establishment of a program of study in consultation with the committee.  
2. Specific courses to be taken are determined by students and their advisory committees. Students should plan to devote a minimum of 4 years beyond the B.A. to attain the Ph.D.  
3. Demonstration of competence in statistics by completing Statistics 531 and 532 with a grade of B or better.  
4. Demonstration of knowledge of one foreign language. This language should normally be French, German, Russian or Spanish, but another language may be substituted at the committee’s discretion. This requirement may be met by:  
a. Successful performance on a language examination administered by the appropriate language department. 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.  
d. Taking of comprehensive examinations in three areas of specialization to be determined by the committee.  
5. Successful completion of a dissertation and defense 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 an in-state tuition basis. The M.A. program in Anthropology is available to residents of the states of Louisiana or Mississippi (concentration in zooarchaeology only), South Carolina, Virginia, or West Virginia. The Ph.D. program is available to residents of Alabama, Arkansas, Louisiana, Mississippi, South Carolina, or West Virginia. Additional information may be obtained from the 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 relationships 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 folklore 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 revitalization and political revolt. Continuity and change in individual and cultural settings through use of archaeological, ethnohistorical, 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. Relationship between actors (individuals) and structures. Encapsulation of traditional political forms and systems within modern states. Prereq: Cultural anthropology or consent of instructor.

431 Ethnographic Research (3) Conceptual and practical exploration of methods and techniques cultural anthropologists use in fieldwork. Prereq: Cultural Anthropology or consent of instructor.

425 Historical Archaeology Laboratory (3) Laboratory procedures for processing, identification, and interpretation of artifacts from historical sites. Artificial material from historic East Tennessee sites used for class projects. Recommended prereq: Historic 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 survey, and analysis of selected case studies. Prereq: 120, 130, 410, or consent of instructor.

450 Current Trends in Anthropology (3) Analytical, integrative review of current directions of research and theory in anthropology.

459 Selected Topics in Anthropology (3) Theoretical issues in anthropology for undergraduate students. Topics may include practical experience or laboratory study of anthropological materials. Prereq: Either Human Origins, Prehistoric Archaeology, Cultural Anthropology, or consent of instructor. May be repeated. Maximum 6 hours.

461 African Prehistory (3) African cultural history from earliest evidence of human activity to times of European contact. Sources: written African folklore and oral history. Prereq: 120 or consent of instructor. (Same as African Studies 461.)

462 Early European Prehistory (3) Origins and evolution of human culture in Europe through beginnings of sedentary 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 economies to rise of States. Mesolithic, Neolithic, and Metal Age lifeways in Africa, Europe, and Asia. Prereq: 120 or consent of instructor.

464 Principles of Zooarchaeology (3) Basic osteological study of major vertebrate groups; aboriginal use of animals in subsistence and culture. Identification and interpretation of archaeologically deposited remains of living vertebrate remains; introduction to laboratory use of comparative collections. Prereq: 120 or consent of instructor.

465 Urban Archaeology (3) Field archaeology and interpretation of archaeological remains on historic urban sites in U.S. Lectures and field and laboratory research on urban sites in East Tennessee. Recommended prereq: Historic Archaeology.

480 Human Osteology (4) Intensive examination of human skeletons. Prereq: 110 and consent of instructor. 3 hrs and 1 lab.

481 Museology I: Museums, Purpose and Function (3) (Same as Art 481.)

492 Museology II: Exhibition Planning and Installation (3) (Same as Art 482.)

494 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 intergroup and intragroup interactions; communication; and cultural behavior. Application of primate studies to human ethnology. Prereq: 110 or consent of instructor.

499 Human Response to Environmental Stress (3) Physical and psychological adaptation of humans to changing environments. Factors such as diet, climate, and socio-cultural structure. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

501 Graduate Research (1-9) Independent investigation of special problems in anthropology. May be repeated. Maximum 18 hrs.

502 Registration for Use of Facilities (3-15) Required for the student 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. 3-15 hrs.

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

511 Special Topics in Cultural Anthropology (3) Seminars for advanced students on topics of special interest: ethnomedicine, 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. Prereq: Cultural area course or equivalent. May be repeated. Maximum 9 hrs.

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


516 Nutritional Anthropology (3) Anthropological contributions to studies 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 social stratification along lines of rank, class, race, ethnicity, and status. Review of inequalities engendered by sex role structure. Construction of social distinctions before and after rise and consolidation of modern world system. Intersection of race and ethnicity with class and gender.

520 Seminar in Zooarchaeology (3) Approaches to analysis and interpretation of zooarchaeological evidence. 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 Zooarchaeology (4) Examination and comparison of skeletal elements of major vertebrate groups; shells of terrestrial and aquatic molluscs, in relation to food remains in archaeological contexts. Basic osteology and shell characters of species encountered in archaeological sites; use of comparative collections. May be repeated. Maximum 9 hrs.

522 Seminar in Archaeology (3) Theoretical and practical issues in contemporary archaeology: ethnoarchaeology, paleoethnobotany, taphonomy, ceramic analysis, agricultural origins, and regional archaeological cultures. May be repeated. Maximum 9 hrs.

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

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

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

561 Archaeological Resource Management (3) Federal legislation and regulations; methods of scientific, protection, and management of archaeological resources. Professional ethics and responsibilities and relationship of federal and state agencies, public interest groups, academic and professional arenas; conflict of federally sponsored archaeology. May be repeated. Maximum 6 hrs.
562 Problems in Old World Archaeology (3) (Same as Classics 562.)


564 Archaeology of Southeastern United States (3) Archeological research on prehistoric American Indian cultures in Southeastern United States, Tennessee prehistory.

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


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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

695 Gross Human Anatomy (9) Skeleton, muscles, and cardiovascular system. Dissection of cadavers. Prereq: 480 or Human Biology 5 hrs and 6 labs.

### Architecture

**College of Architecture and Planning**

**MAJOR**

- Architecture

**DEGREE**

- MArch.

**Professors:**

- Anderson, G. I., MArch, Illinois
- Conley, G. (Emeritus), BArch, Harvard
- Griegor, F., MArch, Pennsylvania
- Kalso, R. M., MArch, Tennessee
- Kasakove, J. A., BSc, Southern Cal
- Lauer, W. J. (Liaison), MArch, Ohio State
- Lester, A. J., MArch, Virginia
- Lizon, P., Ph.D, Pennsylvania
- Moffett, M. S., Ph.D, MIT
- Robinson, M. A., MArch, Pennsylvania
- Ruddy, J. W., MArch, Northwestern
- Shell, W. S., MArch, Columbia
- Watson, J.S., MArch, Pennsylvania
- Wodehouse, L. M. (On Leave), St. Andrews

**Associate Professors:**

- Coddington, J., MArch, Pennsylvania
- Herz, M. D., BArch, Columbia
- Kaplan, M., MArch, Harvard
- Kinzy, S. A., Ph.D, SUNY (Buffalo)
- Martella, W. E., BArch, California
- Rabun, J. S., MArch, Texas

**Assistant Professors:**

- Fox, L. D., MArch, Cranbrook
- French, R. C., BArch, Tennessee
- Livingston, M., MFA, Wisconsin
- Moir-McClean, T. W., MArch, Michigan
- Ware, S. M., MFA, Tennessee
- Watson, J.S., MArch, Pennsylvania

**MASTERS OF ARCHITECTURE PROGRAM**

The School of Architecture offers two tracks leading to the Master of Architecture degree.

**Track 1** 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 the requirements for meeting Graduate School, the following specific admission requirements to the Master of Architecture program must be met:

- 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 3.0 GPA. Candidates with an equivalent degree and 3.0 GPA may be considered for conditional admission when evidence of exceptional promise is identified. Undergraduate course work must include at least twelve semester hours of humanities, a basic understanding of physical principles, and analytical procedures and an understanding of mathematical principles

**Degree Requirements**

**Track 1** requires a minimum of 42 semester hours of graduate preparation and 60 semester hours of graduate coursework, taking approximately 3 1/2 years of full-time study.

**Track 2** requires a minimum of 30 semester hours of graduate coursework. Both tracks require 6 hours of Thesis 500 with a public presentation and oral defense of thesis. Retention in the program is contingent upon evidence of satisfactory progress toward the degree. Each student's progress will be reviewed each semester by the Coordinator of Graduate Studies. Any questions regarding progress will be reviewed by the Graduate Program Advisory Committee.

For further information, contact the School of Architecture.

**ACADEMIC COMMON MARKET**

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

**GRADUATE COURSES**

- **400 Service Practicum (0)** Experience in architectural or equivalent office for a minimum of 3 months to be completed prior to fifth year entry. E.
- **403 Introduction to Preservation (3)** History, theory, and legal aspects of architectural preservation and restoration.
- **404 Preservation Technology (3)** Techniques of preservation: methods of analysis, history of materials and technology used in old buildings. Prereq: 403.
- **405 Descriptive Analysis of Historic Buildings (3)** Identification and analysis of characteristic elements of buildings from various architectural periods. American architecture, survey techniques.
- **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 discrete elements of design for specific cultures with emphasis on housing. Cultural, social, economic, climatic, and technical forces as sources of form.
- **410 History and Theory of Urban Form (3)** Patterns of community development. Selected historical and contemporary examples. Basic urban design issues and exemplary design approaches through lectures, readings, essays, and sketch studies. Historical change in urban form and design.
412 Non-Western & Indigenous Architecture (3) Building responsive to climate, material availability, and economic level, as designed by anonymous builders. Prehistoric times to present throughout world. Textbooks: Crespi, Indu (Valley); Hindu, Buddhist, and Mughal architecture of India, China, and Japan.

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

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, 1840-1940 (3) Stylistic periods from Greek Revival through twentieth century.

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

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

428 Special Topics in Architecture (1-4) Individual projects undertaken in consultation. Credit adjusted to project complexity and level of effort. May be repeated. Maximum 6 hrs. E

429 Special Topics in History, Theory and Criticism (1-4) Special topics in history-related subjects. May be repeated. Maximum 8 hrs. E

433 Building Energy Analysis (3) Balancing heat flow through external skin of residential and small and large commercial buildings. Local climate evaluation. Site planning, building size and orientation, window area, wall treatment, infiltration control, and other design elements.


