal, and cultural issues. Strategic management/policy deployment topics and organizational culture, design and change management for global competition. Issues, trends, and international current issues. Prereq: 552. Coreq: 563.

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.


593 Directed Independent Study (3) Cross-disciplinary topic of mutual interest to student and faculty. Available only by prearrangement with supervising faculty member. May require approval of Director of Graduate Business.
Chemical Engineering

(College of Engineering)

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

Charles F. Moore, Head

Professors:
Blanchard, Paul R., Ph.D. ....................... Purdue
Bogue, Donald C., Ph.D. ....................... Delaware
Counce, Robert M., Ph.D. ....................... Tennessee
Crawford, Lloyd W. (UTSI), Ph.D. ........ Cincinnati
Culberson, Oran L. (Emeritus), Ph.D. ...... Texas
Cummins, Peter T. (Distinguished Scientist), Ph.D. ............... Melbourne
Frazier, George C., Jr. (Condra Prof.), Ph.D. ............... Johns Hopkins
Hansen, Marion G., Ph.D. ....................... Wisconsin
Holmes, John M. (Emeritus), Ph.D. ........ Tennessee
Hsu, Hsien-Wen (Emeritus), Ph.D. ......... Wisconsin
Moore, Charles F. (Alumni Prof.) (Liaison), Ph.D. ............... Louisiana State
Perona, Joseph J., Ph.D. ....................... Northwestern
Prados, John W. (University Prof.), Ph.D. ............... Tennessee
Sheth, Atul C. (UTSI), Ph.D. ................... Northwestern
Thomas, Carl O., Ph.D. ......................... Tennessee

Associate Professors:
Bruns, Duane D., Ph.D. ....................... Houston
Wang, Tae-Wei, Ph.D. ......................... MIT
Weber, Frederick E., Ph.D. .................... Minnesota

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

THE MASTER’S PROGRAM

Thesis Option: The standard master’s program includes a thesis and leads to the Master of Science. Minimum departmental requirements are as follows:
1. A total of at least 21 hours in graduate coursework in chemical engineering and related areas excluding thesis. The minimum requirements are 15 hours in graduate coursework, 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 examination. 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.

DEGREE REQUIREMENTS

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 topics in chemical engineering, 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 it is offered.

GRADUATE COURSES

403 Introduction to Optimization (3) Principles and applications of optimization techniques to chemical process design: unconstrained and equality constrained optimization, linear programming, dynamic programming, and geometric programming. Prerequisites: Mathematics 241.


425 Introduction to Chemical Process Economics (3) Concepts and methods of capital investment, cost of capital, and equity financing, discounted cash flow methods, and estimating of product manufacturing costs. Case study and use of computer methods for financial and sensitivity analysis. Prerequisites: CHE 403 or equivalent.

447 Honors: Transport Phenomena (3) Momentum, heat and mass transfer processes, analogies, differential and integral balances, applications involving molecular diffusion, simultaneous mass transfer and chemical reactions. Prerequisites: CHE 403 and CHE 425.

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

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

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

505 Engineering Analysis (2) Formulation and solution of problems in chemical engineering and materials areas, ordinary and partial differential equations; types of ODEs, PDEs and solution techniques; transformation methods; conformal mapping; variational methods; introduction to numerical methods. (Same as Materials Science and Engineering 505.)

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

522 Statistical Mechanics (3) Molecular distribution functions, equilibrium distributions, algorithms and expansions, distribution function theory, perturbation theories, time-dependent correlation functions, theory of transport processes, and phase transitions. Prerequisite: Background in mathematics, thermodynamics, transport phenomena, and computer programming.

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

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

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

563 Process Modeling and Simulation (3) (Same as Materials Science and Engineering 563.)

575 Applied Microbiology and Bioengineering (3) Cross-disciplinary course combining basic concepts in microbiology, biochemistry, reaction kinetics, and biochemical and environmental engineering. Prerequisites: CHE 501 and CHE 522, or consent of instructor.

461 Advanced Process Dynamics and Control (3) Process and control system simulation and advanced industrial system design. Cascade, feedforward, multivariable, statefeedback, adaptive, and nonlinear control system design. Both computer and laboratory work. Lab Prerequisite: CHE 563.
immobilization methods. Fundamental laboratory techniques during 4-week laboratory period. (Same as Environmental Engineering 575, Agricultural Engineering 575 and Microbiology 575.)

590 Technical Review and Assessment (3) Preparation of critical review of literature in area related to chemical engineering. Limited to candidates in nonthesis option. Prereq: Consent of advisor. Ea/F.

581 Industrial Pollution Prevention (3) Principles and practical aspects of industrial waste minimization. Regulatorv pollution, 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. (Same as Environmental Engineering 581 and Engineering Science and Mechanics 585.)

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

590 Special Topics in Chemical Engineering (3) May be repeated. Maximum 8 hrs.

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

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

641 Advanced Diffusional Operations (3) Fixed and fluidized bed operations, recent developments in separation processes. Prereq: Consent of instructor. Ea/F.

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


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

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

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

Chemistry
(College of Arts and Sciences)

MAJOR

DEGREES

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

Gleb Mamantov, Head

Professors:

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

Alexandratos, S. D., Ph.D. ............ California

Baker, D. C., Ph.D. ......................... Ohio State

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

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

Bull, William E., Ph.D. ............... Illinois

Chambers, J. O, Ph.D. ................. Kansas

Compton, R. L., Ph.D. .................. Tennessee

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

Dean, J. A. (Emeritus), Ph.D. ........ Michigan

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

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

Grimm, F. A., Ph.D. ...................... Cornell

Guilochon, G. (Distinguished Scientist), Ph.D. ..... Ecole Polytechnique and Paris VI

Kabalka, G. W. (Distinguished Prof.), Ph.D. ........... Purdue

Kleinfeiler, D. C., Ph.D. ............... Princeton

Kovac, J. D., Ph.D. ......................... Yale

Lietzke, M. H. (Emeritus), Ph.D. .... Wisconsin

Magee, L. J., Ph.D. ...................... Tennessee

Megid, R. M., Ph.D. ..................... Yale

Mamantov, Gleb (Distinguished Prof.), Ph.D. .......... Louisiana State

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

Peterson, J. R., Ph.D. ..................... California

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

Seppala, M. J., Ph.D. .................... Iowa State

Smith, W. T. (Emeritus), Ph.D. ........ Ohio State

VanHouten, W. A., Ph.D. ............. Johns Hopkins

Wehry, E. L., Ph.D. ....................... Purdue

Williams, T. F. (Distinguished Prof.), Ph.D. .......... London

Woods, C. Ph., Ph.D. ................. NC State

Wunderlich, B. (Distinguished Scientist), Ph.D. ........... Northwestern

Associate Professors:

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

Feigere, C. S. (Lission), Ph.D. .... Colorado

Lane, C. A., Ph.D. ....................... California

Schell, F. M., Ph.D. ...................... Indiana

Assistant Professor:

Dadum, Mark, Ph.D. ......................

Hinde, Robert J., Ph.D. ...............

Tuinman, Albert, Ph.D. ...............

Xue, Z. B., Ph.D. ....................... California

Students majoring in Chemistry for the master's or doctoral degree are required to present as a prerequisite one year each of general, analytical, organic, and physical chemistry with a satisfactory record. At least 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 recommended 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 study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)

3. Prescribed remedial courses based on performance on entrance examinations.

4. Sufficient graduate coursework in chemistry at (the 400 level or above), and/or a related field to make an overall total of 30 hours, including one of the following sequences: 530-51-52-53, 550-51-52-53, 590-94-95, or 600 Doctoral Research and Dissertation (3-15) P/NP only. E

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


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

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

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

GRADUATE COURSES

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 520. Prereq or coreq: 380 or 381. Sp

431 Radioactivity and Its Application (2) Radioactive materials in tracer and therapeutic applications. Radioactive decay, detection apparatus and techniques, tracer procedures, safety precautions in agriculture, biology, medicine, nutrition. Not for credit by chemistry, physics majors or minors. Prereq: Mathematics 122 or equivalent and 1 yr of general chemistry. Sp


471-81 Biophysical Chemistry (3.3) (Same as Biochemistry 471-81)

473-83 Physical Chemistry (3.3) Students may not receive credit for both 473 and 473 nor for both 481 and 483. 473-83 Properties of gases; first, second, and third laws of thermodynamics; chemical equilibria; simple phase equilibria; properties of solutions; introduction to statistical thermodynamics. 483-85 Kinetics of chemical reactions. Introduction to quantum mechanics and applications to electronic structure of atoms and molecules; molecular spectroscopy. Prereq: General Chemistry, Fundamentals of Physics, and Calculus III. E

479-89 Physical Chemistry Laboratory (2.2) Experiments on topics discussed in 471-81 or 473-85.
540 Nuclear and Radiochemistry (3) Nuclear properties, radioactivity, atomic decay processes, nuclear structure and models, nuclear reactions, radiation and matter, radiation detection. Prereq: 1 yr of physical chemistry. 

541 Nuclear and Radiochemistry (3) Nuclear properties, radioactivity, atomic decay processes, nuclear structure and models, nuclear reactions, radiation and matter, radiation detection. Prereq: 1 yr of physical chemistry. 

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

543 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet, and mass spectrometry. Prereq: 360 or equivalent. F

544 Organic Spectroscopy Laboratory (1) Use of IR, UV, MS, and multiwave FT-IR/NMR spectroscopy. Development of problem-solving ability in area of spectroscopic characterization of organic molecules. Prereq: 360 or equivalent. Coreq: 553. F

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

571 Advanced Quantum Chemistry and Spectroscopy (3) Prereq: 1 yr of instructor. Prereq: Consent of instructor. F

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

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

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

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


595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solid phase and solution properties, rubber elasticity, kinetics of polymerization, polymer thermodynamics. Prereq: 590 or equivalent. Sp

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

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

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

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

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 559-557-558 or consent of instructor. May be repeated. Maximum 12 hrs.


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

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

Child and Family Studies

(College of Human Ecology)

MAJORS

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

Connie Steele, Head

Professors:

Blanton, Priscilla, Ed.D. .............. Tennessee

Cunningham, Jo Lynn, Ph.D. ....... Michigan State

Fox, Great L., Ph.D. ................ Michigan

Moran, James D., Ph.D. .............. Oklahoma State

Northfall, M. Rick, Ph.D. ............ Tennessee

Steel, Connie, Ed.D. .................. Texas Tech

Twardosz, Sandra (Liaison), Ph.D. .. Kansas

Associate Professors:

Allen, Jan, Ph.D. ....................... Purdue

Buehler, Cheryl, Ph.D. ............... Minnesota

McInnis, Jackie H., Ph.D. ............ Florida State

Tegano, Deborah, Ph.D. .............. Virginia Tech

Assistant Professors:

Grovos, Melissa, Ph.D. ............... Virginia Tech

Malia, Julia, Ph.D. ..................... Iowa State

Morris, Lane, Ph.D. ................... Tennessee

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 complete 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, undergraduate/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 collaboration with his or her major professor and committee. The program provides for a concentration in either child development or family studies. The student and his or her committee will develop a program of study tailored to the individual's needs and interests.

The M.S., with a concentration in child development offers two tracks. Track 1 is designed to meet the needs of professionals who work in programs encompassing a variety of early childhood programs. Specialization in Track 1 consists of early childhood education, early childhood special education, and early childhood administration and child development. Track 2 is designed for students seeking initial teacher licensure in early childhood education (pre-K through grade 3). Thesis and non-thesis options are available for both tracks.

Track 1 - All students in the child development concentration must enroll in CFS 510, 540,
and 571. At least 6 hours in a cognate area outside the department must be completed. Thesis students are required to take: 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 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 584, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

Track 2 - All students in the early childhood education licensure program must enroll in Human Ecology 574, 575, 591, and Holistic Teaching/Learning 505 (or equivalent CFS course). Thesis students are required to take: CFS 510 or 512; 3 hours of 500-level statistics; 3 hours of 500-level research methods; two courses selected from CFS 520, 521, 522, 530, 540, 525, 590; 6 hours of thesis credit; and an oral comprehensive examination (45 hours). Non-thesis students are required to take: CFS 510 or 512; three courses selected from CFS 520, 521, 522, 530, 540, 525, 590; 3 hours of 500-level statistical methods or interpretation of statistics and research methods; and a written comprehensive examination (39 hours).

Students in the early childhood education licensure program may choose to complete their M.S. degree requirements with a major in Child and Family Studies or Human Ecology. The family studies concentration consists of specializations in family life intervention and family science. Thesis and non-thesis options are available in both concentrations. Students should also consider an interdisciplinary minor in gerontology to provide a life span perspective to human development or family studies. Students in the family studies concentration must enroll in CFS 550, 571, and 540 or 560. At least 6 hours in a cognate area outside the department are required. Thesis students are required to take: 3 hours of 500-level research methods; 3 hours of 500-level statistics; 6 hours of CFS courses in an area of concentration; 6 hours of thesis credit; and an oral comprehensive examination. Non-thesis students are required to take: 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. with a major 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 concomitantly specialized and integrative in nature reflects the core disciplinary content to formulate theoretical questions, and broadens the empirical literature for addressing those questions.

Requirements include:
1. Minimum 10-12 credits in child and family studies required foundation courses: 510, 550, 570, 571. 532 is also required for family studies area students. 2. Minimum 12 credits in 500- and 600-level courses in child development or family studies, with at least 3 credits in 600-level courses (in addition to the required courses described in #1); 3. Minimum 6 credits in a cognate area; 4. Minimum 9 credits in graduate-level statistics; with 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;

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 (concentration in early childhood only) is available to residents of Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
507 Development of Interpersonal and Supervision Skills (2) Refinement of skills needed to work with families and other professionals. Supervisory training in others' skills development, active listening, self-disclosure, relational building, and negotiation. F
510 Survey of Theory and Research in Child Development (3) Theoretical and research literature in child development (conception through adolescence); application to research intervention and education. Prereq: 3 hrs of either upper division undergraduate or graduate social science or consent of instructor. F
512 Survey of Research in Early Childhood Education (3) Current literature and issues in early childhood education. Prereq: 510 or equivalent or consent of instructor. F
515 Children in Contemporary Society (3) Theory and research on environmental and developmental issues in contemporary family situations and educational environments for children from infancy through middle childhood. Implications for programs and policy. F
520 Curriculum and Program Development in Early Childhood Education (3) Current programming issues in early childhood education: description, analysis and evaluation of curriculum models, teaching methods, administrative styles, and supervision of personnel. Experience in designing and evaluating early childhood programs for young children: special needs, infancy-age 8. Prereq: 512 or equivalent or consent of instructor. F
521 Organizational Management in Early Childhood Education (3) Designing, implementing, and evaluating physical and human resources in educational environments. Development of skills in environmental organization, interpersonal leadership, and supervision of staff. Prereq: 512 or equivalent or consent of instructor. F

522 Naturalistic Interventions for Parents and Teachers of Children with Disabilities (3) Common problems faced by parents and teachers; methods available to modify problem behavior. Prereq: 510 or equivalent or consent of instructor.
525 Seminar on Play (3) Comparison and contrast of theoretical frameworks and research methodologies on play. Developmental perspectives on play.
530 Families of Handicapped Children (3) Developmental nature of caregiver experiences caring for handicapped children, especially during infancy and early childhood. Prereq: 510 or consent of instructor.
540 Parent-Child Relations (3) Influence of parenting on children; influence of parent-child relations, reciprocal interaction between parents and children, attachment systems, models, child abuse, and impact of divorce on children. Prereq: 550 or equivalent or consent of instructor.
550 Survey of Theory and Research in Family Studies (3) Use of family conceptual frameworks and application of theoretical models in research and family life process. F
582 Family in Contemporary Social Thought (3) Alternative conceptualizations of family in current social thought. Variations of family construction by race, gender, and social class. Prereq: 550, FA
555 Children, Divorce and Remarriage (3) Children's and adolescents' adjustment to transitions involved in parental divorce, single-parenthood, and remarriage. FA
560 Marital Dys (3) Communication, power, sexuality, marital stability, and marital satisfaction. Prereq: 550 or equivalent or consent of instructor.
562 Families in Crisis (3) Family process during times of stress, vulnerabilities and coping mechanisms of families. Prereq: 550 or equivalent.
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 Human Ecology 563.)
564 Practicum in Human Development or Family Studies I (3) School and community programs. Education for human development and family living. Prereq: Consent of instructor. S/NC only. F
565 Practicum in Human Development or Family Studies II (3) School and community programs concerned with education for human development and family living. Committee approved and supervised written project. Prereq: 564 and consent of instructor. S/NC only. E
566 Approaches to Family Intervention and Counseling (3) Various theoretical approaches for family intervention and counseling. Structural, strategic, experiential and social learning schools of practice. Effects of intervention from perspective of their impact on family functioning and communication. Prereq: 562. (Same as Counseling Education and Counseling Psychology 566.)
567 Family Violence (3) Theory and research on precipitation, maintenance and cessation of violent behaviors in intimate family contexts, and assessment of responses to violent family behaviors, perpetrators, victims, and family systems. Prereq: 550, FA
570 Research Methods in Child and Family Studies (3) Empirical means of studying human behavior, evaluating and conducting empirical research. Prereq: 9 graduate hrs in major. SP
571 Research Seminar (1) Presentation and critique of research projects. Prereq: Departmental major or consent of instructor. May be repeated. S/NC only. E
580 Special Topics in Human Development or Family Studies (1-3) Research, theory and current issues in child development or family studies: divorce, handwriting, aging, symbols, language, work and family. Preregistration required. Prereq: 6 graduate hrs in required concentration. 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 and early childhood 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 (3) Theory, empirical research and practices related to measurement of development and learning in young children.

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

510 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.

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.

530 Advanced Developmental Processes (3) Socioemotional, cognitive/language development during infancy and childhood. Normative and nonnormative development. Prereq: 510 or equivalent or consent of instructor. May be repeated with different topics. Maximum 6 hrs.

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

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

633 Survey Design and Analysis (3) Same as Sociology 633.

634 Advanced Survey of Family Theory and Research (3) Conceptualization, analysis, and critical assessment of pertinent conceptual and empirical literatures at advanced level for variety of contemporary family issues. Prereq: 510, 550, 570 or equivalent research methods course. S,A

652 Men and Families (3) Contemporary American men: primary psychological processes in sociological context. Reciprocal influence of society, men, and their families in relation to marriage and parenthood. Prereq: 9 hrs of graduate family studies coursework. F,A

653 Women and Families (3) Contemporary American women: primary psychological processes in sociological context. Reciprocal influence of society, women, and their families in relation to marriage and parenthood. Prereq: 9 hrs of graduate family studies coursework. S,A

691 Assessment of Family Behavior (3) Analysis of methods and measures used in family science research. Prereq: 550, 571, 3 hrs graduate statistics, or consent of instructor.

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:
Bennett, R. M., Ph.D. ........................................ Illinois
Burdette, E. G. (Fred N. Peebles Prof.), Ph.D. .............. Illinois
Chatterjee, A., Ph.D. ........................................ NC State
Davis, W. T., Ph.D. ......................................... Tennessee
Drumm, E. C., Ph.D. ......................................... Arizona
Ghosh, M. (Goodrich Chair of Excellence), Ph.D. ......... Illinois
Goodpasture, D. W., Ph.D. ................................... Illinois
Grecco, W. L. (Emeritus), Ph.D., Michigan State
Heathington, K. W. (Emeritus), Ph.D. ....................... Northwestern
Humphreys, J. B. (Emeritus), Ph.D. Texas A&M
Johnson, H. L. (Emeritus), M.S. ......................... Tennessee
Miller, W. A. (Granger Prof.), Ph.D. ......................... Georgia
Read, G. D. (Liaison), Ph.D. ................................ Arkansas
Robinson, R. B. (Fisher Prof.), Ph.D. ......................... Ohio State
Schantz, B. A. (Condra Prof.), Sc.D. ......................... New Mexico State
Walker, C. R. (Emeritus), M.S. ............................. MIT
Wegmann, F. J., Ph.D. ....................................... Northwestern

Associate Professors:
Chou, K. G., Ph.D. .......................................... Northwestern
Deatharger, J. H., Ph.D. ..................................... Tennessee
Hansen, J. H. (UTSI), Ph.D. ................................. Missouri
Miller, T. L., Ph.D. ........................................ Tennessee
Moore, A. B., M.S. ......................................... Tennessee
Richards, S. H., Ph.D. ....................................... Tennessee
Smoel, J. L., Ph.D. .......................................... Virginia
Tiry, R. F. (Emeritus), B.S. ................................... Marquette

Assistant Professors:
Cox, C. D., Ph.D. ........................................... Penn State
Han, L. D., Ph.D. ........................................... California
Mauldon, M., Ph.D. ......................................... California
Robinson, K. G., 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 waste 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 in Civil Engineering.

Thesis Option: A minimum of 30 semester hours, including 8 hours of thesis, is required.

Non-Thesis Option: A minimum of 33 semester hours, including a 3-hour special problems project, is required. The special problem will culminate in a written report which must be approved by the student's major professor.

Environmental Engineering

For a Master of Science with a major in Environmental Engineering, normally a Bachelor's degree in a field of engineering is required. For a student who does not have an engineering background, the following minimum prerequisite courses will be required: Basic Engineering or Computer Science 101; Basic Engineering 121, 131; Engineering Science 231; Statistics 521; Civil Engineering 390, 395, 380; Mathematics 141, 142, 231, 241; Chemistry 120, 130. In general, these must be completed with a B average before courses for graduate credit can be taken.

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

Thesis Option: The student must present a minimum of 30 semester hours of approved graduate courses. The major shall include 6 semester hours of thesis and a minimum of 12 semester hours of approved environmental engineering coursework. A minor may be selected but is not necessarily required.

Non-Thesis Option: The student must present a minimum of 33 semester hours of approved graduate courses. The major shall include a minimum of 18 semester hours of approved environmental engineering coursework. A minor may be selected but is not necessarily required.

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

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

THE DOCTORAL PROGRAM

A graduate program leading to the Doctor of Philosophy is offered in Civil Engineering.

Specific departmental requirements for the Ph.D. degree include the following:

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 24 semester hours in 600 Doctoral Research and Dissertation will be required.

2. A minimum of 24 semester hours of graduate courses in civil engineering, exclusive of thesis or dissertation credit, at least 6 hours of which must be 600-level courses.

3. Supporting courses in related scientific and engineering fields, amounting to approximately 24 semester hours, subject to approval by the student's faculty committee. These related fields will normally include disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 9 semester hours of mathematics will be required beyond the civil engineering undergraduate requirements.

4. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.

5. Upon completion of at least one-half of all coursework, each student must pass a comprehensive examination.

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

GRADUATE COURSES

408 Legal and Ethical Aspects of Engineering (2) Legal principles underlying engineering work; laws of contracts, torts, real property; professional registration and ethics. Prereq: Senior standing.

421 Portland Cement and Asphal tic Concrete (3) Aggregates and cements, structural chemistry of concrete, mix design for concrete, asphalt concrete, admixtures, tests of asphalt and asphalt mixes, and nondestructive testing. Prereq: 521. 2 hrs and 1 lab.

451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; application of various engineering principles and techniques to process of planning, locating, and design of highway facilities; both geometric and pavement design. Prereq: 210, 251, 352.

452 Traffic Engineering (3) Characteristics of driver, vehicle, and roadway and their interaction; traffic studies: basic considerations of traffic circulation and control, lighting, capacity analysis, roadway safety analysis and design. Prereq: 210, 251, 352.

453 Airport/Railroad Planning and Design (3) Airport master planning and railroad engineering. Runway configuration, airfield capacity, geometric and terminal layout, and design; railroad capacity, geometrical design and structural design and layout. Prereq: 210, 251, 352.

461 Analysis of Framed Structures (3) Maximum stresses due to moment and shear; influence lines; forces due to earth pressure; analysis of portal, building frames, and space frames; matrix methods; use of computer in structural analysis. Prereq: Structural Analysis II.

472 Steel Design (3) Design of plate girders and composite beams; consideration of members subjected to combined stresses; design of typical framed building connections. Prereq: 471.

474 Reinforced Concrete Design (3) Reinforced concrete compressive beams and 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, analysis, and construction; analysis of earth and gravity dam stability analyses; drains and filters; maintenance and operation principles; and dam safety concepts; dam break analyses. Prereq: 390, 395.

494 Urban Drainage Engineering (3) Design and management of stormwater and sanitary sewer systems. Application of hydrologic and hydraulic principles to design of drainage systems for urban, strip mining, and highway developments; design of pipe structures, culverts, and detention and retention basins; application of commonly-used computer runoff models; evaluation of land use on streamflow quantity and quality. Prereq: 390, 395.

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 resource development alternatives, multi-objective 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/or 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 responsibility of city engineer, street lighting, water, sewerage, refusal collection, park management, finance, planning, and public relations. Prereq: Graduation standing or consent of instructor.

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


534 Geological Engineering (3) Influence of geologic origin and history on engineering characteristics of rocks and soils; application of geology in planning, design and construction of civil engineering projects. Prereq: Introduction to Soil Behavior. (Same as Geological Sciences 534.) 2 hrs and 1 lab.


537 Issues in Geotechnical Engineering (1-3) Special readings, problems, discussions, and presentations in geotechnical engineering. Prereq: Graduate standing or consent of instructor. May be repeated.

538 Finite Element Applications in Geotechnical Engineering (3) Application of the finite element method to typical problems in geotechnical engineering. Confining and unconfining stress flow through porous media; stresses and strains in soil mass; linear and nonlinear finite element analysis of nonline soil behavior with elastic and elastic-plastic models; soil interaction effects. Prereq: Introduction to Soil Behavior and 561.

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

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

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

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

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

552 Traffic Engineering-Operations (3) Signals, signs and signal timing; short-term operations; control; signal timing/planning; one-way reversible flow; system operations; identification and correction of high-accident locations and system deficiencies. Prereq: 551 or 452.

553 Geometric Design and Layout of 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; technology for access control, freeway interchanges and street 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 and mode models; urban highway, rail, and mass transportation tools; special topics: urban goods movement, transportation system management. Prereq: 362 or graduate standing.

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

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control proposed, 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 micro-computers to analysis of transportation alternatives. Prereq: 551, 554.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationship between various transportation modal systems and urban development. Transportation and other community features. Use of planning processes to establish existing travel patterns, modeling of demand, planning transportation activity and evaluation. Prereq: Graduate standing. (Same as Planning 537.)

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

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

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

567 Structural Systems (3) Structural system analysis and design; dead, live, wind, and earthquake loads on buildings, vertical and lateral load resisting systems, use of computer in analysis and design. Prereq: Introduction to Structural Design.

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

572 Connections for Structural Steel Frames (3) Design, analysis, and behavior of connections for struc-
Environmental Engineering

GRADUATE COURSES

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

522 Floodplain and Urban Flood Management (3)
Review of national, regional, and local flood problems; state of the art flood damage reduction alternatives: structural and non-structural, institutional responses; policies, programs, regulations, and legal aspects; floodplain hydrology and hydraulics; HEC-1, HEC-2; floodway encroachment, flood hazard zone and damage potential determinations; case studies. Prereq: Civil Engineering 390 or consent of instructor.

525 Soil Erosion and Sediment Yield (3) Theory of soil erosion and sediment yield processes from disturbed land; methods and computer models for estimating sediment yield; erosion and sediment control theory and management practices. Local and state regulations. Prereq: Civil Engineering 395 or consent of instructor.

530 Stormwater Modeling (3) Systems approach to stormwater modeling; Hydrosite computer models and parametric computer models. Prereq: Civil Engineering 395.

535 Ground Water Hydrology (3) Dynamics of flow and contaminant transport in porous media; hydrodynamics, dispersion, anisotropy, layered soils, unsaturated flow and groundwater contaminant transport phenomena. Analytical and numerical solution of flow and transport equations. Prereq: Hydraulics and Hydrology or Civil Engineering 485 for geo majors. (Same as Geologic 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; remote and thermal imagery with application to transportation and facilities planning; construction and operations. Prereq: Consent of instructor.

541 Remote Sensing Data Acquisition and Analysis (1-6) Source, data acquisition techniques, and techniques for digital analysis and interpretation systems; image enhancement and classification techniques for color aerial photography and Thematic Mapper data; image analysis techniques for land use planning and environmental impact assessment. Prereq: Consent of instructor.

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

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

551 Physicochemical Unit Processes (3) Theory and design application of environmental pollution and 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 380. 2 hrs and 1 lab. (Same as Agricultural Engineering 552.)

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.

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

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

566 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.

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

575 Applied Microbiology and Bioengineering (3) Microorganism classification techniques, microbial growth kinetics, design applications for environmental pollution and treatment. Prereq: Consent of instructor.

577 Industrial Pollution Prevention (3) same as Chemical Engineering 575. 2 hrs and 1 lab. (Same as Agricultural Engineering 577.)

580 Special Problems in Industrial Hygiene (3) Selected advanced topics of current interest. Prereq: Consent of instructor. May be repeated.

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

590 Special Problems in Environmental Engineering (1-6) Enrollment limited to environmental engineering students in non-thesis program. Prereq: Graduate standing. May be repeated. Maximum 8 hrs. S/N only.

592 Water Pollution Control Systems (3) Applied microbiology and biochemistry of gaseous and particle air pollutants. Comprehensive design of specific devices and systems. Prereq: 570.

593 Sampling of Air Pollutants (3) Standard sampling methods for particulate and gaseous air pollutants. Comprehensive design of sampling and monitoring systems. Prereq: Consent of instructor.
462 Roman Law (3) Development of Roman law through examination of cases from writings of Roman jurists, world's first legal professionals. Understanding legal institutions in relationship to Roman society, Roman property and contract law.

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

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

541-42 The Latin Epic: Lucretius, Vergil (3,3) Advanced study of epic masterpieces of Lucretius 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 6 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

DEGREES

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

The College of Communications offers the Master of Science degree and the Doctor of Philosophy degrees with a major in Communications. For application forms and other information about the M.S. and Ph.D. programs in Communications, write to: Associate Dean for Graduate Studies, College of Communications, 426 Communications Building, The University of Tennessee, Knoxville, TN 37996-0347.

ADMISSION REQUIREMENTS

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

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

A baccalaureate degree in communications or a related field is recommended. Admission is possible with other baccalaureate degrees. However, all applicants without the appropriate background are required to take up to 15 semester hours of prerequisite and corequisite courses as determined by the department in which the student is enrolled. Students may take a proficiency test on any prerequisite course, subject to review by the master's or doctoral committee of the College of Communications. Students who have had no courses in their major area of concentration may expect to spend four or more full-time semesters in the program, including a media internship.

ACADEMIC COMMON MARKET

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

ACADEMIC STANDARDS

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

THE MASTER'S PROGRAM

The Master of Science with a major in Communications is intended for students who desire a career in the mass media with an emphasis on communications management and a deeper understanding of the communication process and social role of the 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 or 560, the first three of which must be taken during the first two semesters of the student's program, except with written approval of the Associate Dean for Graduate Study of 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 599, or Journalism 599 on a basis of hours of credit for the equivalent of 15 weeks of full-time professional experience. This credit is to be included in the hour requirements for the M.S. program. Previous professional experience will be evaluated by the student's committee.

Students interested in subsequent entry into a doctoral program must apply 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, students will be required to pass an oral examination conducted by his/her graduate committee. The non-thesis option requires a written comprehensive examination and an oral defense of the project.

THE DOCTORAL PROGRAM

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

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

The master's degree is required for entry into the doctoral program. Students lacking academic or professional experience in communications will be required to take prerequisite courses. In general, however, the program may be completed within three academic years of full-time study beyond the master's degree.