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

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

463 Architectural Development (3) Principles and practice of architect as developer. Impact of economics, finance and urban policy on design and development of real estate. Open only to all students.

464 Project and Construction Management (3) Principles, methods, and application of project and construction management processes. Project manager's and construction manager's function, responsibilities, and activities investigated through case studies. Method and techniques of estimating project cost and building cost in current practice, new techniques of cost analysis.


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

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

592 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/NP only. E

511 Graduate Seminar: Environmental Influences (3) Environmental factors influencing regional character of architecture. Natural forces associated with these factors, cultural interpretation and response regarding importance and impact. Coreq: 571.


513 Graduate Seminar: Ethical Imperatives (3) Social, cultural, philosophical and moral issues which impact professional responsibilities. Attributes, values, and ideas that address formation of professional ethos. Coreq: 573.

521 Principles of Architectural Form (3) Historical and contemporary architectural theory through investigation of literature and related examples. Theorie of understanding and theories of application related to generation of architectural form and space in response to both cultural and environmental focus. Coreq: 571.

551 Introduction to Research Methods (3) Qualitative and quantitative research methods in architectural inquiry. Systematic study of applied and speculative investigations in field of architectural research. Review of techniques and applications for architectural research and scholarship.

552 Application of Research Methods (3) Projects and case studies applied to methods of architectural research and scholarship identified in 551.

562 Professional Practice (3) Management and organizational theories and practices for delivering professional design services: assessment of building industry and its influence on practice; analysis of management functions within professional firms; legal and ethical concerns facing practitioners today; and introduction to special obligations and privileges of design professional.

571 Architectural Design Studio/Seminar I: Environmental Forces (6) Environmental forces influencing regional character of architecture. Examination of associated natural forces and cultural interpretation. Readings and discussions; application in design studio to specific projects. Prereq: Design II. 1 hr and 5 labs.


573 Architectural Design Studio/Seminar III: Cultural Aesthetics (6) Role of cultural influences on architectural form. Investigations into relationship between place and culture and impact on architectural character. Readings and discussions; process of formal synthesis in design studio. Prereq: Design II. 1 hr and 5 labs.


591 Foreign Study (1-9)

592 Off-Campus Study (1-9)

593 Independent Study (1-9)

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 assistance, if desired.
2. Three letters of recommendation from former professors or professionals in the field.
3. An undergraduate major in art or evidence of equivalent proficiency.
4. A portfolio to be evaluated by the faculty. Further information is available by writing to the Department of Art.
M.F.A. Requirements
A minimum of 60 hours is required:
1. Successful completion of 20 hours of studio in a concentration area. An inter-area program must be approved by the graduate faculty only after the second semester in residence. Ten hours of concentration must be in second year courses (512, 514, etc.).
2. A minimum of 9 hours of art history for graduate credit.
3. Eleven hours of electives which may consist of any combination of courses offered by the University for graduate credit.
4. Art 599, Project in lieu of Thesis (20 hours). A third year of semi-independent study. Student must have completed all other coursework prior to registration.
5. A student with the permission of the area faculty can petition to take 3 hours of outside academics as a substitute for 3 hours of art history or 3 hours of concentration area. The petition is to be presented to the graduate committee for final approval and should directly address the need and relevance of this substitution to the student's concentration.

Four semesters (normally the first 40 hours) beyond the Bachelor of Fine Arts 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. Residence is defined by the Department of Art as (1) a minimum enrollment of 6 hours per semester and (2) use of Department of Art facilities so that students are available for discussion and criticism.

The candidate's committee will consist of a minimum of 3 members and a maximum of 6 members and will be appointed prior to registration. The Department of Art reserves the right to approve the membership of the committee shall be as follows: one from the candidate's concentration area who shall be the major professor, one from art history, and one from a studio discipline outside the concentration area.

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

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

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.F.A. program in Art is available to residents of the State 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. Prerequisites: Art History 399, 499. May be repeated. Maximum 12 hours.

GRADUATE COURSES
400 History of Photography (3) Survey of history of photography from introduction of daguerreotype and calotype to more recent trends. Aesthetics and use of photography as medium for artistic expression.
401 Individual Class Projects in Fabric (3-6) Prereq: Two-Dimensional Fabric. Three-Dimensional Fabric or consent of instructor. May be repeated. Maximum 12 hours.
402 Individual Class Projects in Fiber (3) Prereq: Two-Dimensional Fiber. Three-Dimensional Fiber or consent of instructor. May be repeated. Maximum 12 hours.
404 Computer Enhanced Design (3) Exploration of computer systems, software and techniques. Prereq: Introduction to Computer Enhanced Design or consent of instructor. May be repeated. Maximum 6 hrs.
405 Advanced Computer Enhanced Design (3) Prereq: 404 or consent of instructor. May be repeated. Maximum 6 hrs.
409 Special Topics in Fiber/Fabric/Facilit (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hours.
411 Drawing IV (6) Individualized pursuit of personal drawing techniques and concepts, supplemented by individual and group critiques; weekly life drawing sessions. Prereq: 311. May be repeated. Maximum 12 hours.
413 Painting IV (6) Individual concepts and personal expression with varied media. Prereq: 313. May be repeated. Maximum 12 hours.
415 Watercolor IV (6) Water-based media on paper; individual concepts and personal approaches. Prereq: 315. May be repeated. Maximum 12 hours.
424 Ceramics: Clay and Glasses (3) Clay chemistry, clay bodies, glaze theory, glaze calculation, intensive formulating; mixing and applying of clay bodies and glaze formulas. Prereq: 321 and 322.
425 History of Ceramics Seminar (3) Ceramics from ancient through contemporary. Ceramics sculpture, and vessel aesthetic. Slide lectures and individual presentations. May not be used toward art history requirement. Prereq: 321 and 322.
429 Special Topics in Ceramics (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hours.
431 Photography III (3-6) Individual development of photographic problems and techniques. Prereq: 222 and 331. May be repeated. Maximum 12 hours.
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 hours.
441 Advanced Sculpture (3-6) Individual development of sculptural problems and techniques. Prereq: 600 level sculpture. May be repeated. Maximum 12 hours.
449 Special Topics in Sculpture (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hours.
453 Advertising Illustration (3) Advertising illustration media and techniques as applied to product illustration. Prereq: 354.
454 Editorial Illustration (3) Editorial illustration and techniques as applied to book, magazine, and newspaper illustration. Prereq: 453.
456 Graphic Design/Illustration Practicum (1-12) Practical experience in design or illustration field. Only by arrangement with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hours.
459 Special Topics in Graphic Design/Illustration (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hours.
462 Intaglio III (3-6) Individual projects through advanced color etching methods from stones and alternative plates. Prereq: 362. May be repeated. Maximum 12 hours.
463 Lithography III (3-6) Individual projects through advanced color etching methods from stones and alternative plates. Prereq: 363. May be repeated. Maximum 12 hours.
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 hours.
471 History of North American Art (3) Landmarks in potters, artists, sculpture, and design from prehistory 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 Gopley to emergence of "The Eight."
474 History of Modern Architecture in Europe and America (3) 19th-century styles, Sullivan and skyscraper, 20th-century: Viennese leaders, the Bauhaus, Gropius, Van der Rohe, Le Corbusier, and Wright. Aalto to Kahn, Tange and Metabolism, Archigram, Soleri, and Venturi.
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 hours.
541 Museology I: Museums, Purpose and Function (3) Development of museums of art, history, natural and applied science. (Same as Anthropology 481.)

462 Museology II: Exhibition Planning and Installation (3) Exhibition concept development and implementation. Exhibition design and installation techniques. Publicity, promotion, and public relations. Maximum 12 hrs. (Same as Anthropology 482.)

484 Museology III: Field Projects (1-12) Special project: restoration, preservation, registration, and other related research. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)

535 History of Printmaking (3) Prints from 15th century to present: 20th century in Europe and U.S. Prereq: 481 and 482. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)

485 History of Printmaking (3) Prints from 15th century to present: 20th century in Europe and U.S. Prereq: 481 and 482. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)

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

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

494 Individual Problems (3) Prereq: Determined by department. 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 student uses University facilities and/or faculty time before degree is completed. May be used toward degree requirements. May be repeated. S/N/C only.

505 Graduate Fiber and Fabric I (2-6) May be repeated. Maximum 10 hrs.

506 Graduate Fiber and Fabric II (2-6) May be repeated. Maximum 10 hrs.

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

523 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 ca. 1850 to present. Prereq: M.F.A. candidate or consent of department. May be repeated. Maximum 6 hrs.

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

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

553 Computer Enhanced Design (2-6) Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.

561 Graduate Printmaking-Illustration I (2-6) May be repeated. Maximum 10 hrs.

562 Graduate Printmaking-Illustration II (2-6) May be repeated. Maximum 10 hrs.

563 Graduate Printmaking-Lithography I (2-6) May be repeated. Maximum 10 hrs.

564 Graduate Printmaking-Lithography II (2-6) May be repeated. Maximum 10 hrs.

565 Graduate Printmaking-Screen Printing I (2-6) May be repeated. Maximum 10 hrs.

566 Graduate Printmaking-Screen Printing II (2-6) May be repeated. Maximum 10 hrs.

571 Studies in Medieval Art (3) Art and architecture of the Middle Ages: major monuments from Byzantium or western Europe. Prereq: M.F.A. candidate or consent of instructor. May be repeated. Maximum 10 hrs.

572 Studies in Italian Renaissance Art (3) Art and architecture of the 15th, 16th, and/or 17th centuries in Italy. 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) The 17th-century art and architecture: major artists and works from southern and 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 9 hrs.

580 Seminar in Art Criticism (3) Theory and practice. Prereq: M.F.A. candidate or consent of instructor.

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

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

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

595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May be repeated 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/N/C only.