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

1. A 3.0 (4.0 system) grade-point average in undergraduate studies, or 3.5 for graduate work in a master's degree;
2. above the fiftieth percentile in verbal and quantitative aptitude on the Graduate Record Examination;
3. endorsement by at least three former teachers or professional colleagues; and
4. a statement of 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.

522 Registration for Use of Facilities (3-15) Required. May be repeated. Maximum 6 hrs.

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

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

610 Orientation to Doctoral Research (1) Degree and dissertation requirements. Candidates formation and program planning. Overview of research methodologies and inter-disciplinary sources. Prereg: Consent of instructor or admission to program. S/N/C only. F

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

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

632 Mass Communications History and Historiographical Methodology (3) Advanced study of mass media in America. Philosophies of history. Historical sources and their verifications. Synthesis and interpretation of data. Prereg: 612 or consent of instructor. Su

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


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

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

692 Advanced Topics in Communications Theory and Methodology (3) Advanced study of communication issues, theories, and methods. May use qualitative, quantitative, historical or legal approaches. May be re-
familiar with theirscholastic or professional degree with coursework in chemistry through organic, mathematics through calculus, physics, Master of Science Degree Program applicants must furnish three letters of School of UT Knoxville apply. In addition, all Departmentsoflifesciences. Hematology and Oncology services, and Laboratory, Knoxville Zoological Park, Hematology and Oncology Center at Knoxville, the Oak Ridge National Research and Graduate Programs, P.O. Box 1071, Knoxville, TN 37901-1071. Joint Graduate Coordinating Committee: Fuhr, J. E., Ph.D., Medical Biology Lawler, J. E., Ph.D., Psychology Luzzio, C. M.D., Medical Biology Potgieter, L. N. D. (Liaison), B.V.Sc., Ph.D., Veterinary Teaching Hospital Slauson, D. O., D.V.M., Ph.D., Veterinary Teaching Hospital The Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a joint-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 experimental pathology, infectious diseases, immunopathology, hematology, aberrant metabolism, oncology, and genetic disorders. The Ph.D. program is open to approved graduate students seeking training in this area and is especially useful for individuals with professional degrees. For the student with undergraduate biological science background, the Comparative and Experimental Medicine program provides an unusual opportunity to study disease processes common in humans and animals from a multidisciplinary perspective. The scope of this intercollegiate program, which pools faculty resources from both veterinary and human medicine, is broadened by faculty members representing animal science and numerous areas of the life sciences. The interdisciplinary training environment includes such diverse support as facilities and personnel at the Veterinary Teaching Hospital, UT Medical Center at Knoxville, the Oak Ridge National Laboratory, Knoxville Zoological Park, Hemophilia Clinic, Developmental and Genetic Center, Hematology and Oncology services, and departments of life sciences. For additional information, write to the Office of Research and Graduate Programs, P.O. Box 1071, Knoxville, TN 37901-1071. ADMISSION 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. 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. Doctor of Philosophy Degree Program Applicants generally will be expected to have a master's degree in one of the biological sciences and a Graduate Record Examination score of at least 1000 for the quantitative and verbal sections, 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 admitted to the Comparative and Experimental Medicine graduate program but will be enrolled officially as veterinary students. During summers such students may take advantage of registering for graduate courses to be counted as elective courses in the veterinary program. THE MASTER'S PROGRAM All students must take at least 4 credit hours in 500- or 600-level courses in basic mechanisms of disease and at least 7 credit hours of 500-level biochemistry or cell biology. See listings under Biochemistry and Life Sciences programs for information on these courses. In addition, students must complete a minimum of 8 hours of coursework in a specified discipline, 5 or more hours of electives, and 6 hours of Thesis 500. The graduate committee (at least 3 members) is chosen after the first term and must include at least one member from the College of Veterinary Medicine and at least one member from the Graduate School of Medicine. If a minor is declared, one member must be from the minor discipline. A final oral examination is given at the end of the program. THE DOCTORAL PROGRAM All students must take at least 4 credit hours in 500- or 600-level courses in basic mechanisms of disease and at least 7 credit hours of 500-level biochemistry or cell biology. See listings under Biochemistry and Life Sciences programs for information on these courses. In addition, students must complete a minimum of 8 hours of coursework in a specified discipline. Areas of emphasis may include hematology, oncology, comparative pathology, comparative pharmacology, toxicology, immunology, genetics, infectious diseases, or biochemistry of disease. At least 24 hours of coursework, including a minimum of 6 hours at the 600 level, and 24 hours of Dissertation 600 are required for a total of 48 hours. For students with professional degrees, a minimum of 18 hours of coursework beyond the professional degree is required for a total of 42 hours.

The doctoral committee (at least 4 members) is chosen during the first year. Three of the four members, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be from the College of Veterinary Medicine and at least one member from the Graduate School of Medicine. A comprehensive examination is given at the completion of coursework. A seminar and final oral defense of the dissertation culminate the program.

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

500 Thesis (1-15) P/NP only. E
501 Special Topics in Comparative and Experimental Medicine (1-4) Specialized experience in comparative and experimental 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
503 Predictive Toxicology (3) Principles and techniques of predictive toxicology: structure-activity relationships, expert systems, neural nets and molecular similarity.
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 humane surgical modifications of experimental animals. Techniques of anesthesia, Drug administration and postoperative care. Prereq: Embryology, parasitology, physiology and/or consent of instructor. 1 hr. and 2 lab. E
521 Advanced Mammalian Physiology I (4) Mammalian nervous system, muscle, cardiovascular system, and control mechanisms. Prereq: general undergraduate anatomy and physiology and Biochemistry I or I and II equivalent or consent of instructor. Recommended prereq: Biochemistry I. (Same as Zoology 521) 3 hrs and 1 lab. E
522 Advanced Mammalian Physiology II (4) (Same as Zoology 522)
530 Wildlife Diseases (2) (Same as Wildlife and Fisheries Science 530)
533 Epidemiology/Public Health (4) (Same as Veterinary Medicine 533)
536 Toxicology (2) (Same as Veterinary Medicine 536)
537 Multispecies Medicine (4) (Same as Veterinary Medicine 537)
538 Nutritional Aspects of Companion Animal Health (2) (Same as Animal Science 538)
545 Principles of Medical Science (2) (Same as Veterinary Medicine 545)
551 Mammalian Organology (3) (Same as Animal Science 551)
Comparative and Experimental Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Computer Science

Graduate Minor consists of any two of Computer Science 530, 560 and 580.

Comparative and Experimental Medicine--Graduate School of Medicine

GRADUATE COURSES

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

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

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

509 Review of Graduate Computing Facilities (1) Required of all graduate students during the first semester in which they used computing facilities. May be repeated. S/NP only, E

552 Principles of Oncology (3) Lectures, classroom discussion, and case reports surveying major topics of oncology. Prereg: Biology 220-30 or consent of instructor. F

553 Current Topics in Cancer (1) May be repeated. Maximum 4 hrs. E

554 Comparative Hematology (3) (Same as Animal Science 554.)

561 Pharmacology (4) Principles of pharmacokinetics and pharmodynamics properties of drugs: mode of action, pharmacologic effects, chemical and physical properties, metabolism, toxicities, important idiosyncrasies and clinical applications. Prereg: Consent of instructor. F

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

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

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

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

605 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar per term on allotted. Prereg: Consent of instructor. May be repeated. Maximum 4 hrs. Class meets once monthly. 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. Prereg: Celluar and Comparative Biochemistry, and Advanced Topics in Biochemistry, Virology and Virology Lab, or Microbiology-Veterinary Medicine 611-812. 2 hrs and 1 lab. Sp.A

608 Graduate Research Participation (3) Advanced research techniques while conducting individual biomedical research projects under supervision of faculty. Open to all graduate students. Prereg: Consent of instructor. May be repeated with consent of instructor. Maximum 9 hrs. S/NC only, E

610 Medical Biology Seminar (1) Invited speakers. Topics posted in advance. May be repeated. S/NC only. F

611 Advanced Topics in Medical Science (1-3) New developments in biological research applicable to clinical medicine. Primarily for doctoral candidates in Comparative and Experimental Medicine. Prereg: Consent of instructor. May be repeated. Maximum 6 hrs. (Same as Zoology 611.) F

652 Special Topics in Pathology (1-3) Pathologic anatomy, biochemical pathology, and related areas. Primarily for doctoral candidates in Comparative and Experimental Medicine. Prereg: Consent of instructor. May be repeated. Maximum 6 hrs. F

657 Immunology and Epidemiology of Domestic Animals (1) Bacterial and viral diseases, bacterial and viral diseases of horses, swine, and poultry. Prereg: Consent of instructor. May be repeated. Maximum 4 hrs. E

690 Mechanisms of Disease (4) Advanced topics in pathophysiology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, and therapy. Prereg: Consent of instructor. May be repeated. Maximum 4 hrs. E

698 Seminar in Immunology (1-3) Prereg: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

751 Principles of Genetics (3) Human molecular genetics:染色体、基因组、遗传信息的编码、重组、复制、转录、翻译、调控和表达。Prereg: Consent of instructor. May be repeated. Maximum 6 hrs. F

752 Principles of Genetics (3) Human molecular genetics:染色体、基因组、遗传信息的编码、重组、复制、转录、翻译、调控和表达。Prereg: Consent of instructor. May be repeated. Maximum 6 hrs. F

754 Mechanisms of Disease (4) Advanced study of disease models in model systems. Prereg: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

762 Disorders of the Endocrine System (2) (Same as Animal Science 652.)

THE DOCTORAL PROGRAM

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

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

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

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

Original research reported in a dissertation of high quality is emphasized. The minimum hour requirements are 24 hours of course 600 Doctoral Research and Dissertation and 24 hours of graduate courses beyond the equivalent of a master's degree (i.e., beyond 30 graduate course 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 UTK. 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

420 Advanced Topics in Machine Intelligence (3) Search, learning, expert systems, neural networks, pattern recognition and natural language processing. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

430 Advanced Topics in Hardware Systems (3) Architecture, parallel processors, microprogramming, networks and communications research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

460 Advanced Topics in Software Systems (3) Operating systems, compilers, parallel computation, software engineering, database systems and programming languages. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

470 Advanced Topics in Scientific Computation (3) Numerical methods, supercomputers and computer modeling and simulation of physical systems. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

471 Special Topics in Computer Science (1-3) May be repeated. Maximum 9 hrs.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when 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 only. E

521 Artificial Intelligence (3) Heuristic search, automatic theorem proving, symbolic methods, semantic information processing and representation theory. Prereq: Discrete Structures and Problem Solving.

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

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

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


532 Boolean Algebra, Logic Design and Microprocessors (3) Boolean algebra, combinational and sequential logic design, microprocessors, hardware lab. Prereq: One year of mathematics beyond algebra and trigonometry.


551 Pattern Analysis (3) Decision-theoretic and statistical pattern analysis. Deterministic and statistical decision rules, feature extraction and representation; symbolic 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) as Mathematics 571-72.

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

574 Finite Element Methods (3) as Mathematics 574.

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

576 Sparse Matrix Computations (3) Solution of large sparse linear systems: graph models, reordering techniques, symbolic factorizations, data structures, numerical algorithms, complex 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.


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.
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. For information about the various programs of study, write to the unit admissions secretary.

ADMISSION REQUIREMENTS

Admission requirements include up-to-date scores from the GRE, the unit admission application form and letters of recommendation. For the doctoral programs, a writing sample is also required. The application deadline for admission is February 1 for all programs. Some programs also review applications November 1.

GRADUATE COURSES

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

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 completed. May not be used toward degree requirements. May be repeated. S/NC only. E


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

518 Educational Specialist Research and Thesis (3) May be repeated. 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

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

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

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

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

554 Group Dynamics and Methods (3) Theory and types of groups, dynamics 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. F.Su

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

558 Internship in School Counseling (1-6) Supervised postpracticum employment at academic unit approved site. Prereq: 555 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

559 Internship in Community Agency Counseling (1-6) Supervised postpracticum employment at academic unit approved human services agency. Prereq: Admission to community agency program, 555 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

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

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

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

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

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

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

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

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

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

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

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

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

659 Internship in Counselor Education (1-6) Supervised employment in academic unit approved internship sites in counselor education. May be repeated. Maximum 12 hrs. S/NC only. E

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. F.Sp


670 Foundations of Counseling Psychology (3) History, theory, research and practice of counseling psychology. Prereq: Admission to counseling psychology doctoral program. May be repeated. Maximum 6 hrs. F.Sp

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

672 Psychological Dysfunction (3) Classification methods, dynamics and treatment of dysfunctional individuals in counseling. Prereq: 525 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. S/NC only. E

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

Culture Studies in Education

(Major of Education)

MAJOR DEGREES

Curriculum and Instruction ................... M.S., Ed.D. Education ........................................... Ph.D. Human Performance and Sport Studies .......................... M.S., Ed.D.

J. Paul, Leader

Professors:

Associate Professors:

The Cultural Studies in Education unit offers graduate programs leading to the Master of Science with a major in Curriculum and Instruction, concentration in educational foundations and elementary teaching; the Doctor of Education with a major in Curriculum and Instruction, concentration in social foundations; and the Master of Science and the Doctor of Education with a major in Human Performance and Sport Studies, concentrations in mental health, behavior and social and cultural foundations. The unit also participates in the college-wide Ph.D. program with a major in Education. See Education under Fields of Instruction for full description of all degree requirements.
**GRADUATE COURSES**

500 Thesis (1-6) P/NP only. E

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

502 Registration for Use of Facilities (0-15) 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.


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


513 Philosophy of Education (3) Truth, knowledge, and valuation in relation to work in schools. F

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

515 Social Theories of Sport (3) Liberal, democratic, and Marxist social theories of sport. (Same as Sociology 505.) E

526 Philosophy of Education (3) Truth, knowledge, and valuation in relation to work in schools. F

528 Motor Behavior: A Theoretical Perspective (3) Motor behavior from information processing perspective; overview of current research that supports theoretical bases. Prereq: Undergraduate course in general psychology or consent of instructor. E

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

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

540 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 set of techniques for conducting educational enterprise. F

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

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


544 Survey in Contemporary Philosophies of Education (3) Introduction to major philosophical and sociological perspectives in contemporary theories of education. E

545 Educational Sociology (3) Sociological analysis of educational system. Controversial 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

549 Topics in International Education (3) Historical, philosophical, and sociological foundations for educational systems and their cultures. May be repeated. E

560 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research, including the following qualitative research methods: ethnography, case study, history, and life history. Critical reading and evaluation of qualitative research studies. F

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

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

595 Special Topics (1-3) Advanced study in selected aspects of cultural studies. Maximum 9 hrs. S/NC or letter grade. E

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

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

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

605 Seminar in Philosophy of Education (3) Selected philosophical issues in education. Prereq: 2 courses in philosophy of education or consent of instructor. E

625 Seminar in History of Education (3) Selected historical issues in education. Prereq: 2 courses in history or philosophy of education. Prereq: 2 courses in history or philosophy of education. May be repeated with consent of instructor. F

626 Seminar in Educational Anthropology (3) Advanced seminar in educational anthropology. Prereq: Consent of instructor. E

627 Seminar in Educational Anthropology (3) Advanced seminar in educational anthropology. Prereq: Consent of instructor. E

649 Topics in Philosophy of Education (3) Advanced seminar in educational philosophy. Prereq: Consent of instructor. May be repeated. E

651 Seminar in Educational Anthropology (3) Specialized study of educational anthropology. Prereq: Consent of instructor. E

652 Advanced Studies in Educational Anthropology (3) Specialized study of educational anthropology. Prereq: Consent of instructor. E

658 Seminar in Educational Anthropology (3) Specialized study of educational anthropology. Prereq: Consent of instructor. E

661 Practicum (1-3) Intern experience in areas of major interest. May be repeated. E

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

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

695 Special Topics (1-3) Study for doctoral students in selected aspects of cultural studies. May be repeated. Maximum 9 hrs. S/NC or letter grade.