575 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second-year evaluation by graduate faculty may be repeated. Upon admission to the M.F.A. program at UT Knoxville, a student may apply for the graduate faculty to offer him/her a minimum of 30 semester hours of approved graduate credit in the department.

590 Special Topics (2-4) Prereq: Determined by department. May be repeated. Maximum 10 hrs.

450 Metal Design (2-4) Intermediate to advanced. May be repeated. Maximum 8 hrs.

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

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

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

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

Astronomy

See Physics and Astronomy

Audiology and Speech Pathology

(Majors in College of Liberal Arts)

MAJORS

DEGREES

Audiology........................................Ph.D.

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

Speech Pathology................................Ph.D.

Patrick J. Carney, Head

Professors:

Asp, Carl W., Ph.D....................................Ohio State

Carney, Patrick J. (Lisbon), Ph.D...................Iowa

Luper, Harold L., Ph.D............................Ohio State

Nabelek, Igor V., Sc.D............................Prague

Petersen, H. A., Ph.D..............................Illinois

Silverstein, B., Ph.D................................Purdue

Associate Professors:

Burchfield, Samuel B., Ph.D........................Michigan State

Farrell, Charles J., M.A..........................Tennessee

Theilen, J. W., Ph.D.........................Northwestern

Wallace, Gloria L., Ph.D........................Northwestern

Assistant Professor:

Gordon, Pearl A., Ph.D....................Tennessee

Johnson, Ravi A., Ph.D............................Texas

THE MASTER'S PROGRAM

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

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

Students majoring in either of the two areas are expected to complete the academic requirements for clinical certification from the American Speech-Language-Hearing Association, including the required number of clock hours of clinical practicum (minimum 250 hours as a graduate student, 375 total). An exception to this rule must be approved by the appropriate departmental committee. Enroll in clinical practicum courses is required for all clinical practice experiences. If the student is to be enrolled in clinical practice experiences, it is required to make up for any deficiencies.

Students may elect either the thesis or the non-thesis option. Students in both programs are required to take 511. The Master's program with thesis will include a minimum of 30 semester hours of approved graduate credit in...
Audiology and Speech Pathology

speech-language pathology or a minimum of 33 semester hours of approved graduate credit in audiology, including 6 semester hours in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least two-thirds of these total hours must be at the 500 or 600 level, including no more than 6 hours of thesis and no more than 51 credits in the concentration area. 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 support a scholarly program of independent study of 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
   d. 3 semester hours in supervised teaching experience.
5. A comprehensive examination to demonstrate scholarly knowledge of audiology, speech and language pathology, and speech and hearing science; and advanced knowledge of the specific area of concentration.
6. A final oral examination.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

432 Stuttering (3) Nature, appraisal and treatment. Prereq: 304 or consent of instructor. May be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.
433 Observation of Clinical Practice (1) Prereq: Speech and Language Development, Articulation Disorders, or consent of instructor. (Same as Special Education 433.)
434 Clinical Practice in Speech-Language Pathology II (1-4) Prereq: 433 and consent of instructor. Enrollment for less than 2 hrs must have prior departmental approval. (Same as Special Education 434.)
440 Voice Disorders (3) Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 304, 306, or consent of instructor. (Same as Special Education 440.)
455 Problems in Speech Pathology (1-3) Prereq: Consent of instructor.
465 Speech and Language of the Culturally Different Child (3) Speech and language differences of children of various minority groups, of different ethnic and class memberships and from different geographic regions.
473 Audiology II (3) Basic principles of clinical audiology: pure tone, speech, masking and overview of special auditory tests. Prereq: 371. (Same as Special Education 473.)
494 Auditory Rehabilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification components/characteristics, assistive devices, speech acoustics, speech perception, speech reading, parent-infant, preschool school years of children, communication impairments/handicaps/remediation of adults, effects of aging/remediation on the elderly, and case studies. Prereq: Phonetics and Acoustics of Speech and 473, or equivalents or consent of instructor.
500 Thesis (1-15) S/NP only. E
502 Registration for Use of Facilities (3-15) Required toward degree requirements. May be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.
506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role in speech and language. Prereq: 306.
507 Anatomy and Physiology of Hearing (3) Structure and function of the peripheral and central auditory systems, and their roles in mediating auditory processes. Prereq: 473 or equivalent or consent of instructor.
511 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, fundamentals of statistics, application of statistics, and completion of a proposal and hypothetical pilot research project. Prereq: 473 or equivalent or consent of instructor.
512 Clinical Practice in Audiology (1-4) Prereq: 473 and 494. May be repeated. Maximum 6 hrs.
513 Clinical Practice in Audiology: Off-Campus Sites. (1-4) Prereq: Consent of instructor.
514 Practicum in Verbal-Tonal Habilitation (1-4) Prereq: 494, 565, 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 and case assignments for familiarization of students with instruments for measuring speech and hearing processes.
520 Aphasia (3) Historical review of aphasia literature, theories of brain functioning, aphasic classification and terminology, tests and rationales for testing, etiology, therapy, considerations and prognosis for recovery. Prereq: 506 or equivalent or consent of instructor.
522 Seminar: Articulation and Voice Disorders (3) Current research and diagnosis and management of articulation and voice disorders. 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 Advanced Clinical Practice in Speech-Language Pathology (1-4, 1-4, 1-4) Prereq: 433 or equivalent and consent of instructor. 534 may be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.
535-36 Advanced Clinical Practice in Speech-Language Pathology and Campus Sites (1-4, 1-4, 1-4) Prereq: 433 or equivalent or consent of instructor. May be repeated. Maximum 6 hrs each. Enrollment for less than 2 hrs must have prior departmental approval.
536 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4) May be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs must have prior departmental approval.
539 Motor Speech Disorders (3) Neurological organization for speech production; types of motor speech disorders and associated neuromuscular symptomatology; diagnosis and management of motor speech disorders. Prereq: 453.
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 loss, hearing aids, components and performance characteristics. Electroacoustical and real-ear analysis of hearing aids. Coupler material and geometry effects. Practical experience in troubleshooting, repair, and construction of hearing aids. Prereq: 473 or 507 or equivalents or consent of instructor.
545 Sound Measurement Techniques and Hearing Conservation (3) Techniques of measurement and analysis of sound: hearing conservation in schools and industry. Prereq: Consent of Instructor.
546 Audiology Aesthetics (3) Theoretical bases for behavior and perceptual measures of speech sound 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. May be repeated. Maximum 6 hrs.
549 Hearing Science (3) Study of psychoacoustic phenomena and how they relate to perception and diagnosis of hearing. Prereq: 473, 507, and 546 or equivalents or consent of instructor.
550 Seminar in Audiology (1-3) Significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.
552 Seminar in Speech Pathology (2-3) Current significant research in speech pathology. Topics vary. Prereq: 473 or in speech pathology. May be repeated. Consent of instructor.
554 Seminar in Multicultural Issues in Communication Disorders (3) Discussion of current research relevant to cultural language differences. Prereq: 465 or equivalent or consent of instructor.
555 Special Problems in Speech-Language Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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


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 548, or equivalents or consent of instructor.

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

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

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


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

610 Seminar in Hearing Science (Advanced study of perceptual organization of non-speech acoustic signals, detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 602 or consent of instructor. May be repeated. Maximum 6 hrs.

611 Experimental Design in Speech and Hearing (2) Analysis of experimental design in thesis and related journals. Generation of experimental designs. 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 or 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/C 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.

5. R. D. Kimberlin, Program Chair

**Professors:**

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

**Assistant Professor:**

Solles, U. P., Ph.D. .......................... Tennessee

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

To qualify for admission to this program, the applicant must possess a Bachelor's degree in engineering or science from an accredited institution, show evidence of ability to pursue and benefit from the program, and fulfill the University of Tennessee and Graduate School admission procedures and grade-point standards. It is expected that the student will have a basic knowledge of computer utilization and statistics; an understanding of aerodynamic fundamentals, aircraft propulsion, and performance; and some understanding of economics.

Both thesis and non-thesis programs are available. The thesis program involves a minimum of 30 semester hours credit while the non-thesis program involves a minimum of 33 semester hours credit.

**THESIS OPTION**

The thesis program involves satisfactory completion of the following requirements:

**Research and Development Specialization**

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

**Administration Specialization**

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

**NON-THESIS OPTION**

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

**Research and Development Specialization**

1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering (engineering management).
3. Twelve hours of electives in the major field, mathematics or engineering.
4. Three hours of an assigned project under Aviation Systems 550.
5. A comprehensive final written examination on all coursework submitted for the degree and defense of the project course paper.

**Administration Specialization**

1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Three hours in industrial engineering (engineering management).
3. Three hours in economics or finance.
4. Twelve hours of electives in the major field, mathematics or engineering.
58 Biochemistry

5. Three hours of an assigned project under Aviation Systems 550.

6. A comprehensive final written examination on all coursework submitted for the degree and defense of the project course paper.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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

501 Aviation Systems: An Overview (3) Aviation systems, present and future. Socioeconomic base, aerospace and propulsion technology, meteorology, air traffic control, airport community interface, and technological trends and developments pertinent to present status and future development of air transportation.

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

503 Air Vehicles (3) Current capabilities and future requirements for civilian and military air vehicles. Parameters significant for air vehicle type selection, integration of air vehicle into aviation systems. Prereq: 501.

504 Airports and the Community (3) Structure of airports and their communities. Technology and economics of cargo, baggage, ticket and passenger handling. Airport management, economics and logistics, interfaces with community, plans, programs and developments for collecting and distributing passengers and freight from various types of airports. Types of airport developments and their projections. Prereq: 501.

505 Governmental Policies for Aviation (3) Theoretical and legal basis for economic and governmental regulation of aviation. Historical and legislative development of aviation regulation agencies, organizational structure, administrative and enforcement procedures. Prereq: 501.

506 Aircraft Design (3) Design process, compromise of conflicting requirements, economical, industrial, and legal aspects. Definition of mission requirements, synthesis and optimization techniques, safety and reliability, systems integration, standards and regulations, teamwork and decision-making process.

510 Special Topics in Aviation Systems (3) Current problems. Prereq: Consent of instructor. May be repeated with consent.


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

588 Measurement Science I (3) Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Engineering Science and Mechanics 588, Mechanical Engineering 588 and Aerospace Engineer ing 588.

589 Measurement Science II (3) (Same as Nuclear Engineering 589 and Engineering Science and Mechanics 589.)

Biochemistry (College of Liberal Arts)

MAJOR

Biochemistry ........................................ M.S., Ph.D.

John W. Koontz, Head

Professors:

Church, Jorge E., Ph.D. ............... Sheffield
Joishi, J. G., Ph.D. ................. Poona
Monty, Kenneth J., Ph.D. ......... Rochester
Sano, T. P. (Emeritus), Ph.D. ....... Michigan
Wicks, Wesley D., Ph.D. ......... Harvard

Associate Professor:

Howell, Elizabeth E., Ph.D. .......... Lehigh
Koontz, John W. (Liaison), Ph.D. .... Kentucky
Roberts, Daniel M., Ph.D. ....... California (Davis)
Serpesh, Enin H., Ph.D. ........... Hapeke

Assistant Professors:

Bruce, Barry P., Ph.D. .......... California (Berkeley)
Fainberg, R. H. (Emeritus), Ph.D. .... California
Peterson, Cynthia B., Ph.D. ....... LSU

Adjunct Faculty:

Farkas, W., Ph.D. ................. Duke
Georgiou, S., Ph.D. ............. Manchester
Kennon, S., Ph.D. ............... California (San Diego)

THE MASTER'S PROGRAM

1. At least one year each of Introductory Organic Chemistry with laboratory and approved physical chemistry.

2. A minimum of 8 semester hours of approved biology courses beyond the introductory level and including the subject areas of genetics and physiology.

3. Biochemistry 511-12 and 515-16.

4. At least 6 hours of advanced seminar courses from the following: 501, 603, 604, 605, 606.

5. Six hours of Master's research and a thesis.

6. A final examination that covers both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

1. Introductory Organic Chemistry, Introductory Physics, Differential and Integral Calculus, approved physical chemistry, and at least 12 hours of biology beyond the introductory level and including the subjects of genetics and physiology.

2. Biochemistry 511-12 and 515-16.

3. At least two approved graduate courses in chemistry, physics, or other physical science; for example, Chemistry 550, 551, 552, Physics 521, 522, 551. No survey courses will be accepted.

4. At least 6 hours of topics offered in 521 and 621.
516 Experimental Techniques II (3) Laboratory rotations. Student works in laboratory of faculty member on clearly defined project. Written proposal and oral report. Prereq: 515. 3 Sp.

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

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

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


603 Current Topics in Biochemistry (1) Seminars and discussions. Topics posted in advance. Required every semester in residence. S/NC only. F.Sp.

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

605 Current Topics in Regulation of Protein Function (1) Covalent modifications of proteins by phosphorylation-dephosphorylation allosteric interactions. Prereq: 410 or equivalent. May be repeated. Maximum 5 hrs. S/NC only. F.Sp.

606 Current Topics in Biological Membrane Research (1) Prereq: 410 or equivalent. May be repeated. Maximum 5 hrs. (Same as Microbiology 606). S/NC only. F.Sp.

621 Advanced Topics (1-3) Biochemical and biophysical methods, mechanisms of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry. Prereq: 511-12 or consent of instructor. May be repeated. Maximum 5 hrs.

Biomedical Sciences
(Office of the Vice Chancellor for Academic Affairs)

MAJOR DEGREES

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

Raymond A. Popp, Director

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

Research Professor:
Olins, Ada L., Ph.D. .......................... New York

Research Assistant Professor:
Foote, Robert S., Ph.D. ...................... Duke

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

Oberbacher, Edward C., Ph.D. .......... Pennsylvania

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

Bunick, Gerald J., Ph.D. ...................... Pennsylvania

Cook, John S., Ph.D. ........................ Princeton

Fry, R. J. M., M.D. .......................... Dublin

Godfrey, Virginia L., D.V.M., Ph.D. ....... Tennessee

Hartman, Fred C., Ph.D. .................. Tennessee

Jacobson, K. Bruce, Ph.D. ............... Johns Hopkins

Kennel, Steve, Ph.D. ....................... California (San Diego)

Larimer, Frank W., Ph.D. .................. Florida State

Lee, Kai-Lin, Ph.D. ........................ Tulane

Littlefield, Gaylor, Ph.D. ................. Georgia

Mazor, Peter, Ph.D. ........................ Harvard

Murich, Richard, Ph.D. ..................... Georgia

Niyogi, Selik, Ph.D. ......................... Northwestern

Popp, Raymond A. (Liason), Ph.D. ....... Michigan

Russell, Jane B., Ph.D. ...................... Chicago

Shugart, Lee H., Ph.D. ..................... Tennessee

Snyder, Fred L., Ph.D. ...................... North Dakota

Solomon, A., M.D. ........................ Duke

Stevens, Audrey L., Ph.D. ................. Western Reserve

Studds, Lisa J., Ph.D. ...................... California (San Diego)

Terzaghi-Howe, Peggy, D.Sc. .......... Harvard

Vo-Dinh, Tuan, Ph.D. ..................... Swiss Fed IT

Waters, Larry C., Ph.D. ..................... Georgia

Woychik, Richard P., Ph.D. .............. Case Western

Yang, Wen K., M.D., Ph.D. ............. Tulane

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 work are biochemistry, biophysics, carcinogenesis, genetics, cellular, developmental and mammalian biology, and radiation biology. Included are such subjects as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytokology, radiation and environmental biology, virology, development, experimental pathology, microbial and mammalian genetics, mutagenesis, and problems of aging.

ADMISSION REQUIREMENTS

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply. Completed applications, Graduate Record Examination scores and letters of reference should be sent directly to the address below. The student will need preparation in biology, calculus, physics, and organic and physical chemistry. A course in physical chemistry is offered by the school in order to meet the last requirement. It is recommended that deficiencies in preparation, as identified in the admission process, be eliminated prior to entrance. Requests for application forms, information on admission, financial support, and housing should be sent to Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Division, ORNL, Box 2009, Oak Ridge, Tennessee 37831-8077.

THE DOCTORAL PROGRAM

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

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

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 (518-19); plus any three of the following courses: Genetics (515); Molecular Genetics (517); Statistics for Biologists (574); or Computing for the Life Sciences (526).

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

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

4. 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.

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

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

7. 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
Botany
(College of Liberal Arts)

MAJOR

DEGREES

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

Edward E. Schilling, Head

Professors:
Caponetti, J. D., Ph.D. ............... Harvard
Clebsch, E. E., Ph.D. ................. Duke
DeSelms, H. R. (Emeritus), Ph.D. ...... Ohio State
Emons, A. M. (Emeritus), Ph.D. ........ Michigan
Hernond, W. R. (Distinguished Prof.), 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
McCormick, J. F., Ph.D. ............... Emory
Mullin, B., Ph.D. ................. NC State
Norris, F. H. (Emeritus), Ph.D. ...... Ohio State
Petersen, R. H. (Distinguished Prof.), Ph.D. .... Columbia
Schilling, E. E. ( Liaison), Ph.D. ........ Indiana
Sharp, A. J. (Emeritus), (Distinguished Prof.), Ph.D. .... Duke
Smith, W. O., Ph.D. ................. North Carolina
Wilke, P. L. (Distinguished Prof.), Ph.D. ....... Texas

Associate Professors:
Amundsen, C. C., Ph.D. ............... Colorado
Bland, A. S., Ph.D. ................. Ohio State
Grund, O. J., Ph.D. .............. NC State
Kimbell, J. D., Ph.D. ................. Tennessee
Wolford, 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, biochemistry, biology, cytology, cytogenetics, ecology, genetics, fermentation, molecular biology, plant anatomy and physiology, plant physiology, plant pathology, and taxonomy.

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

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

ADMISSION REQUIREMENTS

The Botany Department requires scores from the general and biology subject portions of the Graduate Record Examination, at least three letters of recommendation or standard recommendation forms from academic or professional personnel, 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 2.5 or better on a 4.0 scale, with evidence of ability to do work of graduate quality.
2. General botany or general biology: 8 semester hours.
3. Advanced botany or closely allied biological sciences: 12 semester hours.
5. College mathematics: 6 semester hours including 1 term of calculus.

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

THE MASTER'S PROGRAM

The program for the Master of Science is patterned to fit the needs of students who desire a 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 must be completed before enrolment in Botany 500.
2. Successful completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.
3. Satisfactory completion of two hours at the 600 level.
5. Completion 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 of 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 and 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).

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

GRADUATE COURSES

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


412 Plant Anatomy (3) Cells, tissues, and organs; development in vegetative and reproductive structures of vascular plants—seed plants. Prereq: 110-20 or Biology 110-20. Maximum 9 hrs.

431 Plant Ecology (3) Interactions between individuals, species, communities, and their environments. Circulation of energy and matter in ecosystems. Weekly field trips or laboratory periods, and at least two weekend field trips. Prereq: 350 or equivalent. S

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organs; media preparation and maintenance of cultures. Prereq: 110-20 or Biology 110-20 or equivalent or Plant Pathology 120-30 or equivalent. Recommended prereq: 310-20, 321-42, Microbiology 310 or 319; Ornamental Horticulture and Landscape Design 330, and Plant and Soil Science 331.

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

501 Mycology (4) Intensive survey of fungi, all major classes. Field and laboratory information. Occasional field trips. Prereq: 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. May be repeated. Maximum 4 hrs. E

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

507 Biological Illustration (3) Principles and applications of photography (B&W and Color) photographically and photomicrography, drawing, graphics and video for recording and presentation for research and publication of data in pictorial and graphic form.