**Ecology**

(20433)

MAJOR

DEGREES

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

Dewey L. Bunting, Director

J. Larry Wilson, Associate Director

Paul A. Delcourt, Associate Director

Professors:

Bunting, Dewey L. (Liaison), Ph.D. Oklahoma State

Delcourt, Hazel, Ph.D. Minnesota

Drake, James A., Ph.D. Purdue

Gross, L. J., Ph.D. Cornell

Emory

Farkas, Walter, Ph.D. ............ Duke

Pimm, S. L., Ph.D. .................... New Mexico State

Riechert, Susan E., Ph.D. ............ Wisconsin

Sayler, Gary S., Ph.D. ............... Idaho

Smith, W. C., Ph.D. ................... Duke

Stacey, G., Ph.D. ..................... Texas

Shared faculty are drawn from other University departments, the Oak Ridge National Laboratory, and the Tennessee Valley Authority.

The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdisciplinary 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 a spectrum of natural habitats and consequential 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...
the Ecology Program. Inquiries concerning the admission requirements should be addressed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37996-1610.

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 thesis committee. A listing of approved campus-wide ecology offerings is provided to each student during orientation.

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

THE DOCTORAL PROGRAM

The requirements for this degree are in general the same as those of The Graduate School. The doctoral program must include Ecology 573, 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.

MINOR IN ENVIRONMENTAL POLICY

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

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

484 Conservation Biology (3) (Same as Zoology 484.)
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E
510 Special Problems in Ecology (1-3) Individual investigations in ecology. May be repeated with consent of instructor. Maximum 6 hrs.
520 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. Appropriate for students in Planning and Environmental Engineering.
552 Development Planning in the Third World (3) (Same as Planning 552.)
555 Environmental Planning (3) (Same as Planning 555.)
561 Environmental Toxicology (3) (Same as Biochemistry 561.)
573 Population Biology (3) (Same as Zoology 573 and Botany 573.)
574 Communities and Ecosystems (3) Patterns underlying principles behind short and long term community and ecosystem organization, dynamics, energetics and nutrient cycling.
600 Doctoral Research and Dissertation (3-15) P/NP only. E
604 Current Topics in Environmental Toxicology (1) (Same as Biochemistry 604.)
610 Special Topics in Ecology (3) Seminars on advanced topics and recent developments. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
620 Seminar in Ecology (2) May be repeated. Maximum 12 hrs.
635 Environmental Assessment and Sustainable Development in Third World Countries (3) Concepts and methods of environmental impact assessment and risk assessment. Sustainable development concepts and issues in developing countries. The role of risk and impact assessment in achieving sustainable development. Prereq: General ecology or equivalent. (Same as Botany and Planning 635.)

Economics

(Major of Business Administration)

MAJORS DEGREES
Economics M.A., Ph.D.
Business Administration MBA

William F. Fox, Head

Professors:
Bohm, Robert A. (Liaison), Ph.D., M.D. ... Washington (St. Louis)
Bowdler, Roger L., Ph.D. ...................... Texas
Carroll, Sidney L., Ph.D. ....................... Harvard
Chang, Hsi S., Ph.D. .......................... Vanderbilt
Clark, Don P., Ph.D. ........................... Michigan State
Cole, William E., Ph.D. ........................ Texas
Davidson, Paul (J. Fred Holly Chair), Ph.D. .......... Pennsylvania
Fox, William F., Ph.D. ........................ Ohio State
Garrison, Charles B., Ph.D. ................. Kentucky
Herzog, Henry W., Ph.D. ..................... Maryland
Jensen, Hans E. (Emeritus), Ph.D. ............ Texas
Lee, Fung-Yao, Ph.D. ........................... Michigan State
Mayhew, Anne, M.S. ........................... Texas
Moore, John R. (Distinguished Prof.) (Emeritus), Ph.D. .......... Cornell
Neale, Walter C. (Emeritus), Ph.D. ............. London
Russell, Milton, Ph.D. ........................... Oklahoma
Schlottman, Alan M., Ph.D. ..................... Texas
Spiva, George A. (Emeritus), Ph.D. ............. Texas

Associate Professors:
Gauger, Jean A., Ph.D. ........................ Iowa State
Glustoff, Errol, Ph.D. ............................ Stanford
Kahn, James R., Ph.D. ........................... Maryland
Mayo, John W., Ph.D. ......................... Washington (St. Louis)
Murray, M. N., Ph.D. ............................ Syracuse
Phillips, Keith E., Ph.D. ....................... California (Davis)
Rubin, Jonathan D., Ph.D. ...................... California (Davis)
Bearac, Peter M., Ph.D. ........................ Virginia
Farmer, Amy L., Ph.D. .......................... Duke

The Department of Economics offers graduate programs leading to the M.A. and Ph.D. The M.A. may be completed by either a thesis or non-thesis option, while the Ph.D. requires successful completion of a dissertation. Applicants to these programs should contact the Director of Graduate Studies, Department of Economics, for further information. The Department also offers an area of concentration for the M.B.A. degree. Students interested in the M.B.A. 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 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 established by the degree program for part-time students and the next two semester's coursework as established by the degree program for full-time students.

STUDENT'S RIGHT TO PETITION

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

THE MASTER'S PROGRAM

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

The non-thesis option requires 30 hours of coursework at the 400 level or above. Of these, at least 24 hours (at least 18 hours of which are in economics) must be at the 500 level or above. Of the minimum of 16 hours in economics at the 500 level or above, 12 hours must consist of 511, 512 and 513, 514, and the remaining 6 hours must be in one field of economics. Of the 30 hours, a maximum of 9 hours in courses approved by the department may be taken in fields other than economics. Students electing the non-thesis option are required to pass a final comprehensive examination.

The thesis option requires 30 hours of coursework at the 400 level or above, including at least 24 hours at the 500 level or above, 6 hours of which may be thesis hours. Of the remaining 18 hours at the 500 level or above, at least 15 hours must be in economics and must
THE DOCTORAL PROGRAM

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

1. Students are required to complete the following core requirements:
   a. Economic Theory: Microeconomic theory and macroeconomic theory by a qualifying exam taken not later than the beginning of the fourth semester of study.
   b. History of Economics: Completion of 515 or 516 with a grade of B or better, or by qualifying examination.
   c. Quantitative Methods: Completion of 581, 582 and one additional course in quantitative methods approved by the department with grades of B or better, or by qualifying examination.

   Students failing a qualifying examination must retake the examination the next time offered. A qualifying examination may be taken a third time only with approval of the department. Failing a qualifying examination for a third time will result in dismissal from the doctoral program.

2. Students are required to demonstrate competence by comprehensive examination in at least two fields of specialization in economics. Students failing a comprehensive examination must retake the examination the next time offered. A comprehensive examination in a specific field may be taken a third time only with approval of the department.

3. Students are required to complete with a grade of B or better two elective courses in economics at the 500 level or above, outside the core subject areas and outside the fields of specialization.

4. Students are required to complete a doctoral dissertation and to defend it successfully before the faculty.

MINOR IN ENVIRONMENTAL POLICY

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

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

1. Ecology 520 or Plant and Soil Sciences 414 or Geology 433 or an equivalent course approved by the coordinating committee.
   2. Six hours of coursework outside the master’s discipline approved by the coordinating committee.

BUSINESS ADMINISTRATION CONCENTRATION

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

MBA Concentration: Economics

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

GRADUATE COURSES

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

413 Macroeconomic Fluctuations (3) Analysis of historical data, methods of analyzing macro-economic fluctuations, theories of monetary and fiscal policies in aggregate economy. Major writing requirement. Prereq: Intermediate Macroeconomics or consent of instructor.

415 History of Economics (3) Methods of study of doctrinal history. Origins and evolution of major doctrines: classical and neoclassical economics, economics of Keynes and his followers, principal developments of second half of 20th century. Major writing requirement. Prereq: 201 and equivalent 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. Prereq: 201. This course includes a major writing requirement. May be repeated when topic varies. Maximum 9 hrs.


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

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

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

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

511-12 Microeconomic Theory (3,3) Theory of consumer choice and demand, theory of revealed preference, attributes of goods and implicit prices, market demand, labor supply, individual behavior under uncertainty, theory of firm, theory of production and cost, market structures, derived demand and factor pricing.


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


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

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

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

562 Labor Relations and Collective Bargaining (3) (Same as Management 522.)

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

579 Environmental Policy Research Workshop (1) Multidisciplinary analysis of advanced topics in environmental policy. Student participation required. May be repeated. Maximum 6 hrs.


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

613 Advanced Macroeconomic Theory (3) Prereq: 514 or equivalent.


623 Economic Development: Theories and Policies (3) Principal theories explaining economic behavior in developing countries and policies and strategies used to promote development. Prereq: Graduate degree in economics or consent of instructor.

624 Economic Development: Western Impact on Asia and Africa (3) Studies of consequences of contact between developed world and developing countries of Asia and Africa. Prereq: 21 hr of economics, undergraduate social science or consent of instructor.

Artistradirectregulation. Prereq: Consent of instructor.

642 Labor History and Legislation (3) Development of organized labor as an important economic and political force in U.S., from Colonial times to present. Evolution of legal status of labor unions and of individual workers vis-à-vis their employers.

651 Monetary Theory (3) Study of money, credit, and liquidity as related to real output determination, interest rates, employment, and prices. Prereq: 513.

652 Topics in Monetary Theory (3) Advanced monetary models, issues in monetary policy, open economy monetary theory and policy. Student participation. Prereq: 651.

661 Regional and Urban Location and Development Theory (3) Theory of industrial and agricultural location and human migration. Economic basis for land-use patterns, central places, and urban form. Spatial inequalities and urban problems. National policies for regional and urban assistance.

662 Methods of Regional and Urban Analysis (3) Theory of regional urban economic structure and growth. Regional income and product accounts, shift and share analysis, economic base studies, and regional urban input-output models. Theory and problem solution.


672 Public Finance: Taxation and Intergovernmental Relations (3) Theory of taxation; tax incidence and tax efficiency; policy analysis of U.S. tax structure at federal, state, and local levels. Theory of fiscal federalism and intergovernmental relations.

677 Environmental and Natural Resource Economics (3) Alternative paradigms for allocating and valuing environmental resources. Exploration of issues related to market failure and differences between renewable and nonrenewable resources.

678 Economics of Environmental Policy (3) Topics in environmental policy analysis. Consideration of alternative policy instruments, defining policy objectives and role of risk in decision-making process.

681-82 Econometric Methods (3, 3) Theory and techniques of statistical testing of economic hypotheses and construction and estimation of econometric models. Review of classical least squares regression model, and approaches to simultaneous equation models with application to current econometric research. Prereq: 582 or equivalent.

690 Workshop (3) Advanced topics in economics. Student participation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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THE MASTER'S PROGRAMS

College Student Personnel

This program under the unit of Leadership Studies 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 the thesis and non-thesis options. A minimum of 38 hours, which includes 6 hours of practicum experience, is required in either option, with a minimum of 12 hours in Higher Education courses.

Counselor Education and Counseling Psychology

Education in the Sciences, Mathematics, Research and Technology

Exercise Science

Holistic Teaching/Learning

Inclusive Early Childhood Education

Language, Communication and Humanities Education

Leadership Studies

Psychoeducational Studies

Rehabilitation and Deafness

Sport and Physical Activity

The College also offers an extended teacher preparation program with majors in Curriculum and Instruction and in Special Education. The program features a professional year internship with accompanying coursework.

TEACHER LICENSURE

For teacher licensure, a student must complete the 24 hours associated with the professional year as follows:

Fall Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internship</td>
<td>4</td>
</tr>
<tr>
<td>Speciality Studies</td>
<td>6</td>
</tr>
<tr>
<td>Analysis of Teaching for Professional Development</td>
<td>2</td>
</tr>
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</table>

Spring Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internship</td>
<td>8</td>
</tr>
<tr>
<td>Clinical Studies</td>
<td>4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>24 hrs</td>
</tr>
</tbody>
</table>

To receive graduate credit, a student must be admitted to The Graduate School prior to the first semester of internship and register as a graduate student. If a master's degree is desired with a major in either Curriculum and Instruction or Special Education, a student must be admitted to the program prior to completion of the first semester of internship. See the individual Track 2 program descriptions below for complete details.

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EDUCATIONAL PSYCHOLOGY

Admission requirements include up-to-date scores from the GRE, application form and letters of recommendation. All programs include thesis and non-thesis options. Under Counselor Education and Counseling Psychology, a major in Guidance, concentrations in elementary guidance, school counseling, and secondary guidance, requires 60 hours plus supervised practicum and internship experiences working with clients. Under Psychoeducational Studies, the major in Educational Psychology requires 36 hours. A final examination is required of all master's degree students.

Guidance

Admission requirements include up-to-date scores from the GRE, the unit admissions application form and letters of recommendation. The program includes thesis and non-thesis options. Under Counseling Education and Counseling Psychology, a major in Guidance, concentrations in elementary guidance, school counseling, and secondary guidance, requires 48 hours and supervised practicum and internship experiences working with clients. A final examination is required.

Human Performance and Sport Studies

Concentrations are available in motor behavior and sociocultural foundations under Cultural Studies in Education; exercise science (exercise physiology/fitness, kinesiology/sports medicine) under Exercise Science; and sport administration/management under Sport and Physical Activity. Both thesis and non-thesis education and social science education under Holistic Teaching/Learning; elementary education under Inclusive Early Childhood Education; and art education, English education, foreign language education and reading education under Language, Communication, and Humanities Education.

The non-thesis option requires the completion of 33 hours of coursework. The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. Both options require a minimum of 12 hours in the major discipline.

For art education, the non-thesis requirements are Art Education 510, 520, 530, and 540; Education 517, 574, 575, 591; and 3 hours selected from Social Foundations of Education 511, 526, 542, 543, 544. Education in the Sciences, Mathematics, Research, and Technology 535, 589, 599 or 588 for a total of 36 semester hours.

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Track 2 - Concentrations are available in elementary teaching and in secondary teaching under Education in the Sciences, Mathematics, Research, and Technology, and under Holistic Teaching/Learning; elementary teaching under Cultural Studies in Education, and under Inclusive Early Childhood Education; and art education and secondary teaching under Language, Communication, and Humanities Education.

The requirements are the same as those for Teacher Licensure plus 12 hours in the academic discipline as approved by the student's committee, for a total of 36 hours. The thesis option requires 6 additional hours of Thesis 500 for a total of 42 hours.

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

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THE COLLEGE OF EDUCATION

MAJORS DEGREES

College Student Personnel M.S.

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

Education Ph.D.

Educational Psychology M.S., Ed.D.

Educational Psychology and Guidance Ed.S.

Guidance M.S.

Human Performance and Sport Studies M.S., Ed.D.

Leadership Studies in Education M.S., Ed.S., Ed.D.

Rehabilitation Counseling M.S.

Special Education M.S.

The College of Education offers the Master of Science, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees in cooperation with eleven individual units:
options are available. The non-thesis option requires 32 hours, including a project, and a course in research design or an approved specialized research class. The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. Both options require a minimum of 12 hours of Sport Studies, Exercise Science, or Sport Management courses.

Leadership Studies in Education

The master’s degree program under Leadership Studies offers concentrations in adult education and in educational administration and supervision. Both concentrations require a minimum of 33 credit hours including 6 hours of Thesis 500 for the thesis option and 36 hours for the non-thesis option.

The concentration in adult education requires a minimum of 12 hours in Adult Education courses.

The concentration in educational administration and supervision consists of a minimum of 18 hours of coursework in Educational Administration and Supervision. A final oral examination is required for the thesis option, with a written exam at the option of the committee. A final written comprehensive examination is required for the non-thesis option, with an oral exam at the option of the committee. Students entering either of these options must complete the introductory core consisting of Educational Administration and Supervision 513, 515, 516, and 535 or a demonstrated computer proficiency. The courses are prerequisites to other courses in the unit.