509 Morphology and Evolution of Basidiomycetes (4) Structure and function of normal and sexual life cycles as applied to evolution in group. Cultures and specimens in laboratory. Prereq: 210 or equivalent.

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

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


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

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

536 Plant Communities and Plant Geography (4) Plants in communities and their classification and ordination; geographic distribution of communities—their climatic and soils relationships. Prereq: 431. (Same as Geography 363.)

544 Seminar in Botany (1) Readings and discussions of current literature. Special topics in botany research. Maximum 8 hrs. S/NC only.


565 Phytoplankton Ecology (3) Interaction between environment and phytoplankton. Nutrient uptake, primary production, competition, ecological theory applied to phytoplankton communities, and physiological adaptation by populations to environment. Prereq: 210 or consent of instructor.

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

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

581 Cytogenetics (3) Chromosome structure and behavior in mitotic and meiotic divisions in relation to structural changes, genetic controls, hybridization, speciation, and polyploidy. Laboratory work on normal and abnormal meiotic systems and somatic chromosomes from plants and animals. Prereq: 210 and at least 6 additional hrs in biological sciences. (Same as Forestry 581.) Sp,A

582 Methods and Instrumentation in Laboratory Investi-gation (1) Project experience and theoretical background in various research methods, ion exchange resins, adsorption spectrophotometry, electron microscopy, photosynthesis, zonulaculitration, gas chromatography, autoanalyzers, microscopy, culture methods, use of spectrophotometers. Prereq: Chemistry 350, 360: Physics 121, 122. May be repeated. Maximum 5 hrs. S/NC only.

583 The Field Research Problem (3) Conceptualization, planning, and implementing field research. Criteria for choosing instrument, sampling methods, and locations for study of populations, communities, and ecosystem. Field practice. Development and critique of formal research proposal, as those required by granting and contracting agencies. Prereq: 431, or 536 or 573.

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

590 Developmental Plant Morphology (3) Developmental morphology of plants from vegetative and reproductive organogenesis, and organ differentiation and development. Prereq: 431, 530 or 412 and 521 or 522 or consent of instructor. 2 hrs and 1 lab. F,A

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

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

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

625 Environmental Assessment and Sustainable Development in Third World Countries (3) (Same as Ecology and Planning 653.)

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

The objective of the program is to develop leaders able to enhance the success of their organizations. The program consists of two 15-credit-hour MBA core courses in the first year and 24 credit hours of concentration/elective courses in the second. Elective courses carry 3 or 6 semester hours of graduate credit.

Admission Requirements

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

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

For admission to the MBA program, consideration is given to (1) the 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 experiences 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 is not included in calculus should arrange to take it at UT Knoxville or at another accredited institution prior to the fall semester of entry into the program. Those electing the management science or statistics concentration must have completed two years of college-level calculus.

MBA Core

The MBA core consists of two 15-hour courses, one taken each semester. The courses are taught by the MBA core faculty in an integrated fashion and through a year-long simulation requiring students to learn the functional fundamentals (accounting, finance, management, marketing) when they need to apply them to solving a specific business problem. The topics included in 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 shareholder 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.

Concentration and Electives
A concentration area may be indicated on the MBA Program Application or this declaration may be deferred until after matriculation. In any event, selection must be made no later than completion of 15 hours of MBA program coursework. Requests for changes in concentration area must be submitted for approval to the Office of Graduate Business Programs. Among the 24 credit hours in the concentration/electives block, at least 9 but not more than 12 must be in one of the following concentration areas. For specific courses required in concentration areas, see the appropriate field of instruction.

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

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 via formal petition to the Office of Graduate Business Programs.

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

- 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 in the fall semester permits graduation in the following spring semester.)

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

BUSINESS ADMINISTRATION 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 Graduate Business Programs. Students pursuing a concentration in global business are strongly encouraged to pursue an international or international 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 without prior 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 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 or marketing) to achieve a dual concentration.

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

PRE-MBA PROGRAM

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

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

The application in the program are counseled initially in the Liberal Arts Advising Center regarding admission standards and Liberal Arts requirements. At the end of the 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 fifth year (minimum of 30 semester hours of graduate credit), the student receives the MBA degree.

DUAL J.D.-MBA PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual program leading to the conferral 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 business management 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 must 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 Administration will award up to 9 semester hours of credit toward the MBA for acceptable performance in approved courses offered in the College of Law. The approval of courses is the responsibility of the Dual Program Committee and the student's assigned advisor.

Students may begin their studies in either the J.D. or the MBA program, but may not enroll in MBA coursework while completing the first year of the law curriculum and may not enroll in J.D. coursework while completing the first year of the business curriculum. During the first year in the J.D. program, students register through the College of Law. For any term in which students take MBA courses, even though they are also taking law courses, they must register through The Graduate School. The Graduate School registration form must be approved by the 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 will be converted to either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college in which such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a law course in which the student has earned a 2.3 grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

**Approved Dual Credit**

MBA courses to be counted toward the J.D. program must include 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 for the benefit of both company and individual. 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 contiguous 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 application 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 a recommendation from his/her company, and the Graduate Management Admissions Test (GMAT) score report. The first items should reach the Graduate School one month before the MBA application deadline to allow for processing.

For admission to this program, primary consideration is given to the applicant's work history and the recommendation from the sponsoring organization and the GMAT. There is no cut-off for either grade-point averages 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 third term is comprised of Executive Core III and Management Project III. It includes two residence sessions, the first of which will be in some international venue.

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

The management project, to be carried out as an independent study project, involves the diagnosis and analysis of some significant aspect in the sponsoring organization and will be based on applying major themes in the core courses. The written project and presentation to senior management and the College of Business Administration as the comprehensive examination.

All of the off-campus work will require substantial and regular contact with faculty and other program participants.

**Transfer Credits**

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

**Other Requirements**

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

**THE DOCTORAL PROGRAM**

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

**Admission Requirements**

Students seeking a Ph.D. degree must be recommended for acceptance by the College of Business Administration to The Graduate School. Actual admission is based on the applicant's overall standing compared with other applicants and with the number of vacancies in each department. The Graduate School requires 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
- Management (Operations Management and Strategic Management)
- Marketing
- Logistics and Transportation

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

Degree Requirements

Doctoral students must file a program of study that has been approved by their temporary doctoral advisory committee and the Associate Dean by the end of the first semester of coursework after entry into the program. This committee is composed of the department chairperson in a student's intended area of concentration, subject to the Graduate Council's approval by the temporary doctoral advisory committee in approving the specific coursework required. Available concentrations are: accounting, finance, management (operations management and strategic management), marketing, and logistics/transportation. See the appropriate fields of instruction for specific course requirements.

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

Graduate courses are offered in functional areas, basic disciplines, concentration and cognate areas. Graduate courses accepted for credit toward the Ph.D. degree must be approved by the student's doctoral committee. Graduate courses accepted from other institutions must be included. Under "Other Requirements," the date of acceptance of the research proposal by the doctoral committee should be indicated. The application must be approved by the student's doctoral committee and the Associate Dean before submission to The Graduate School.

Dissertation

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

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

GRADUATE COURSES

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

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

506 Information Engineering and Management (3) Design and management of information necessary to accomplish organizational objectives using activity blueprints, entity-relationship diagrams, CASE (Computer-Aided Software Engineering) tools.

510 Management of Responsive Service Organizations (3) Management of organizations which respond to customer requests rather than to reduce inventory, non-product economics, relationship building and management methods built on enabling, empowering, mentoring 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-site periods. Integration of major business functions through strategic perspectives, application of functional knowledge to tactical and strategic issues. Role of managers within and across organizations to deliver value to customers and other stakeholders.

Ethical Issues. Personal development for leadership: individual and interpersonal skills, 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.
Associate Professors:
Basaran, Osman A. (Adjunct), Ph.D.…… Minneapolis
Brune, Duane D., Ph.D.…………… Houston
Cochran, Henry D. (Adjunct), Ph.D.…… MIT
Davison, Brian H. (Adjunct), Ph.D.…… Cal Tech
Downs, James E. (Adjunct), Ph.D.……… Tennessee
Phipps, Tommy J. (Adjunct), Ph.D.……… Wisconsin
Scott, Timothy C. (Adjunct), Ph.D.……… Texas
Vogel, Ernest F. (Adjunct), 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, biochemical engineering, 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 degree. Minimum requirements are as follows:

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


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

Non-Thesis Option: Under certain conditions, a candidate may apply for a nonthesis 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 committee 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.

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

THE DOCTORAL PROGRAM

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

Department requirements consist of the satisfactory completion of:

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

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

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

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

GRADUATE COURSES

401 Chemical Engineering Data Analysis (3) Experimental data; identification of system extremes; statistical properties of samples; empirical modeling of processes; statistical process control; optimization techniques.

403 Introduction to Optimization (3) Principles and applications of optimization techniques to chemical processes; design, unconstrained and constrained optimization, linear programming, dynamic programming, and geometric programming.


440 Transport Phenomena (3) Momentum, heat and mass transfer processes, analogies, differential and macroscopic balances, applications involving molecular diffusion, simultaneous mass transfer and chemical reaction.

461 Advanced Process Dynamics and Control (3) Process and control system simulation and advanced industrial system design, Cascade, feedforward, multivariable, deadtime, adaptive, and nonlinear control system design. Both computer and laboratory work.

485 Hydrocarbon Processing (3) Chemical and physical properties of selected hydrocarbons and those processes utilized in conversion of raw materials into various fuels and selected chemical feedstocks.

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

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

502 Registration for Use of Facilities (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 (3) Formulation and solution of problems in chemical engineering and materials areas, ordinary and partial differential equations; types of ODEs and solution by the Laplace transform; conformal mapping; variational methods, introduction to numerical methods. (Same as Materials Science and Engineering 505.)

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

507 Application of Numeric Linear Algebra in Systems and Control Engineering (3) Fundamental concepts of linear algebra to problems in systems and control area. Analytical and physical interpretation of relevant concepts: least squares problems, LU, QR, and SVD decompositions of matrices, eigenvalue problems and similarity transformations in solving difference and differential equations. Numerical computational aspects of various algorithms. Application of linear algebra concepts in optimization studies. Introduction to linear programming. Computer projects. Prereq: Graduate standing or consent of instructor. (Same as Electrical and Computer Engineering 507 and Mechanical Engineering 507.)

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


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

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

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

561 Process Modelling and Simulation (3) Theories and structures of models and art of simulation. Model development from basic principles. Model development from plant data. Use of models in design, optimization and control. Prereq: Consent of instructor.

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

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


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

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

586 Measurement Science I (3) (Same as Nuclear Engineering 586, Civil Engineering 558, Engineering Science and Mechanics 586, Mechanical Engineering 588 and Aerospace Engineering 588.)

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

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

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


642 Advanced Topics in Polymer Processing (3) (Same as Materials Science and Engineering 542.)


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

675 Microbial Systems Analysis (3) Identification and analysis of complex microbial systems using perturbation-response methods, understanding of important mechanistic processes, interactions, and regulation at several systems levels (reactor or macro, ecological, cellular/physiological and molecular). Experimental designs for data gathering, signal resolution and processing, mathematical signal analysis, model development (deterministic, stochastic, phenomenological), and utility and limitations of approach. Prereq: 576 or consent of instructor. (Same as Environmental Engineering 675.)

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

698 Measurement Science II (3) (Same as Civil Engineering 558, Civil Engineering 559, Civil Engineering 588, Civil Engineering 589, Engineering Science and Mechanics 586, Engineering Science and Mechanics 587, Mechanical Engineering 588 and Aerospace Engineering 588.)

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

THE DOCTORAL PROGRAM

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

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

1. Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 500.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
3. Prescribed remedial courses based on performance on entrance examinations.
4. Sufficient graduate coursework in chemistry (at the 400 level or above) and/or a related field to make an overall total of 30 hours, including one of the following sequences: 530-531-532, 550-551-552, 570-72-73, 590-94-95, or three courses from 510-11-12. At least 14 hours of this graduate coursework must be at the 500 level or above.
5. A final oral examination.

THE DOCTORAL PROGRAM

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

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

1. Research and a dissertation to give at least 24 hours of graduate credit in Chemistry 600. Registration must be continuous from the beginning of research.

2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.

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

4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 600.

5. Eighteen additional hours in courses at the 500 level or above including at least one course above 601 and one of the following sequences: 510-11-12, 530-31-32, 550-51-52-53-54, 570-71-72-73, and 590-94-95.

6. A final oral examination.

The Ph.D. program in concentration in chemical physics is conducted jointly with the Department of Physics. Requirements depend on the choice of the major department. Chemistry departmental requirements include passing the above degree requirements in chemistry with concentration in physical chemistry plus 6 additional hours in physics at the 500 level or above. Three of the additional physics courses can be used to satisfy the 18 hours requirement in item 5.

GRADUATE COURSES

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 230. Prereq or coreq: 320 or 391. 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 or physics majors or minors. Prereq: Mathematics 122 or equivalent and 1 yr of general chemistry. F


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 or for both 483 and 483. 473-Properties of gases, first and second, and third laws of thermodynamics; chemical equilibrium: simple phase equilibria; properties of solutions; introduction to statistical thermodynamics. 483-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 473 or 473. Prereq or coreq: Corresponding courses 471 or 473 for 479 and 481 or 483 for 489. 1 lab. E

484 Advanced Physical Chemistry (3) Chemical dynamics, statistical thermodynamics, quantum mechanics of atomic and molecular systems, crystal structure and solid state. Prereq: 461 or 483. Sp

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

501 Chemistry Seminar (1) Lectures and discussion on current research. May be repeated. Continuation registration required for resident graduate students. S/N/C 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/N/C only. E

505 Special Problems (3) Specially assigned theoretical or experimental work on problems not covered in other courses. Prereq: Consent of department. May be repeated. Maximum 5 hrs. S/N/C only.

510 Analytical Spectroscopy (3) Principles and practice of optical and mass spectrometric techniques in quantitative chemical analysis. Prereq: 1 yr of physical chemistry.

511 Analytical Separations (3) Principles and practice of chemical separations based on extraction, chromatographic, and electrophoretic phenomena. Prereq: 1 yr of physical chemistry.

512 Electroanalytical Chemistry (3) Fundamentals of electrode processes; principles and practice of electroanalytical techniques in quantitative chemical analysis and applied to study of chemical systems. Prereq: 1 yr of physical chemistry.

520 Chemical Instrumentation (3) Principles of analog and digital systems in chemical instrumentation; practice in design and construction of chemical instruments. Prereq: Consent of instructor.

530 Chemical Bonding (3) Wave mechanical atom, nucleus, molecule, and solid state. Prereq: Mathematics 122 or equivalent and 1 yr of general chemistry. F

531 Characteristics of Inorganic Compounds (3) Descriptive chemistry of elements, structure, reactions, kinetics, mechanisms, equilibria, and spectra of coordination, organometallic, binuclear compounds. Prereq: 530. Sp

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

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

550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, stereochemistry, conformations, and molecular mechanics; substituent effects on acidity and reactivity; introduction to reaction mechanisms. Prereq: 360. F


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

553 Spectroscopic Characterization of Organic Compounds (2) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, infrared, ultraviolet, and mass spectrometry. Prereq: 530 or equivalent. F

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

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

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

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

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in 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.


595 Physical Chemistry of Polymers (3) Conformation of macromolecules, solution and bulk 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/N/C only. E

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

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 550-551-552 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.

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Child and Family Studies

(Commerce 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

Denger, Jack, Ph.D..................................Michigan State

Moran, James D., Ph.D............................Ohio State

Norquist, V. Mick, Ph.D.............................Tennessee

Seiple, Connie, Ed.D...............................Texas Tech

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

Associate Professors:

Allen, J., Ph.D. ........................................Purdue

Buehler, C., Ph.D. ...}.................................Minnesota

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

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

ADMISSION REQUIREMENTS

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

Admission to the program is contingent upon faculty evaluation of GRE scores, 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 usually includes a concentration in either child development or family studies. Specializations in the child development concentration consist of early childhood education, early childhood special education, early childhood administration, and child development. Specializations in the family studies concentration consist of family life, family science, and family and human development, and a concentration in child development or family studies, and an emphasis on becoming proficient producers and consumers of research. A doctoral program that is concurrently specialized and integrated in nature reflects the complexity of the disciplinary subject matter, provides a broader context to formulate theoretical questions, and broadens the empirical literature for addressing those questions.

Requirements include:
2. 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.
8. Minimum 8 credits of electives.

THE PH.D. CONCENTRATION

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

Requirements include:
2. 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.
8. Minimum 8 credits of electives.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state basis. The M.S. in Child and Family Studies (concentration in family studies 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 be repeated. S/N only. E
510 Survey of Theory and Research in Child Development (3) Theoretical models and research literature in child development (concepts through adolescence); research methods; application to research intervention and education. Prereq.: 3 hours of advanced course in social, economic, or psychological factors of development. 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. Sp.
521 Organizational Management in Early Childhood Education (3) Designing, implementing, and evaluating physical and human resources in educational environments. Development of skills in environmental organization, interpersonal leadership, and supervision of staff. Prereq.: 512 or equivalent or consent of instructor. Fa.
522 Naturalistic Interventions for Parents and Teachers of Young Children (3) Common problems faced by parents and teachers; methods in response to modify problem behavior. Prereq.: 510 or equivalent or consent of instructor. F.
525 Seminar on Play (3) Competency in the theoretical framework and research methodologies on play. Developmental perspective on play. E
530 Families of Handicapped Children (3) Developmental nature of families' experiences in caring for handicapped children, especially during infancy and early childhood. Prereq.: 510 or consent of instructor. F.
540 Parent-Child Relations (3) Influence of parents on children, influence of children on parents, reciprocal interaction between parents and children, applications of systems models, child abuse, and impact of divorce on children. Prereq.: 550 or equivalent or consent of instructor. F.
550 Survey of Theory & Research in Family Studies (3) Research issues and literature in family studies; use of family conceptual frameworks, development of theoretical models and application to research and family life programs. F.
560 Martial Dyad (3) Communication, power, sexuality, marital stability, and marital roles. Prereq.: 550 or equivalent or consent of instructor. F.
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

Profs:

Burdette, E. G. (Fred N. Peebles Prof.), Ph.D................. Illinois
Chatterjee, A., Ph.D. ................................... North Carolina
Davis, W. T., Ph.D. ...................................... Tennessee
Ghosh, M. (Goodrich Chair of Excellence), Ph.D............ Illinois
Goodpasture, D. W., Ph.D. ............................... Illinois
Greco, W. L. (Emeritus), Ph.D. ............................ Michigan State
Heathington, K. W. (Emeritus), Ph.D. ....................... Minnesota
Humphreys, J. B. (Emeritus), Ph.D. ........................ Texas A&M
Johnson, H. L. (Emeritus), Ph.D. ......................... Tennessee
Miller, W. A. (Gradprof), Ph.D. ........................... Georgia Tech

Tiry, R. F. (Emeritus), B.S. ................................. Marquette

DEGREES

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

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.

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

Option II: A minimum of 33 semester hours, including a 3-hour special problems course, 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 use the engineering background, the following minimum prerequisite courses must be taken:

- Basic Engineering 121, 131, 122, 231, 241, 251, 351; Civil Engineering 390, 395, 380, 380; Mathematics 141, 142, 231, 231, 241;
- Chemistry 210, 130, 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 Civil Engineering.

Option I: 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.

Option II: 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...
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, 332.

452 Traffic Engineering (3) Characteristics of driver, vehicle, and roadway and their interrelationship; traffic studies; basic considerations of traffic circulation and control, lighting, capacity analysis, roadway safety analysis, and design. Prereq: 210, 251, 332.

453 Airport/Railroad Planning and Design (3) Airport master planning and railroad engineering. Runway configuration, airfield capacity, geometrics and terminal layout and design. Railroad capacity, geometrics and system layout and design. Prereq: 210, 251, 332.