Rehabilitation Counseling

The program under Rehabilitation and Deafness prepares professional counselors for successful practice in public and private rehabilitation programs. Rehabilitation counselors assist individuals with disabilities to achieve their optimal level of functioning in living, learning, and working environments. Rehabilitation counselors work primarily with youth and adults who have congenital or acquired physical, intellectual, or emotional disabilities. Clinical practice offers students an opportunity to emphasize skill development for specific or general disability caseloads. The program is fully accredited by the Council on Rehabilitation Education, Inc. and requires 60 semester hours, including internship. A minimum of 12 hours of Rehabilitation and Deafness courses is required. Thesis and non-thesis options are available. Graduates are employed by federal and state governments, hospitals, private industry, and a variety of community agencies.

Special Education

Two tracks are offered for the master’s degree with a major in Special Education. Track 1 is for students who are already licensed to teach in special education or a related field or those who are seeking a master’s degree without teacher licensure. Track 2 is for students seeking initial licensure. Thesis and non-thesis options are available for both tracks.

Concentrations for both tracks are offered in general special education under Inclusive Early Childhood Education; and hearing impaired under Rehabilitation and Deafness.

Track 1 - Coursework may apply toward State of Tennessee endorsements (add-on certification in specific licensure areas). The non-thesis option requires 36 hours, including a minimum of 18 in the specific discipline, and a final written and oral comprehensive examination. The thesis option requires 50 hours, including 6 hours of Thesis 500, and a minimum of 12 hours in the discipline.

Track 2 - The requirements are the same as those for Teacher Licensure plus 12 hours in the academic discipline as approved by the student’s committee, for a total of 36 hours. The thesis option requires 6 additional hours of Thesis 500 for a total of 42 hours.

Students completing a program of study in the general special education concentration area are qualified to be teachers and/or consultants in a variety of special education programs providing services to people certified as emotionally retarded, learning disabled, emotionally disturbed, multiply disabled, and socially or emotionally disturbed. General special education majors, in conjunction with their committees, select one or more specializations for their program of study. Six to nine hours of coursework in the designated area should be taken. Approved specializations include effective/motivational approaches, assessment/diagnosis, cognitive education, early childhood, gifted education, rehabilitation, and/or technology. Students also may select a cognate of three to six hours of coursework taken outside the unit.

Students completing a program of study in the education of the hearing impaired concentration area are qualified to teach in public or residential schools for the hearing impaired. Graduates are eligible for both Council on Education of the Deaf (CED) certification and Tennessee state certification. Internships (student teaching) may be completed at the Tennessee School for the Deaf, in mainstream programs in the state or in programs for the hearing impaired in North Carolina, Kentucky, Georgia, Virginia and the District of Columbia.

THE SPECIALIST IN EDUCATION PROGRAMS

Curriculum and Instruction

The Educational Specialist degree program with a major in Curriculum and Instruction encompasses concentrations in curriculum, elementary education, instructional media and technology, mathematics education, and science education under Education in the Sciences, Mathematics, Research, and Technology; in elementary education, reading education, social science education, and teaching and learning under Holistic Teaching/Learning; in elementary education under Inclusive Early Childhood Education; and in English education, foreign language education, and reading education under Language, Communication, and Humanities Education.

Refer to Degree Requirements under The Graduate School for complete program requirements.

Educational Psychology and Guidance

Under Counselor Education and Counseling Psychology, the minimum hours required for the concentration in counselor education is 79. Under Psychoeducational Studies, the minimum number of hours required is 90. Residence is two consecutive semesters. The concentration in counselor education requires a year-long practicum sequence and the equivalent of a year’s full-time work as an intern in an appropriate counseling setting. It also requires supervised practicum experience in classroom teaching. Coursework in statistics and research design is a requirement for all concentrations/programs. All doctoral students take written comprehensive examinations in the program concentration, supporting specialization and cognate areas. The guidelines for each program concentration may be consulted for further requirements.

Leadership Studies in Education

For the Ed.D. program under Leadership Studies, with concentrations in adult education, educational administration and supervision, and
higher education, 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 Leadership Studies unit also offers an Ed.D. concentration for practicing school administrators. Please contact the unit for further information.

Human Performance and Sport Studies

The Doctor of Education with a major in Human Performance and Sport Studies is available under Cultural Studies in Education with concentrations in motor behavior and sociocultural foundations (history, philosophy, sociology); under Exercise Science with a concentration in exercise science (exercise physiology/fitness, kinesiology/sports medicine). Please contact the appropriate unit for further information.

THE DOCTOR OF PHILOSOPHY PROGRAM

The intercollegiate Ph.D. program with a major in Education provides five concentrations. The units participating in the Ph.D. program are Counseling Education and Counseling Psychology; Cultural Studies in Education; Education in the Sciences, Mathematics, Research, and Technology, Exercise Science; Holistic Teaching/Learning; Inclusive Early Childhood Education; Language, Communication, and Humanities Education; Leadership Studies; Psychoeducational Studies; and Rehabilitation and Deafness.

The program requirements 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</td>
<td>6</td>
</tr>
<tr>
<td>General Core Requirements</td>
<td></td>
</tr>
<tr>
<td>- History and philosophy of education</td>
<td>4</td>
</tr>
<tr>
<td>- Learning theory and curriculum</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></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>
<tr>
<td>Concentrations</td>
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<tr>
<td>- Primary Concentration: A minimum of 15 hours normally selected from one or two specializations within the primary concentration</td>
<td>16</td>
</tr>
<tr>
<td>- Supporting Specialization: A minimum of 9 hours selected from a specialization in a concentration other than the primary concentration</td>
<td>9</td>
</tr>
</tbody>
</table>

Cognate

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

Dissertation

- The concentrations and specializations are:

Administrative Theory and Practice

Specializations:

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

Theories of Curriculum Development and Foundations of Education

Specializations:

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

Instructional Theory and Practice

Specializations:

1. Principles and models for instructional improvement
2. Elementary and early childhood instruction and practices
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. Special education and rehabilitation

Theories and Practice of Educational and Personal Adjustment

Specializations:

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

Foundations of Human Movement

Specializations:

1. Exercise Science: Kinesiology/Sports Medicine Exercise Physiology/Fitness
3. Sociocultural Foundations of Sport: Sport History Sport Philosophy Sport Sociology

For the Ph.D. with a major in Education under Counselor Education and Counseling Psychology and under Psychoeducational Studies, two applications are required: one for the Ph.D. in Education program and one for the unit that specifies which specialization is desired, in addition to the application for admission to The Graduate School.

Under Counselor Education and Counseling Psychology, the following minimum number of hours is required in each program specialization: counseling psychology, 98; counselor education, 98; educational psychology, 92. Residence is three consecutive semesters of full-time coursework. The 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 specializations. Pre-dissertation research participation is also a requirement. The specializations in counseling psychology and counselor education 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 specializations in educational psychology and counselor education also require supervised practicum experience in classroom teaching.

MINOR IN GERONTOLOGY

Graduate students in the units of Counselor Education and Counseling Psychology, Exercise Science, or Psychoeducational Studies, may pursue a specialized minor in gerontology. This interunit/interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Curriculum and Instruction (concentration in foreign language education) is available to residents of the state of Tennessee. The M.S. program in Counseling Psychology, specialization in counseling psychology, 92; school psychology, 97. The guidelines for each program specialization may be consulted for further requirements.

GRADUATE COURSES

510 Advanced Educational and Clinical Procedures (3-6) Integration of advanced educational and clinical procedures: skills and knowledge for implementing instruction and for consulting with other persons in treatment of exceptional individuals. May be repeated. Maximum 6 hrs.

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

526 Constructive Research: Analysis and Application (3) Analysis of research on instruction. Translation and application of research findings into instructional performance. Prerequisite: Consent of instructor. F/Su

540 Topics in Improvement of Instruction (1-3) Special conferences, workshops, and service programs. May be repeated. Maximum 6 hrs. S/NC only. E
552 Direction and Supervision of Student Teaching (3) Roles and responsibilities of cooperating teachers and student teacher; objectives and policies of student teaching program; elements of clinical supervision; overview of research. Prereq: Consent of Instructor.
568 Teacher-Parent-Community Relations (3) Techniques for effective relations between parents and teachers; examination of roles and expectations; personal involvement; volunteer programs; influence of community on educational process. Prereq: Consent of Instructor.
574 Analysis of Teaching for Professional Development (2) Strategies to document and analyze effectiveness of teaching and of professional development. Study and application of various approaches. Coreq: 575. F
575 Professional Internship in Teaching (1-6) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to postbaccalaureate students in professional year program. Prereq: Admission to Teacher Education Program. May be repeated. Maximum 12 hrs. S/NC only. F,Sp
576 Practicum in Classroom Teaching (1-6) Teaching and teaching-related experiences in elementary and secondary school settings. Specific hours and school level assignment determined by license or certification requirements. May not be used for probationary license year. May not be used toward degree requirements. May be repeated. Maximum 12 hrs. S/NC only. E
589 Field Experience (1-3) Application of field and instructional principles, methods, and materials in schools. Prereq: Program prerequisites and consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E
591 Clinical Studies (4) Group of individual seminar activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.
593 Teacher Education in America (3) For students preparing to enter teacher education. Unites historical development, program analysis and evaluation, current issues, and future directions. F
595 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
596 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
598 Teaching Science Grades 7-12 (3) Preparation of teaching plans, evaluation, materials for teaching mathematics; teaching simulation and directed observation in schools. Prereq: Admission to Teacher Education Program.
599 Techniques of Research in Education (3) Study of research methodology applicable to curriculum, instruction, and classroom management applications from microcomputers to supercomputers. Prereq: Consent of instructor. F,Sp
518 Educational Specialist Research and Thesis (3) May be repeated. P/NP only. E
520 Techniques of Research in Education (3) Study and application.
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,Sp
519 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. E
555 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
541 The High School Curriculum (3) Identification of problems associated with curriculum study. Tennessee curriculum framework, assessment of trends in programs of local, regional, and national significance. E
557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Characteristics of junior high and middle school. Sp,Su
558 Curriculum Planning and Development (3) Foundations and principles of curriculum planning and development. Historical analysis of curriculum theory, principles of planning and development, and classroom applications for improved teaching. E
560 Educational Statistics (3) Applications of descriptive and inferential statistics to educational and instructional programs. Use of electronic calculators in educational research. Prereq: One year of college mathematics, an elementary course in statistics, or consent of instructor. F,Sp
565 Instructional Trends and Issues in Science Education (3) Analysis of current trends in science instruction, instructional issues facing elementary, secondary, and community college science teachers, and application of learning theory to teaching biological, physical, and environmental sciences. Prereq: 406, 422, or equivalent.
566 Administering Instructional Media Programs (3) Leadership roles and responsibilities of professional media administrator in various of organizational settings. F
569 Advanced Production of Audiovisual Software (3) Hand and mechanical lettering, flat picture mounting, laminating, overhead projection, audio production, TV studio orientation, sync-taping, multilens presentation, and printing techniques. (Same as Information Sciences 569.) F
570 Techniques for Research in Curriculum and Instruction (3) Fundamentals of research methodology applicable to curriculum, instruction, and classroom management applications from microcomputers to supercomputers. Prereq: Consent of instructor. F,Sp
573 Utilization of Educational Television and Radio (3) Television and radio as instructional and training media. Selecting, making and evaluating instructional training video and audio tapes. F
575 Introduction To Data Processing in Curriculum and Instruction (3) Analysis of current activities in educational computing and data processing. Curricular, instructional, research, and classroom management applications from microcomputers to supercomputers. Prereq: Consent of instructor. F,Sp
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 courses in teaching of mathematics. Su
582 Teaching Enrichment Mathematics in Middle and Junior High Schools (3) Topics to enrich middle
and/or junior high mathematics. Geometrical, laboratory, and problem solving activities. Special attention to metric system. Opportunities for individual projects. Prereq: 581. Su


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

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

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

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

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

596 Curricular Trends and Issues in Science Education (3) Analysis of elementary and secondary curriculum projects and trends in physical, and environmental sciences. Impact of current learning theories on future curriculum development projects. Prereq: 496, 422, or equivalent. Prereq or coreq: 565 or consent of instructor.

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

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

623 Using Research for Curriculum Improvement (3) Research methodology; application to descriptive/survey curricular materials. Critical reading of research, methodological development in descriptive and survey areas. So


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

671 Advanced Educational Statistics (3) Applications of parametric and non-parametric statistical inference to educational and psychological problems. Use of microcomputers in educational research. Prereq: 581. Sp,Su

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

675 Curriculum Evaluation: Theory and Application (3) 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

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

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

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

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


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**Electrical and Computer Engineering**

(Former College of Engineering)

**MAJOR**

Electrical Engineering ................................ M.S., Ph.D.  
R. C. Gonzalez, Head

Professors:

Alexeff, Igor, PE, Ph.D. ......................... Wisconsin  
Bailey, J. Milton, Ph.D. ......................... Georgia Tech  
Birdwell, J. Douglas, Ph.D. ..................... MIT  
Bishop, Ase O., Jr., Ph.D. ..................... Clemson  
Blaiock, T. Vaughn, Ph.D. ..................... Tennessee  
Bodtenderhuis, Robert E., Ph.D. ........ ...... Northwestern  
Bose, Bimal K. (Condra Chair of Excellence), Ph.D. ....................... Calcutta  
Bouloud, Donald W., Ph.D. .................... Vanderbilt  
Gonzalez, R. C. (Distinguished Prof.), Ph.D. ....................... Florida  
Hoffman, Graham W., Ph.D. ................... Harvard  
Hungr, James C. (Distinguished Prof.), Ph.D. ....................... New York  
Kennedy, Eldredge J., PE, Ph.D. .............. Tennessee  
Lawler, Jack S., Ph.D. .......................... Michigan State  
Leffell, Will O. (Emeritus), M.S. ............ Tennessee  
Neff, Herbert P., PE, Ph.D. .................... Auburn  
Pace, Marshall O. (Liaison), Ph.D. ......... Georgia Tech  
Pierce, J. Frank (Distinguished Prof.) ....... (Emeritus), PE, Ph.D. ....................... Pittsburgh  
Pujoil, Alfonso Jr. (UTSI), Ph.D. ............ Vanderbilt  
Roberts, M. J., Ph.D. ............................ Tennessee  
Robichet, Robert W. (Emeritus), Ph.D. ..... Maryland  
Roth, J. Rose, Ph.D. ............................. Cornell  
Symonds, Frederick W., Ph.D. .............. Nottingham  
Tillman, James D. (Emeritus), Ph.D. .......... Auburn  
Trivedi, Mohan M., Ph.D. ..................... Utah State  
Weaver, Charles H. (Emeritus), Ph.D. ...... Wisconsin

Associate Professors:

Abidi, M. A., Ph.D. ................................. Tennessee  
Bomar, Bruce W. (UTSI), Ph.D. ............. Tennessee  
Brazakov, Dragana, Ph.D. ..................... Florida  
Crilly, Paul B., Ph.D. ............................ New Mexico State  
Joseph, Roy D. (UTSI), Ph.D. ............... Case Western  
Kosh, Daniel, Ph.D. ............................. Missouri (Rolla)  
Rosenberg, David, Ph.D. ..................... New York  
Robichet, James M., Ph.D. .................... Tennessee  
Wallger, J. Wayne, Ph.D. ...................... Tennessee

Assistant Professor:

Smith, L. Montgomery (UTSI), Ph.D. ........

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 master's degrees in the field of nuclear engineering. 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 Assistant- ship positions 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.

**Admission Requirements**

Students applying for admission to the Master of Science program and who hold a B.S. in Electrical Engineering must meet the admission standards except for this background. Students should have also have a background equivalent to that obtained by earning credit with a minimum 3.0 grade-point average in the Electrical Engineering courses normally taken at the 200 and 300 levels in the Bachelor's program in this department, and two senior electrical and computer engineering courses (and any labs associated with them) in the student's area of interest. Students from fields other than electrical engineering who have met the admission standards except for this background will be admitted only as non-degree students until they have completed coursework to provide this background.

**Master's Degree Requirements**

Specific degree requirements which must be met include:

1. Electrical and Computer Engineering 503 and 504.
2. Six semester hours of graduate credit in mathematics consisting of mathematics courses of 400 level or higher which have been approved by the 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 of electrical and computer engineering courses and 6 semester hours of 500-level work in another area approved by the student's master's committee. The 500-level work in electrical and computer engineering courses must include at least 6 hours in the student's major area.
demonstrate a mastery of the dissertation area, ability to think analytically and creatively, skill in using academic resources, and ability to complete the dissertation satisfactorily.

The oral part consists primarily of a professional presentation of a proposal for dissertation work and its defense. The committee may cover additional topics in the oral part.

5. Participation in departmental seminars.


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 and then to the Department Faculty.

GRADUATE COURSES

Note: Courses required in the Electrical and Computer Engineering undergraduate curriculum cannot be used in the M.S. or Ph.D. programs. No 300-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, non-recessive and recursive filter design, and CAD tools for filter design. Includes laboratory experiments and projects.


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 driver point synthesis, transfer function synthesis, approximation theory, topics in active network synthesis. Prereq: 412.

421 Electric Energy Systems (3) Structure and operation of electrical energy grid; load flow; economic loading; planning; control; reliability, Balanced and unbalanced faults; system protection; system stability. Prereq: Electric Energy System Components.

422 Machines (4) Dynamic behavior of rotating machines; transfer functions for common modes of operation of a.c. machines; response to different waveforms in supply; describing equations for a.c. machines and their numerical solutions. Includes laboratory experiments and projects. Prereq: Electric Energy System Components.

431 Digital and Analog Integrated Electronics (4) Basic building and fabrication of active and passive components for monolithic integrated circuits. Characteristics of bipolar, MOS, and JFET transistors in typical analog and digital integrated circuit designs. Standard digital circuit families, such as NMOS, CMOS, and GaAs gates and arrays; design concepts for op-amps, comparators, references, regulators, and other linear functions. Includes laboratory experiments and projects. Prereq: Electronic Circuits.

432 Analog Signal Processing Electronics (4) Transducer and interconnecting characteristics; analog integrated circuits: operational, instrumentation, and isolation amplifiers; a.c. and d.c. amplifiers, and function generators; integrated circuit applications; active filters, level and phase detection, multiplexers, memories, and digital/analog converters; comparators. Includes laboratory experiments and projects. Prereq: Electronic Circuits.

433 Electronic Amplifiers (4) Feedback amplifier principles; wideband linear amplifier design; radio frequency and audio power amplifier design; linear regulated power supply design; oscillator principles. Includes laboratory experiments and projects. Prereq: Electronic Circuits.


442 Antennas and Propagation (3) Linear antennas, arrays, and gain antennas. Antenna gain, impedance, communication link parameters. Wave propagation in earth bound free space, earth's troposphere and ionosphere. Reflections from earth; effects on link reliability. Prereq: Fields.


504 Random Process Theory for Engineers (3) Probability and random variables as approached by set theory. Statistical averages, marginal and correlation functions of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis as applied to systems of random signals.

505 Digital Signal Processing I (3) Discrete-time signals and systems, sampling, fast Fourier transform (FFT) and fast convolution, design of FIR filters and IIR filters.

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

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

511 Linear Systems Theory (3) State space models of linear dynamical systems, state transition map, matrix exponential, controllability, observability, realization theory, and stability theory. Core: 503.

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

515 Adaptive Control and System Identification (3) Adaptive control of linear deterministic and stochastic systems, adaptive filtering and prediction, parameter estimation for deterministic and stochastic systems. Prereq: 511-2 or 518-6.


519 Control Systems Design II (3) Digital control, variable structure control, state-space design of SISO systems, use of estimators, design of controllers, control principles 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 faults. 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 stability. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 521.

523 Power Electronics and Drives (3) Forced commutated inverters, advanced PWM techniques, current-fed inverters, drive system modeling, vector and scalar control of inverters, parameter variations, control principles of synchronous machine.

524 High Voltage Systems (3) Phenomena, generation, measurement practices and insulation in high voltage systems. Testing, surge and arc control, shielding, reliability. Prereq: 421.

528 Advanced Electrical Machines I (3) Fundamental processes of electromechanical energy conversion; application in conventional machines. Differential equations for rotating machinery. Prereq: 422 or equivalent.


532 Advanced Analog Electronics II (3) Design and analysis of wide-band low noise feedback amplifiers and radio-frequency amplifiers using discrete, monolithic and hybrid devices; voltage and current regulators, switching regulators, the use of specialized electronic systems in analog signal processing. Advanced topics from current literature. Project laboratory. Prereq: 531.

541 Electromagnetic Fields (3) Maxwell's equations, special relativity, wave reflection and transmission, generation of electromagnetic waves; guided waves; guided propagation from current elements. Prereq: Mathematics 404.


545 Introductory Microwave Networks and Components (3) Scattering and transmission representation for microwave devices: unilateral and bilateral microwave and millimeter wave devices. Component and system parameter measurement by modern network analyzers. Electronic components and systems: oscillators, amplifiers, mixers, transistors, diodes, parametric devices, mixers, switches.


552 Digital Signal Design II (State identification and design of sequential machines. Design and implementation of digital systems. Analog to digital conversion and analog to digital interface. Use of specialized electronics systems. Digital signal architecture design: microprogramming and interrupt control. Prereq: 551.

561 Plasma Diagnostics I (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, propagation from time series data. Prereq: 461, 463, or consent of instructor. (Same as Nuclear Engineering 561.)

562 Plasma Diagnostics II (3) Laboratory in operation of plasma diagnostic instruments in plasma science. Experimental design of parameters, data acquisition and analysis, preparation of time series data. Prereq: 461, 463, or consent of instructor.

565 Industrial Plasma Engineering I (3) Low temperature plasma physics relevant to industrial applications: kenetic, particle dynamics, induced electric and magnetic fields, gaseous discharges, and electron, ion, and plasma sources. Prereq: Graduate standing or consent of instructor.

566 Industrial Plasma Engineering II (3) Continuation of 565 to industrial applications: ion implantation in solids, plasma deposition and coating, propellant propulsion systems, plasma chemistry, plasma lighting devices, insulating admixtures and breakdown, materials processing with plasma arcs, and related topics. Prereq: 565 or consent of instructor.

571 Pattern Recognition (3) Decision-theoretic and statistical approaches to pattern recognition. Deterministic and statistical decision rules, feature extraction and representation, syntactic and semantic methods. Prereq: 471 or consent of instructor.


573 Vision and Sensing for Robotics and Automation I (3) Acquisition, processing, integration, and interpretation of a wide range of visual and non-visual sensing modalities as applied to autonomous and tele-operated robotic systems. Prereq: Consent of instructor.

574 Vision and Sensing for Robotics and Automation II (3) Aspects of robot programming and motion
using various sensing modalities. Selected topics from
current literature. Prereq: Consent of instructor.

581 Quantum Electronics I (3) Interaction of elec-
magnetic radiation with atoms and molecules. Com-
parison of classical and quantized models for emission
and absorption. Oscillator spectral line, shape with
amplification by stimulated emission of radiation and
schemes for obtaining population inversion. Optical resonant ca-
vities, steady-state and Q-switched operation. Stability
criteria. Coreq: 503.

582 Quantum Electronics II (3) Laser modulation and
stabilization techniques. Laser power, spectral content
and noise considerations. Analysis of various specific
lasers. Lasers in communication and instrumentation
systems. Plasma diagnostics. Raman emission spec-
troscopy, optical harmonic generation, holography, metal-
working, and biological and medical uses. Prereq: 581.

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

599 Special Topics (1-3) May be repeated. Maximum 9 hrs.

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

611 Stochastic Processes and Filtering Theory (3)
Probability theory and stochastic systems, uncertain
dynamical systems, nonlinear estimation and filtering
theory. Kalman Filter and extensions. Prereq: 504, 512,
Coreq: Mathematics 521.

614 Optimal Control (3) Deterministic and stochastic
dynamic programming in continuous and discrete time,
minimum principle and matrix minimum principle, com-
putational methods in optimal control. Prereq: 511.

617 Special Topics in Systems Theory I (1) Topics of
current interest to students and faculty: large scale
systems, model order reduction, algebraic and geometric
system theories, and advanced design methods. Prereq: 503 and consent of instructor.

618 Special Topics in Systems Theory II (3) Topics of
current interest to students and faculty: large scale
systems, model order reduction, algebraic and geometric
system theories, and advanced design methods. Prereq: 517.

623 Advanced Power Electronics and Drives (3)
Phase-controlled converters, cycloconverter-fed ac drives, resonant converters, vector and scalar control of
synchronous machines, static Kramer drives, static
Scherbius drives, VSCG generation, modern control
theory in ac drives.

624 Electrical Insulation (3) Principles, testing, and
case studies. Principles of aging, losses, charging,
conduction, and breakdown in vacuum, gas, liquid, solid,
and composite insulations. Testing with low
frequency instrumentation, pulse height analysis, optics,
acoustics, and bridges; associated statistics and distrib-
uted parameter effects. Gas studies drawn from active
research, power systems, electronic circuits and devices,
shielding, and stress grading. Prereq: 503, 504,
and consent of instructor.

631 Advanced Topics in Electronic Instrumentation
I (3) Based on particular interests of students. Funda-
mental physical processes in instrumentation transduc-
ers: thermoelectric, magneto-electric, electromagnetic
and quantum-mechanical devices. Prereq: 531-02
and consent of instructor.

632 Advanced Topics in Electronic Instrumentation
II (3) Physical operation of modern discrete, monolithic,
and hybrid electronic structures and their application in
signal processors. Resolution, sensitivity, response time,
and noise considerations in signal processors used in

643 Detection and Estimation Theory (3) Detection
theory; coding theory; system identification. Signals with
unknown parameters, optimal filter synthesis; adaptive
systems; sequential detection; suboptimal detection. Prereq: 504 or consent of instructor.

644 Coding and Information Theory (3) Structure of
algebraic and probabilistic codes; linear codes, corre-
donation codes, error-detecting codes, decoding methods,
Identification schemes: deterministic, stochastic, and
hierarchical methods. Prereq: 543.

651 Computer-Aided Design of VLSI Systems I (3)
Fabrication of microelectronic devices; computer archi-
tecture design; algorithmic state machines; partitioning;
structured design methodology. Prereq: 551-02 or con-
sent of instructor.

652 Computer-Aided Design of VLSI Systems II (3)
Computer-aided design of design and implementation of
fully custom very large scale integrated (VLSI) circuits;
design for testability; testing of fabricated chips. Prereq: 651.

663 Advanced Plasma Physics I (3) Basic concepts of
hot temperature plasma physics. Magnetohydrodynam-
ics and kinetic description of plasma, plasma transport,
plasma waves, equilibrium, and stability. Prereq: Phys-
ics 541-02, 461-02 or 504-04, or consent of instructor.
(Same as Physics 563.)

664 Advanced Plasma Physics II (3) Plasma heating
and radiation phenomena. Advanced topics of current
interest must be taken in sequence. Prereq: 663.

671 Image Processing and Robotics I (3) Three-
dimensional scene modeling and recognition; multi-sen-
sor systems. Prereq: 576 or 577 or consent of instructor.

672 Image Processing and Robotics II (3) Stereo-vision,
shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-
varying imagery, path planning and navigation. Prereq:
672.

681-82 Quantum Electronics (3,3) Prereq: Consent of
instructor.

691 Advanced Graduate Seminar (1) Research in
department. May be repeated. S/NC or letter grade.

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

**Engineering Science and Mechanics**

(College of Engineering)

<table>
<thead>
<tr>
<th>MAJOR</th>
<th>DEGREES</th>
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<td>Engineering Science</td>
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</table>

T. G. Carley, Acting Head

Profiessors:


Associate Professors:


Assistant Professors:

Cazeaux, J. L., Ph.D. ........................ Rensselaer larnell, G. S., Ph.D. ........................ Tennessee Pickle, C. D., PE, Ph.D. ................... Texas Tech Yu, N., Ph.D. ............................... California (San Diego)

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 Engineer-
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 general GRE is required of all international applicants for admission.

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 require-
ments include the following:

<table>
<thead>
<tr>
<th>Hours</th>
<th>Credit</th>
<th>Course Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>6</td>
<td>Engineering courses (Major)</td>
</tr>
</tbody>
</table>

Engineers concentration may include but is not
restricted to courses offered by the
Engineering Science and Mechanics (12-18)

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 shared 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 Admissions Specialist 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: 181, 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, loading rate, section size, material; characterization of fracture toughness by stress intensity factors; strain energy release rates, J integral, COD data, transition temperature tests; use of fracture toughness data in design. Prereq: 321 and Materials Science and Engineering 201. (Same as Materials Science and Engineering 476.) 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: 231, 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 application, materials and procedures for noise abatement. Prereq: Introductory course in vibrations or acoustics.

442 Fluid Mechanics II (3) Differential forms of basic laws: compressibility, isentropic flow, shocks, duct flows with heat transfer and friction; open channel flow, critical flow, energy methods; internal and external viscous flows, boundary layers, elementary turbulent closure models. Prereq: 341, Mathematics 231.

461 Experimental Stress Analysis (3) Theory, techniques, and instrumentation of resistance strain gauges; theory and techniques of brittle coating methods, introduction to other strain measuring devices. Prereq: 311, Electrical and Computer Engineering 301. 2 hrs and 1 lab.

463 Photomechanics (3) Introduction to photoelasticity, photoelastic coating method, Moiré method, interferometry, and holography. Prereq: 32, Physics 232. 3 hrs and 1 lab.

465 Dynamic Data Acquisition (3) Use and calibration of instrumentation for measuring and recording dynamic events; Fourier analysis; transfer function analysis; causal signal processing; transfer function analysis, experimental parameter estimation with applications to modal vibration analysis. Prereq: 431, Electrical and Computer Engineering 201. 2 hrs and 1 lab.

471 Clinical Engineering and Biomaterials (3) Function and characteristics of health care delivery systems; hospital organization and health care economic; development and management principles for hospital-based clinical engineering program. Biomedical instrumentation system operation characteristics; performance of transducers, signal conditioning, data readout and storage devices; evaluation of commercially available systems, selection and procurement methods, custom-designed system, equipment maintenance and control programs for hospitals. Ethical issues and professionalism in clinical engineering. Prereq: Biomedical engineering, Introduction to Pattern Recognition.

473 Biomechanics II (3) Mechanical properties of living tissues; biomechanics of injury, mechanics of prosthesis; material compatibility of prosthesis devices; biomechanical problems related to impact. Prereq: 321.


494-95 Special Engineering Science Topics (1-3,1-3) Problems related to recent developments and practice. 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 (3-15) Required for the student not otherwise registered during any semester when the student uses University facilities and/or faculty time before degree requirements are met. May not be used toward degree requirements. May be repeated. S/N only. E


523 Theory of Elasticity (3) Equations of equilibrium; strain-displacement relations; force and motion; constitutive equations in three-dimensions. Beans, disks, thick-walled tubes, plates with holes; stress concentrations. Prereq: 521, 523, 525, and 527.


529 Fatigue of Engineering Materials (3) Fatigue of structures: crack initiation, propagation, variable amplitude loading, multi-axial loading, environmental fatigue, creep-fatigue, metallurgical and microstructural variables, X-ray diffraction, non-metals. Prereq: Consent of instructor.


538 Advanced Engineering Acoustics (3) Introduction to theory and application of acoustic analysis; vibration of continuous systems; plane and spherical waves; transmission phenomenon, radiation and scattering. Resonators, filters, absorbers, microphones, ultrasonics, sonar transducers. Prereq: 431 or 439.

539 Continuum Mechanics (3) Cartesian tensors, transformation laws, basic continuum mechanics concepts; strain, stress, deformation, constitutive equations. Conservation laws for continuum systems. Applications in solid and fluid mechanics.

541 Fluid Dynamics (3) Kinematic, kinetic and thermodynamic properties of fluids. Development of rate deformation laws; mass, momentum and energy conservation relationships; non-dimensionalization. Applications of Euler and Navier-Stokes equations: exact solutions, potential flow, transonic, boundary layer approximations; coupled heat/mass transfer models. Coreq: 539.