461 Analysis of Framed Structures (3) Maximum stress due to moving loads; use of influence lines; lateral forces due to earthquake and wind; analysis of portals, 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 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, spillway and outlet works design; 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 conveyance and control structures. Application of hydrologic and hydraulic principles to design of drainage systems for urban, rural, mining, and highway development; design of inflow structures, detention, culverts, and detention/filtration basins; application of commonly-used computer runoff models; evaluation of land-use on streamflow and quality. Prereq: 390, 395.

485 Water Resources Development and Management (3) Principles of water resources project development and planning. Institutional framework: water law, evaluation procedures for comparing alternative water resources development alternatives. Multi-disciplinary principles of water management, pricing, principles of engineering economics, benefit-cost analysis, and cost allocation methods; environmental impact assessment procedures; decisions for dam and reservoirs-based methods; case studies. Prereq: Senior standing.

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

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

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

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

530 Soil Strength and Earth Slope Stability (3) Soil strength of fine grained soil from perspective of idealized, simple clay. Drained and undrained shear strength and stress-strain behavior of real soils. Laboratory testing. Stability of natural and cut slopes and earth embankments. Prereq: 331.

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


539 Geomechanics Seminar (1) Seminar topics in geomechanics, geotechnical engineering, geomechanics. Graduate student research contributions and practical applications presented by practicing engineers from companies and agencies. May not be repeated. S/NC only.

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

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

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

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

552 Traffic Engineering-Operations (3) Signs, signals and marketing; short-term operations; control points; signal timing and phasing; one-way reversible flow; system operation and demand models; evaluation of alternatives; implementation; special topics: urban goods movement, transportation system management. Prereq: 352 or graduate standing.

555 Public Transit Planning (3) Characteristics of transit modes; conventional and paratransit; operational design of transit services; route planning and scheduling; load 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 transportation systems; traffic control, road design and crash testing. Prereq: 452 or graduate standing.

557 Transportation Planning and Operations with Micro-Computer Applications (3) Transportation system management techniques and application of micro-computers to analysis of transportation actions. Prereq: 351, 554.

559 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationship between various transportation modes and between transportation and other community features. Use of planning process to
Environmental Engineering

GRADUATE COURSES

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

502 Registration for Use of Facilities (3-15) Required for the first quarter of registration for the academic year when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

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

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

520 Open Channel Hydraulics (3) Open channel flow principles, properties, and classifications; uniform and gradually varied flow theory and applications; open channel design; unsteady flow theory and dynamic; routing; spatially varied flow; non-linear alignment; microcomputer applications, featuring HEC-2 model. Prerequisite: Civil Engineering 380.

522 Floodplain and Urban Flood Management (3) Review of national, regional, and local flood problems; state of the art flood damage reduction alternatives; structure 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. Prerequisite: Civil Engineering 380 or consent of instructor for non-majors.

524 Sediment Transport (3) Sediment properties and measurements; principles of dynamics of suspended and bed sediment transport in erodible channels; erosion, transportation, and deposition of sediment by flowing water; erodible channel design; channel regime theory; common computer models. Prerequisite: Civil Engineering 380.

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. Prerequisite: Civil Engineering 365. (Same as Agricultural Engineering 525.)

530 Stormwater Modeling (3) Systems approach to stormwater modeling. Hydrologic components, linear and non-linear systems integrated into mathematical model of watershed response. Review and application of commonly used deterministic and parametric computer models. Prerequisite: Civil Engineering 365.

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

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

541 Remote Sensing Data Acquisition and Analysis (3) Active and passive sensors; automated analog and digital techniques and interpretation of data; enhancement and classification techniques for color and thermal imagery; applications to environmental policy and stress assessment. Prerequisite: Consent of instructor.

543 Instrumentation and Measurement (3) (Same as Agricultural Engineering 545.)

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

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

552 Biological Treatment Theory (3) Theory and design aspects of biological wastewater treatment. Prerequisite: Civil Engineering 380, 3 hrs and 1 lab. (Same as Agricultural Engineering 552.)

553 Aquatic Chemistry (3) Theoretical, applied and analytical chemistry related to surface water, contamination and treatment of environmental contaminants. Prerequisite: Chemistry 130, 2 hrs and 1 lab.

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

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

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

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

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

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

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

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

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

596 Special Topics in Civil Engineering (1-4) Selected advanced problems of current interest. Prerequisite: Consent of instructor. May be repeated.

596 Special Topics in Civil Engineering (1-4) Selected advanced problems of current interest. May be repeated. Maximum 6 hrs. S/NC only.

620 Advanced Surface Water Hydraulics (3) Advanced topics in surface water hydraulics; solutions in St. Venant equations of unsteady flow for complex channel situations; dam break modeling. Prerequisite: 520.
435 Medieval Latin (3) Selected readings from Latin prose and poetry of medieval Europe. Prereq: Consent of instructor.

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

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

462 Roman Law (3) Development of Roman law through examination of cases from 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 9 hrs. Letter grade or S/NC.

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

COMMUNICATIONS

MAJOR DEGREES

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

The College of Communications offers the Master of Science and the Doctor of Philosophy degrees with a major in Communications.

For application forms and other information about the M.S. and Ph.D. programs in Communications, write to: Associate Dean for Graduate Studies, College of Communications, 426 Communications Building, The University of Tennessee, Knoxville, TN 37996-0947.

ADMISSION REQUIREMENTS

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

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

A baccalaureate degree in communications or a related field is recommended. Admission is possible with other baccalaureate degrees. However, all applicants without the appropriate background are required to take up to 18 semester hours of prerequisite and corequisite courses as determined by the department in which the student is enrolled. Students may take a proficiency test on any prerequisite course, subject to review by the Master’s or Doctoral Committee of the College of Communications.

Students who have had no courses in their major area of concentration may expect to spend four or more full-time semesters in the program, including a media internship.

ACADEMIC COMMON MARKET

An agreement between the 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, Kentucky (concentration in advertising only), Louisiana, and Mississippi. The Ph.D. program is available to residents of the states of Alabama, Arkansas, Louisiana, Maryland, South Carolina, Virginia, or West Virginia. Additional information may be obtained from the Office of Graduate Admissions and Records.

ACADEMIC STANDARDS

A student in the College of Communications whose grade-point average, not including incomplete grades, is below 3.0 or at any time after the end of 12 hours of graduate credit will be placed on probation. A student on probation will not be allowed to register for additional courses before 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 major in Communications is intended for students who desire a career in the mass media with an emphasis on communications management and a deeper understanding of the communication process and social role of the mass media. The program follows a broad-based multi-media approach while allowing the student to concentrate in one or all four fields: advertising, broadcasting, journalism, or public relations. Both thesis and non-thesis options are available.

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

Degree Requirements

The M.S. program emphasizes communications management in the areas of advertising, broadcasting, journalism, or public relations. For the thesis option, a minimum of 31 hours of approved graduate work...
Communications

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 Studies for the College.

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

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

4. Six hours of thesis work (Communications 550), including a thesis seminar, or a 3-hour project (Communications 590).

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

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

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

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

THE DOCTORAL PROGRAM

The Ph.D. 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 candidate 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 doctoral. Personal interviews with two of the Ph.D. Admissions Committee members are recommended and may be required. Professional experience in some field of communications is a highly desirable criterion for admission.

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

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

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

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

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

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

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

GRADUATE COURSES

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

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

512 Fundamentals of Media Research (3) Applications of research techniques for management, evaluation, and decision-making. Data analysis, hypotheses testing, and research design. Prereq: Consent of instructor or admission to program. S/NP only. F

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

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

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

551 Seminar in Science, Society, and the Mass Media (3) Examinations of the role of media in society. Public relations of science, science in the mass media, mass media and science. Specialized seminars in American history, high technology, media economics, and other areas. Prereq: Consent of instructor. S/P

552 Seminar in Health Communications (3) Methods, problems, and issues of health communication. Medical communication. Public relations of health. Health communication. Prereq: Consent of instructor. S/P

553 Seminar in Risk Communications (3) Interaction of communications, economists, and public on scientific, technologic, and medical risks; analysis of methods for enhancing public understanding. Prereq: Consent of instructor. S/P

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

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

593 Seminar in Mass Media Issues (3) Contemporary topics in communications. Prereq: Consent of instructor. S/P only. E

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

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

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

612 Fundamentals of Communications Research (3) Overview of research process from defining ideas and problems to reporting results. Causal inference and relative strengths of research designs. Fundamental and specific applications of research design. Gathering and measurement techniques in communication research: experimental, survey, content analysis, historical content analysis, qualitative. Prereq: Consent of instructor or admission to program. S/P

620 Seminar in Mass Communications Education (3) Role and scope of mass communications teaching unit, historical perspectives of curricular trends, Teaching methods and instructional objectives, curriculum and teaching and measurement tools. Prerequisites: Consent of instructor or admission to program. S/P

622 Quantitative Research (3) Techniques for evaluation of mass communications research and design. Survey, content analysis, and experimental techniques. Assessment of reliability and validity. Data analysis, hypotheses testing, and statistical methods. Prereq: Consent of instructor. S/P

632 Mass Communications History and Historiography (3) Origins and development of mass media in America. Philosophies of history. Historical sources of mass media and their evaluation. Consolidating information and data analysis. Prereq: Consent of instructor. S/P

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

641 Mass Communications Theory II (3) Research hypotheses in theory, critical evaluation of theoretical arguments, derivation of theoretical perspectives, and advanced theory construction. Prereq: Consent of instructor. S/P
Comparative and Experimental Medicine

(Office of the Vice Chancellor for Academic Affairs)

**DEGREES**

**MAJOR**

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

L. N. D. Potgieter, Director

Joint Graduate Coordinating Committee:

Fuhr, J. E., Ph.D., Medical Biology
Lawler, J. E., Ph.D., Psychology
Loozio, 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 jointly-administered graduate program intended to prepare students for teaching and/or research careers in the health sciences. This program emphasizes the comparative approach to the study of pathology, immunopathology, hematology, infectious diseases, aberrant metabolism, oncology, and genetic disorders. The Ph.D. program is open to approved graduate students seeking training in this area and is especially useful for individuals with professional degrees.