542 Fluid Dynamics II (3) Development of basic concepts and principles for turbulence and turbulent flow field motion. Formulation for correlation function, energy spectra, diffusion. Introduction to turbulent transport processes and flow through complex domains; use of engineering turbulence closure models; examination of modern numerical and experimental methods. Prereq: 541.

550 Numerical Heat and Mass Transfer (3) (Same as Mechanical Engineering 510.)


552 Computational Fluid-Thermal Analysis (3) Construction of numerical solution algorithms for various Navier-Stokes flow systems: weak-statement theoretical framework: non-linearly, convection dominated fluid and turbulent flows. Incompressible Navier-Stokes equations; streamfunction-vorticity and primitive variables algorithms. Coordinate transformation and penalization algorithms unified. Theoretical concepts of completeness, accuracy, convergence and stability; grid boundary conditions. Unsteady problems, free surface flow, flows with massive separation, thermally driven buoyant flows. Efficient three-dimensional algorithms, modifications to reproduce finite difference, finite volume and finite element constructions. Computer project. Prereq: 551. (Same as Mechanical Engineering 551.)

553 Computational Solid Mechanics (3) Finite element analysis techniques in structural mechanics and solid mechanics; topics in two- and three-dimensional finite element formulations; isoparametric elements, numerical quadrature. Equation solving; substructuring, skyline solvers, matrix iteration techniques. Applications in beams, plates and shells; use of representative computer programs. Use of networked mini-computer/工作站 environment. CAD, graphics, solid models, data base management. Prereq: 551. (Same as Mechanical Engineering 556.)

557 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/mechanical systems. For departmental thesis students only. May be repeated.

559 Computational Mechanics Laboratory (1) Utilization of networked virtual environment/engineering workstation environment for conducting computational mechanics experiments. May be taken for credit with each of courses 551, 552, 553, and 557. Coreq: 551. (Same as Mechanical Engineering 558.)

562 Experimental Mechanics of Composite Materials (3) Stress-strain relationships for orthotropic and transversely isotropic materials; analysis of composite laminates and laminate; stress and strain transformation; laminated plate theory; matrix integrity, and composite mechanical properties (tensile, flexure, compressive, shear); physical properties; notch-tip stress field, stress intensity factor, notch sensitivity; strain energy release rate, composite damage. Schapery’s failure criteria; progressive damage modeling. Computer program for analysis of composite laminates. Lab. Prereq: 521 or consent of instructor. (Same as Materials Science and Engineering 562.)


565 Optical Engineering I (4) Wave optics; scalar diffraction theory; introduction to Fourier optics; ray or geometric optics; lens, mirror, gratings; paraxial design methods; introduction to aberrations.

566 Optical Engineering II (4) Statistical optics; spontaneous and induced emission; black and gray body radiation; coherent and incoherent radiation; mutual coherence function; detectors; radiometry. Prereq: 556.


572 Biomedical Fluid Mechanics (3) Application of fluid mechanics theory to fluid flows in living systems. Solutions to differential equations for blood flow in arteries, veins and the microcirculation. Measurements of flow properties of blood and other biological fluids. Analysis of blood flow in arteries, for example, technique of analysis of Navier-Stokes flows; applied to biophysical systems, spectra and wave phenomena. Study of flow through artificial heart valves and in extracorporeal devices. Prereq: 541.

575 Applied Artificial Intelligence (3) (Same as Nuclear Engineering 575 and Mechanical Engineering 575.)

576 Expert Systems in Engineering (3) (Same as Nuclear Engineering 576 and Mechanical Engineering 576.)

577 Neural Networks in Engineering (3) (Same as Nuclear Engineering 577 and Mechanical Engineering 577.)

578 Fuzzy Systems in Engineering (3) (Same as Nuclear Engineering 578.)

579 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Prereq: Consent of instructor. May be repeated with consent of department.

580 Industrial Pollution Prevention (3) (Same as Chemical Engineering 581 and Environmental Engineering 581.)

581 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 581 and Mechanical Engineering 581.)

582 Measurement Science I (3) (Same as Nuclear Engineering 582 and Aviation Systems 582.)

583 Measurement Science II (3) (Same as Nuclear Engineering 583 and Aviation Systems 583.)

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

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

611 and 617 Project 2 and 3 (3-15) P/NP

621 Analysis and Design of Thin Wall Structures (3) Geometry of surfaces, deformation of the shell and theory for arbitrary shell geometry; selected applications of theory in structural engineering. Prereq: 525 or Civil Engineering 526.


624 Viscoelasticity (3) Viscoelastic constitutive relations; isothermal boundary value problems; wave propagation in elastic materials; determination of viscoelastic properties. Prereq: 523 and 539 or Polymer Engineering 541.

625 Computational Plasticity and Creep (3) Theory and numerical algorithms used to describe plastic and creep behavior in many materials. Plasticity models, creep models, yield functions, strain-softening models, nonlinear differential equations; constitutive tests; finite element solution algorithms. Prereq: 539 or 523, and 553.


641 Advanced Topics in Fluid Mechanics and Con- ceptual Design (3) Turbulent flow, heat transfer and mass transfer; boundary layer analysis, stability, transition, turbulence, closure models; Navier-Stokes equations, closure procedures: time- and ensemble-averaged, large scale structures; high speed flow, reacting, nonreacting, excitation, ionization. Applications in propulsion, lasers, aerodynamics. Prereq: 542.

645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic turbulence, energy spectra; Kolmogoroff’s hypothesis, large and small eddy structure for turbulent flows; turbulence 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 (3,3) Approximation theory; analysis of accuracy and convergence; finite difference, finite volume, and finite element methods; shock, artificial dissipation; two- and three-dimensional, compressible viscous and inviscid flows. Euler, Navier-Stokes complete Navier-Stokes descriptions; mixed subsonic-transonic algorithms. Algorithm construction: finite difference, finite element, approximate factorization, fluid vector splitting, finite volume. Advanced topics in fluid dynamics and turbulence. Prereq: 532. (Same as Mechanical Engineering 651-52.)

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 crack-plasticity theory; geometrically non-linear problems, large deflection, stability; shell structures. Advanced topics in structural mechanics. Prereq: 533. (Same as Mechanical Engineering 653-54.)

657 Computational Mechanics Seminar (1) Current developments in computational fluid/thermal/structural mechanics. For departmental thesis students only. May be repeated.

571 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 671 and Mechnical Engineering 671.)

681 Advanced Topics in Engineering Mechanics (3) Advanced problems in mechanics, group or individually. Prereq: Consent of instructor. May be repeated with consent of department.


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. A prospective student must contact the department to receive the proper information and forms with which to apply.

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 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.

Final Examination: A candidate presenting a thesis must pass a ninety-minute 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; additional 500-level courses are strongly recommended.

Writing Projects: One of the following writing projects for six hours of credit:
1. A thesis, using research to analyze some aspect of writing or rhetorical theory.
2. A creative project, such as a collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose.

The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and the project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be from the literature faculty.

Final Examination: The reading list may be modified by the M.A. examining committee, meeting as a body with the student, to reflect the candidate's particular writing emphases. However, most of the oral examination should focus upon the literature outlined in the original reading list.

THE DOCTORAL PROGRAM

Requirements

A student must successfully complete a program of study, normally 6 full semesters as outlined below, approved by the candidate's committee or the Director of Graduate Studies in English.

Coursework: At least 51 semester hours beyond the B.A. to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above; (only 3 hours of 593 Independent Study may be applied toward the M.A.); and a special three-hour course in teaching composition; and 12 additional hours at any level, including the 400 level. Up to 6 of these additional hours may be taken in some cognate field or fields such as history, philosophy, French. These courses must be drawn from those approved for graduate credit. All other coursework must be in the English department. In this coursework, students must normally maintain a 3.5 GPA.

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

Language Requirement: A language requirement met in one of the following ways:
1. Two languages approved by the Director of Graduate Studies in English. The requirement for each language may be fulfilled by (a) completion of French 302 or German 332 with a grade of B or better; (b) completion at UT Knoxville of any two courses on the 300 level or above in the foreign language or literature with at least a grade of B in each course; (c) passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.

3. One modern language approved by the Director of Graduate Studies in English.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.

402 Chaucer (3) Reading and analysis of medieval literature in modern English.

404 Shakespeare I: Early Plays (3) Shakespeare's early works, including Macbeth, Hamlet, and Othello.

405 Shakespeare II: Later Plays (3) Shakespeare's later works, including Henry V, Henry VI, and The Tempest.

406 Renaissance Drama (3) English theatre between 1560 and 1640 through reading of representative plays by Shakespeare's contemporaries.

409 Spencer and His Contemporaries (3) Principal achievements in prose and poetry of sixteenth century authors: Spenser, Shakespeare, Marlowe, Jonson, 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 Watton.

411 Literature of Restoration and Early Eighteenth Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1745.

412 Literature of Later Eighteenth Century: Johnson to Burns (3) Survey of English literature and culture from 1745 to 1800.

413 Restoration and Eighteenth-Century Genres and Modes (3) A major genre or literary mode: drama, novel, poetry, non-fiction, romance, or epic, written between 1660 and 1800. May be repeated.

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.

417 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskin, Darwin, and Wilde.

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

421 Modern British Novel (3) Lawrence, Joyce, and Woolf.

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

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

424 American Romanticism and Transcendentalism (3)

425 American Realism and Naturalism (3)

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

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


429 Southern Literature (3) Southern writing from colonial period into twentieth century: frontier humorists, local color writers, and Southern literature of the twentieth century.

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

431 Southern Humor (3) Regional humorists, local color writers, and Southern literature of the twentieth century.

432 American Poetry and Prose (3) From Yeats and Frost to Auden, Stevens, and more recent poets.

433 Modern British and American Drama (3) O'Neill's works as representative of modern dramatists: Williams, Miller, Albee, and representatives of Black theater, Buñuel and Baraka.

434 Continental Drama (3) Selection of plays in English translation by major European writers from late Renaissance to present; twentieth-century achievement.

435 Twentieth-Century International Novel (3) Joyce, Camus, Kafka, Nabokov.

436 Persuasive Writing (3) Persuasive strategies in both student and professional writing. Practice in mastering effective logical and emotional appeals.

437 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.

438 Advanced Technical and Professional Writing (3) For students planning careers 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.

439 Writing for Publication (3) Principles and practices of writing for publication. Prereq: 456 and 459, or consent of instructor.

440 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 435 or consent of instructor.

441 Advanced Fiction Writing (3) Further development of skills acquired in basic writing fiction course. Prereq: 435 or consent of instructor.

471 Sociolinguistics (3) Study of language in relation to society. Empirical and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 471 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. Focus, fun, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 472.)

473 English Teaching 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 (3) Second language acquisition theory. Issues in teaching four language skills to learners of English. Materials and methods of language teaching and testing: preparation of materials. Observation of and team teaching with experienced staff member. Prereq: English 474. (Same as Linguistics 475.)

476 Language Acquisition (3) Theoretical models and research: differences between first and second language acquisition; factors in second language acquisition; learner variables; socio-cultural factors; and implications for second-language instruction.

477 Literary Criticism (3) Historical survey of major works of literary criticism.


481 Studies in Folklore (3) Topics vary. May be repeated with different topic. Maximum 6 hrs.

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

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

484 Special Topics in Writing (3) Original writing integrated with reading, usually taught by professional authors. 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. Particularly 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
Environmental Engineering

See Civil Engineering

Exercise Science

(College of Education)

MAJORS DEGREES

Human Performance and Sport

Ph.D.

Studies M.S., Ed.D.

E. Howley, Leader

Professors:

Howley, Edward T., Ph.D. Wisconsin

Kozar, Andrew J. (University Prof.), Ph.D. Michigan

Liemohn, W. P., Ph.D. Iowa

Rockett, Ian R. H., Ph.D. Brown

Welch, Hugh (Emeritus), Ph.D. Florida

Associate Professor:

Bassett, David R., Jr., Ph.D. Wisconsin

Assistant Professors:

Lewis, J. L., Ed D. Tennessee

Thompson, Dixie, Ph.D. Virginia

The Exercise Science unit offers graduate programs leading to the Master of Science with a major in Human Performance and Sport Studies, concentration in exercise science (exercise physiology/fitness, kinesiology/sports medicine), Doctor of Education with a major in Human Performance and Sport Studies, and the Doctor of Philosophy with a major in Education. See Education under Fields of Instruction for full description of all degree requirements.

Specific questions about these programs should be directed to the leader of the unit.

ADMISSION REQUIREMENTS

Applicants are required to complete the unit application which will be sent to all persons upon their initial inquiry about the program. This is in addition to The Graduate School application.

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

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

GRADUATE ASSISTANTS

A limited number of graduate assistantships are available for qualified women and men who are graduates of accredited colleges or universities. These assistantships are open to students in the master’s and doctoral programs. Students interested in these opportunities should file their applications before February.
variance, capital asset pricing, efficient set theorems, interest rate theory, financial market microstructure.

642 Seminar in Finance II: Theory of the Firm (3) Financial theory of firm and financial decision making under conditions of uncertainty, equilibrium models of firm. Option pricing, agency theory, capital structure, economics of information, and dividend policy.

651 Advanced Seminar in Finance I (3) Recent theoretical and empirical developments in micro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

652 Advanced Seminar in Finance II (3) Recent theoretical and empirical developments in macro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

Food Science and Technology

(College of Agricultural Sciences and Natural Resources)

MAJOR DEGREES

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

Clark J. Brekke, Head

Professors:
Brekke, C. J., Ph.D................................ Wisconsin
Collins, J. L., Ph.D................................ Maryland
Dranghoon, F. A., Ph.D.......................... Georgia
Jaynes, H. O. (Emeritus), Ph.D. ............. Illinois
Melton, S. L., Ph.D................................ Tennessee
Overcast, W. T. (Emeritus), Ph.D. .......... Iowa State
Penfield, M. P., Ph.D............................ Tennessee

Associate Professors:
Christen, G. E., Ph.D............................ Missouri
Lovely, H. D., Ph.D............................... Kansas State
Mount, J. R., Ph.D.................................. Ohio State

Assistant Professor:
Golden, D. A., Ph.D............................... Georgia

The Department of Food Science and Technology offers the Master of Science and Doctor of Philosophy degrees. Students in the doctoral program may choose a concentration 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 scholarship 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 project must register for 6 hours of 503.

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

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

4. Students will be required to take a written comprehensive examination covering 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 9 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 601 (2 hrs.) and are expected to attend 601 during their Ph.D. program.

7. Each candidate must pass 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. Physicochemical interactions of food materials. Prereq: Chemistry 110 or equivalent, 2 hrs and 1 lab. F

411 Food Chemistry II (3) Reactions of inorganic compounds, carbohydrates, lipids, and vitamins in foods. Prereq: Chemistry 110 or equivalent. 2 hrs and 1 lab. Sp

420 Food Microbiology (2) Physical, chemical and environmental factors affecting growth, proliferation and survival of foodborne microorganisms. Prereq: Microbiology 210, Coreq: 429. F

429 Food Microbiology Lab (1) Methods for examination, enumeration, cultivation and identification of foodborne microorganisms. 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

440 Preservation of Food (3) Prevention of deterioration and spoilage of foods. Methods of preservation. Prereq: Agricultural Engineering Technology 422. 2 hrs and 1 lab. Sp

451 Dairy Products II (3) Science and technology of processing dairy products. Chilling, freezing and microbial changes that occur during manufacture. Prereq: Principles of Chemistry, Introduction to Organic and Biochemistry, General Microbiology, 2 hrs and 1 lab. F, A

460 Meat Products Technology (4) Process methods for making cured, smoked, fresh, flaked and formed products. Effect of processing methods on product characteristics. Prereq: 360 or consent of instructor. 3 hrs and 1 lab. F, A

470 Food Crop Products (3) Food products from plants; types, manufacturing systems, quality attributes and utility. Prereq: 3 hrs biological science, 2 hrs and 1 lab. Sp, A

480 Cereal Science and Bakery Products (3) Chemistry and technology of processing cereal grains, interactions of ingredients during production and storage of baked products. Prereq: 410 or 411 or equivalent. 2 hrs and 1 lab. Sp, A

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

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

502 Registration for Use of Facilities (3-15) Required laboratories. May be repeated. Maximum 6 hrs. E

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

510 Instrumental Analysis of Food (3) Modern instrumental methods for control of food processing. Prereq: 410-11, 2 hrs and 1 lab. F

511 Color and Flavor of Foods (3) Chemical basis, measurements, and reactions involved in color and flavor changes in foods. Manufacture and application of ingredients used to modify color and flavor. Prereq: 410-11, 2 hrs and 1 lab. F

520 Food and Industrial Fermentations (3) Microbiology, biochemistry and technology of food-related fermentations involving dairy products, meat, cereals, fruit and vegetables, and food products from food and plant equipment. Prereq: 420-29, 240. Biochemistry 410 or equivalent. 2 hrs and 1 lab. Sp, A

521 Advanced Food Microbiology (3) Microorganisms in foods, their identification, characterization and relationship to food processing. Isolation of microorganisms from foods and plant equipment. Prereq: 420-29, 2 hrs and 2 labs. Sp, A

540 Food Product Development (3) Art, science and technology of developing and marketing new food products. Prereq: 440. 2 hrs and 1 lab. Sp, A

560 Advanced Meat Science (3) Physical and chemical changes that occur in conversion of muscle to meat, effect of postmortem treatments on meat quality, composition and palatability; packaging; preservation, and quality control. Prereq: 460. 2 hrs and 1 lab. Sp, A

580 Oilseed Products (3) Chemistry and technology of foods and food ingredients produced from oilseeds. Prereq: 410-11 or equivalent. 2 hrs and 1 lab. Sp, A

590 Special Topics in Food Technology and Science (1-3) Critical reviews of current research and production concerns of food industry. May be repeated. Maximum 9 hrs. F, Sp

593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry, governmental laboratories, or other institutions. May be repeated. Maximum 6 hrs. E

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

601 Seminar (1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hrs. F, Sp

620 Food Toxicology (2) Basic and applied concepts in food toxicology: toxicological aspects of processed foods, Mode of action, prevention and control of food toxins in food supply. Prereq: 410-11, 521, or consent of instructor. Sp, A

640 Advanced Food Processing (3) Role of processing treatments in modification of food properties; texture, flavor and color characteristics. Prereq: 440, 510, 511 or consent of instructor. Sp, A

Forestry, Wildlife and Fisheries

(College of Agricultural Sciences and Natural Resources)

MAJORS

DEGREES

Forestry ........................................ M.S.

Wildlife and Fisheries Science ................. M.S., M.F.A.

George M. Hopper, Head

Professors:

Barrett, J. W. (Emeritus), Ph.D. .............. Syracuse

Buckner, E. R. (Distinguished Prof.), Ph.D. .................. NC State

Core, H. A. (Emeritus), Ph.D. .............. Syracuse

Deardren, B. L., Ph.D., .............. Colorado State

Dimmick, R. W., Ph.D. .............. Wyoming

Hill, T. K., Ph.D. .............. Auburn

Hopper, G. M., Ph.D. .............. VPI

Little, R. L., Ph.D. .............. NC State

McGee, C. E., (Adjunct), D.F. .............. Duke

Ostermeier, D. M., Ph.D. .............. Syracuse

Peltom, M. R., Ph.D. .............. Georgia

Rennie, J. C., Ph.D. .............. NC State

Schneider, G., 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

Wilson, J. L., Ph.D. .............. Tennessee

Associate Professors:

Hay, R. L., Ph.D. .............. Duke

King, M. M., Ph.D. .............. Utah State

Nodvin, S. C. (Adjunct), Ph.D. .............. Cornell

Schumann, S. E., Ph.D. .............. Colorado State

Smith, K. G. (Adjunct), Ph.D. .............. Utah State

Wells, G. R., D.F. .............. Duke

Winistorfer, P. M. (Liaison), Ph.D. .............. Iowa State
Assistant Professors:
Buehler, D. A., Ph.D. .................. VPI
Clark, J. D. (Adjunct), Ph.D. ......... Arkansas
Fly, J. M., Ph.D. .................. Michigan
Smith, E. R. (Adjunct), Ph.D. ........... Tennessee
Vandiegeroeft, 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 Business Administration, with a concentration in forest industries management, is available for qualified students. This degree program is offered by the College of Business Administration with participation by the Department of Forestry, Wildlife and Fisheries. The Doctor of Philosophy with a specialization in forest biology, wildlife science, or fisheries science can be achieved through the University's intercollegiate graduate program in Ecology.

A joint program between the department and Knoxville College leading to a specialized B.S. in Biology prepares Knoxville College graduates for graduate programs in natural resources.

THE MASTER'S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor's degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must also have taken the general Graduate Record Examination (GRE). Graduate School rating forms or letters of recommendation from three individuals familiar with the applicant's academic ability are required. The department also has an application that must be submitted at the time of application to The Graduate School.

Thesis Option
1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. Registration for 6 hours of Thesis (Forestry 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 22 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 six 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.

MINOR IN ENVIRONMENTAL POLICY

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

For 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. Sp
433 Wood Adhesives and Glued Wood Products (2) Theory and practice of wood bonding; wood-substrate-adhesive interface for bonding; principles of adhesion; wood adhesives; gluing of solid wood and composite wood manufacturing practices; laboratory manufacture and testing of adhesives, adhesive bond strength and glued-wood product performance; day field trips. Prereq: Wood Properties and Wood Identification, or consent of instructor. 1 hr and 2 labs. F
434 Wood Processing and Machining (2) Primary log breakdown and secondary processing into major products. Fundamentals of machining technology for major types of cutting operations: sawing, boring, planing, veneer cutting, and laser machining; day field trip. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. Sp
435 Wood Drying and Preserving (2) Discussion of wood moisture relationships. Introduction to commercial wood drying equipment and operations. Proper use, application, and disposal of preservative treated wood. Day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. Sp
450 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
511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identify, analyze and prepare written reports. Prerequisite: approval of graduate committee. Available only to students in non-thesis option for M.S. in Forestry. E

512 Seminar (1) Current developments in forestry. Required of all graduate students in residence. May be repeated. Maximum 2 hrs. SNC only. F/A
520 Advanced Forest Tree Biology (3) Growth, reproduction, and physiology of trees; forest ecology; variability and taxonomy of forest trees. Prereq: Graduate standing in forestry or biological science, or consent of instructor. F/A
530 Advanced Forest Resource Management (3) Analysis of forest management problems as exemplified in public agencies and private firms. Forest organization and computerized regulation systems; financial and operational planning tools, applied to forest resource management. Prereq: Senior-level forest management or consent of instructor. Sp/A
540 Genetics in Forestry (3) Genetic improvement of forest resources, selection of superior phenotypes; field testing for genetic variability; tree breeding; development of seed orchards; hybridization; tree cytology and tissue culture; use of biochemical variation; planning and conducting forest 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
570 Management & Policy of Forest Resource Organizations (3) Theory and practice of management as applied to natural resource organizations: institutional direction and culture, and strategic management. Development of policy as planning tool and as results from conflict resolution. Linkage between policy development and execution, and structure and management of organizations. Prereq: Forest administration and policy or consent of instructor. F/A
580 Advanced Silviculture (3) Silvicultural practices and systems applied to commercially important hardwoods and softwoods; In-depth analysis of silvicultural principles involved and tools useful for the proper tending and management; computer modeling of stand dynamics, structure, growth/yield. Prereq: Undergraduate silviculture course or consent of instructor. 2 hrs and 1 lab. 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 prediction; even-aged and uneven-aged forests. Prereq: Land Measurement Techniques and Forest Resource Inventory or consent of instructor. F/A
590 Advanced Topics in Forestry (1-3) Recent advances in 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. Applicable to majors in Forestry and in Wildlife and Fisheries Science. 2 hrs and 1 lab. F
416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildlife resource management through developing land management plans and analyzing case studies including conflict resolution. Applicable to majors in Forestry and Wildlife and Fisheries Science. 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.

536 Environmental Impacts to Natural Ecosystems
(3) Current environmental problems impacting natural ecosystems; climate change, acid deposition, air pollution, species declines, and introductions of exotic species. Management methodologies to mitigate environmental problems. Overnight field trips. Prereq: 416 or equivalent or consent of Instructor. Applicable to majors in Forestry and in Wildlife and Fisheries Science.

540 Seminar on Integrated Resources Management in Biosphere Reserves (2) MAB program, UNESCO-sanctioned initiative. Analysis of integrated resources management practices that demonstrate concept of sustainable development. Environmental policy and application of science to management practice. Applicable to majors in Forestry and in Wildlife and Fisheries Science.

Wildlife and Fisheries Science

GRADUATE COURSES

440 Wildlife Techniques (2) Methods of wildlife damage control, forest, farmland, and riparian wildlife habitat management, identification, field and 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 and feeding; and tagging techniques. age determination and incremental growth analysis; stream assessment; equipment and instrumentation usage and maintenance in stream sampling methods. Weekend field trip. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

443 Fisheries Science (3) Quantification and management of freshwater fisheries; population estimation, age and growth, biological assessment, and stocking. Prereq: Principles of Wildlife and Fisheries Management or General Ecology. 6 hrs of mathematics. 2 hrs and 1 lab. Sp

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

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

490 Ethics in Wildlife and Fisheries Management (1) Ethical bases for decision-making and application of methodologies in practice of wildlife and fisheries management. Seminars by ethicists, wildlife and fisheries scientists and managers, and foresters to acquaint students with diverse perspective 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 students use University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May not be repeated. E Only.

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 planning activities of fisheries and wildlife agencies. Decision-making, policy making, case histories. SP, A

525 Endangered Species Management and Conservation of Biodiversity (3) Status, ecology and management of endangered wildlife and plant species. Historic aspects, policy implications and issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor. Sp

530 Wildlife Diseases (2) Necrophy of birds and mammals. Recognition of various diseases and methods of prevention. Pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: yr biology, 444, 445, or consent of instructor: (Same as Comparative and Experimental Medicine - Veterinary Medicine 530). F, A

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

545 Population and Habitat Analysis (2) Detail characteristics, assumptions, and current technologies for fish and wildlife population analysis. Technologies, methodology and goals for wildlife habitat analysis. Use of computers. Prereq: Animal Science 571 or Statistics 538 or consent of instructor. A

555 Fish Culture (3) Principles, concepts and techniques of culturing economically important fish and shellfish species. Prereq: 443 or consent of instructor. 2 hrs. and 1 lab. Sp, A

560 Advanced Topics in Wildlife and Fisheries Science (1-3) Recent advances and concepts, research techniques and analysis of current problems. Prereq: 444, 445, or consent of instructor. May be repeated. Maximum 6 hrs. E

593 Independent Study in Wildlife and Fisheries Science (1-4) May be repeated. Maximum 6 hrs. E

French

See Romance Languages

Geography

(College of Arts and Sciences)

MAJOR

DEGREES

Geography M.S., Ph.D.

Sidney R. Jumper, Head

Professors:


Associate Professors:

Brinkman, Leonard W., Jr., Ph.D. Wisconsin Harden, Carol P., Ph.D. Colorado Horn, Sally P., Ph.D. California Rehder, John B., Ph.D. Louisiana

Assistant Professors:

Orvis, Kenneth H., Ph.D.

THE DOCTORAL PROGRAM

The department offers the Thesis and non-thesis options for the Master's degree. 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.

MINOR IN ENVIRONMENTAL POLICY

The department participates in a program designed to give master's level graduate students an opportunity to develop an interdisciplinary specialization in environmental policy. See Economics for program description.
ACADEMIC COMMON MARKET

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

GRADUATE COURSES

411 Computer Mapping and Geographic Information Systems (3) Concepts, management, and presentation of digital data for spatial analysis: cartographic data structures. Prereq: 310 and knowledge of a computer language or consent of instructor. 2 hrs and 1 2-hr lab.

412 Cartography (3) Cartographic techniques applied to design, compilation, and reproduction of maps and other graphic products. Prereq: 310 or consent of instructor. 2 hrs and 1 2-hr lab.

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

415 Quantitative Methods in Geography (3) Geostatistical application of statistical techniques, point pattern analysis, and analysis of areal units. Prereq: Math 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.

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

432 The Land-Surface System (3) Characteristics of surface form, water, vegetation, and surface materials, and their regional interrelationships. People and evaluation of agents of change. Prereq: Geography of the Natural Environment or consent of instructor.

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

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

436 Water Resources (3) Global water resources and hydrologic processes: water availability, cycling, flooding, and water quality issues from physical and economic geographical perspectives. Prereq: Geography of the Natural Environment 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, soils, and human disturbance. Prereq: 101-02 or 141 or 140 or consent of instructor. (Same as Urban Studies 441.)

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 140 or consent of instructor. (Same as Urban Studies 441.)

433 The Land-Surface System (3) Characteristicsof surface form, water, vegetation, and surfacematerials, and theirregionalinterrelationships. Peopleas evaluatorsand agentsof change. Prereq: Geographyof the NaturalEnvironmentor consent of instructor.


436 Water Resources(3) Globalwaterresourcesand hydrologicprocesses: wateravailability, cycling, flooding, andwaterqualityissuesfrom physical andeconomic geographicalperspectives. Prereq: Geographyof the Natural Environmentor consent of instructor.

439 Plant Geographyof North America (3)Characteris-tics and distributionof majorplantcommunities of Canada, the U.S., Mexico, and Central America. Relationships to climate, soils, and human disturbance. Prereq: 101-02 or 141 or 140 or consent of instructor. (Same as Urban Studies 441.)

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 140 or consent of instructor. (Same as Urban Studies 441.)

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 140 or consent of instructor.

449 Geography of Transportation (3) Examinationof transportation systemsthatference effects on fringes. Problems and potentials of rural America. Prereq: 101-02 or 141 or 340 or consent of instructor.

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

500 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) May be repeated with consent of instructor. Maximum 6 hrs.

504 Research Design (3) Geographical research from selection of topic and development of research design through field work and final report.

505 Directed Research (2-6) Research on problems as defined by individual students. Prereq. Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/NC or letter grade.

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 9 hrs. S/NC or letter grade.

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

512 Topics in Cartography (3) Trends, concepts, problems, and methods in cartography. Prereq: 411 and 412 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

513 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data. Prereq: 413 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

515 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography; research problems utilizing appropriate computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 415 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

517 Geographic Information Management and Processing (3) Concepts and methods in management of geographic information. Database design, manipulation, sampling and analysis. Prereq: Consent of instructor.

519 Graduate Practicum in Cartography/Remote Sensing (2-4) Prereq: Written consent of department prior to registration. May be repeated with consent of instructor. Maximum 6 hrs.

521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography. Prereq: 421 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

533 Topics in Physiological Geography (3) Examination of trends, problems, and methods in physiological geography. Prereq: 433 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

535 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography. Prereq: 425 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

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

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

550 Regional Geomorphology (3) (Same as Geology 450.)

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

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

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

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

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

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

609 Seminar in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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

649 Seminar in Geography of Transportation (3) Prereq: 449 or consent of instructor. May be repeated. Maximum 6 hrs.

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

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

677 Seminar in Biological Conservation (3) Conduct of original research. Prereq: S/NC only. May be repeated. Maximum 6 hrs.

Geological Sciences

(College of Arts and Sciences)

MAJOR DEGREES

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

Harry M. McSween, Head

Professors:

Broadhead, Thomas W., Ph.D. ........Iowa
Driesse, Steven G., Ph.D. .........Wisconsin
Dunne, William M., Ph.D. ..........Bristol
Hatcher, Robert D., Jr. (Distinguished Scientist), Ph.D. ....Tennessee
Kopp, Otto C., Ph.D. .................Tennessee
Labotka, Theodore C., Ph.D. ....Carleton
McLaughlin, Robert E. (Emeritus), Ph.D. ....Tennessee
McSween, Harry Y., Ph.D. .........Harvard