For the student with undergraduate biological sciences background, the Comparative and Experimental Medicine program provides an unusual opportunity to study disease processes common in humans and animals from a multidisciplinary perspective. The scope of this intercollege program, which pools faculty resources from both veterinary and human medicine, is broadened by faculty members representing animal science and numerous areas of the life sciences. The interdisciplinary training environment includes such diverse support as facilities and personnel at the Veterinary Teaching Hospital, the Oak Ridge National Laboratory, Knoxville Zoological Park, Hemophilia Clinic, Developmental and Genetic Center, Pharmacokinetics Laboratory, Clinical Parasitology, Inflammation Research Laboratory, Hematology and Oncology services, and departments of life sciences.

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

**ADMISSION REQUIREMENTS**

**General Requirements**

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

**Requirements for Admission to the Master of Science Degree Program**

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

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

**Requirements for Admission to the Doctor of Philosophy Program**

Applicants generally will be expected to have a Master's degree in one of the biological sciences 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 enrolled in the Comparative and Experimental Medicine graduate program but will be listed officially as veterinary students. Such students may take advantage of enrolling in graduate courses during summers and as elective courses in the veterinary program.

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

**ACADEMIC COMMON MARKET**

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

**Computer Science**

(College of Liberal Arts)

**DEGREES**

**MAJOR**

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

Jesse H. Poore, Head

Professors:

Dongarra, Jack, Ph.D. ....................... New Mexico
Langston, Michael A., Ph.D. ................... Texas A&M
Pooe, J. H., Ph.D. ............................. Georgia Tech
Sherman, Gordon R., Emeritus, Ph.D. ...... Purdue
Thomson, Michael G., Ph.D. ............... Duke

Associate Professor:

MacLennan, Bruce J., Ph.D. ............... Purdue

Assistant Professors:

Beck, Michal, Ph.D. .......................... Cornell
Berry, Michael W., Ph.D. ....................... Illinois
Gregor, Jens, Ph.D. ............................. Aalborg (Denmark)
Jones, Mark, Ph.D. ............................. Duke
Plank, James S., Ph.D. .......................... Princeton
Straight, David W., Ph.D. ....................... Texas
Vander Zanden, Bradley, Ph.D. ............. Cornell
Vose, Michael D., Ph.D. ...................... Texas

Instructor:

Mayo, J. Wallace (Liaison), M.S. .......... Tennessee

**THE MASTER'S PROGRAM**

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

Computer Science 530, 560 and 580 are required for the degree. Graduate courses taken outside the department are sometimes allowed but must be approved by the Graduate Committee before enrollment.

**Thesis Option**

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

**Non-Thesis Option**

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

**Master's Minor in Computer Science**

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

**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
523 Machine Learning (3) Algorithms whereby com-
erators exhibit aspects of learning or inference about their
environment. Supervised and unsupervised methods; data-
driven pattern analysis; explicit and implicit struc-
ture. 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.

530 Computer Systems Organization (3) Architec-
tures and systems organization for serial and parallel
machines. Prereq: Discrete Structures and System
Programming.

532 Boolean Algebra, Logic Design and Micro-
processors (3) Boolean algebra. Combinational
and sequential logic design. Microprocessors. Hardware lab.
Prereq: One year of college mathematics beyond algebra and
trigonometry.

536 Theoretical Aspects of Computer-Aided Design
(3) Algorithms for CAD of VLSI systems. Placement and
routing algorithms; programmable logic arrays. Prereq:
Discrete structures and analysis of algorithms.

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

541 Database Management Systems (3) Data model
theory, optimization, and normalization; intelligent data-
bases systems; comparison of implementations; analysis
of distributed and networked databases. Techniques for
performance of evaluation, integrity, security and reliabil-
ity. Prereq: Discrete structures.

551 Pattern Analysis (3) Decision-theoretic and struc-
tural pattern analysis. Deterministic and statistical deci-
sion rules, feature extraction and representation; syntac-
tic 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.

560 Language Design and Implementation (3) Com-
pliers: lexical analysis, parsing, code generation and
optimization, and run-time storage administration. Lan-
guage design issues: description, structure, and design
philosophies of high-level languages. Prereq: System
Programming.

563 Operating Systems (3) Operating system design,
alternative strategies for memory use, and processor
allocation and management. Protection, time sharing,
real-time systems. Memory management, dispatchers,
interrupts. Design project. Prereq: System Program-
ing.

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

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

574 Finite Element Methods (3) (Same as Mathemat-
ics 574.)

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

576 Sparse Matrix Computations (3) Solution of large
sparse linear systems: graph models, reordering tech-
niques, symbolic factorization, data structures, numeri-
cal algorithms, complexity analyses, parallel algorithms.
Prereq: Numerical linear algebra.

580 Foundations (3) Finite automata and regular sets,
push-down automata and context-free languages, Tur-
ing Machines, recursively enumerable sets, undecidable,
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 algo-
rithms, pattern matching, dynamic programming, effi-
cient approximation algorithms.

586 Computability and Computational Complexity
(3) Computation by abstract devices, recursively enu-
merable sets, decidability, completeness, poly-
nomial-time hierarchy. Prereq: 580.

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

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

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

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

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

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

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

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

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

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

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

Curriculum and Instruction
(College of Education)

MAJOR

DEGREES

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

J. Estill Alexander, Head

Professors:

Alexander, J. Estill, (Liaison), Ed.D. ..., Kentucky
Allison, C. B., Ph.D. .................................. Oklahoma
Bellon, Jerry L., Ed.D. ................................... California
Blank, K. M., Ph.D. ..................................... Ohio State
Butefish, William L., Ed.D. ................................ Texas Tech
Christensen, Mark A., Ph.D. .......................... Kansas
Davis, A. R., Ph.D. ..................................... Ohio State
Dessart, Donald J., Ph.D. ............................... Maryland
Doeck, E. Dale, Ed.D. ................................... Colorado
Frandsen, Henry, Ph.D. ............................... Illinois
French, R. L., Ph.D. .................................... Ohio State
Hippke, Theodore W., Ph.D. ........................... Illinois
Howard, Robert (Emeritus), Ph.D. .............. Ohio State
Huff, P., Ph.D. ......................................... Ohio State
Hull, H. N., Ed.S ..................................... Peabody
Jost, Karl J., Ed.D. ...................................... Oklahoma
Knight, Lester N., Ph.D. ............................... Texas
Malik, Anand, Ed.D. ................................... Columbus
Mays, N., Ph.D. ....................................... Southern Illinois
McLytro, Lonnie D., Ed.D. ........................... Florida
Myer, M. E., Ph.D. .................................... Florida
Ray, John R., Ed.D. .................................... Tennessee
Rosinski, C. E., Ph.D. ................................. Penn State
Rowell, C. Glennon, Ed.D. ........................... George Peabody
Sawson, Wilber S. (Emeritus), Ed.D. ......... Virginia
Turner, T. N., Ed.D. .................................. Wayne State

Wilsey, Patricia D., Ed.D. ............................ Houston
Wisniewski, Richard, Ed.D. ........................ Wayne State
Associate Professors:

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

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

THE MASTER'S PROGRAM

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

Track 1 - Concentrations are available in art education, curriculum, elementary education, English education, foreign language education, instructional media and technology, mathematics education, reading education, science education, social foundations, and social science education. The non-thesis option requires the completion of 33 hours of coursework. The thesis option requires the completion of 30 hours, including 5 hours of Thesis 500.

Specific requirements for the concentration in art education are: For the thesis option, Art Education 510, 520, and 593; 3 hours of 500-level elective courses in art history; 3 hours of C & 1511, 520, 3 hours selected from C & 1511, 528, 524, 543, 544, 535, 558, 569, and 588 and 6 hours of Art Education 500. The non-thesis option requires Art Education 510, 520, 593 and 590; 3 hours of 500-level elective courses in art history; 6 hours of 400- or 500-level elective courses in studio art; C & 1517, 580; 3 hours selected from C & 1511, 526, 542, 543, 544 and 543 and 3 hours selected from 535, 558, 559 or 588. The non-thesis option includes an examination of original works of art produced under the direction of an art education faculty, accompanied by a written analytical and critical essay. This essay must include a philosophical statement, an explanation of process and media for each work presented, and a compositional analysis of each work.

Track 2 - Concentrations are available in art education, elementary teaching and in secondary teaching. For art education, the non-thesis requirements are Art Education 510, 520, 530, and 540; Education 574, 575, 591; C & 1517 and 3 hours selected from C & 1511, 526, 542, 543, 544, 535, 558, 569 or 588 for a total of 36 semester hours. For elementary or secondary teaching, the non-thesis requirements are Education 574 and 591, 6 hours; internship, 12 hours; specialty methods, 6 hours; and 12 hours of electives as approved by the student's committee, for a total of 36 hours.

The thesis option for all concentrations requires 8 additional hours of Thesis 500 for a total of 42 hours.

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

THE SPECIALIST PROGRAM

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

THE DOCTORAL PROGRAM

The Ed.D. program in Curriculum and Instruction may include concentration upon the following fields: educational administration, educational research, elementary education, English education, foreign language education, mathematics education, reading education, science education, social science education. The Doctor of Philosophy with a major in Education includes concentrations and specializations as listed under Education.

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

ACADEMIC COMMON MARKET

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

Art Education

GRADUATE COURSES

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

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

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

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

530 Production and Critical Analysis of Art (3) Relationship of production and critical analysis of works of art to discipline-based art education. Prereq: Admission to Teacher Education Program.

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

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

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

Curriculum and Instruction

GRADUATE COURSES

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

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

422 Elementary and Middle School Teaching Methods (1-6) Methods and materials (knowledge base) for teaching reading, language arts, mathematics, science and social studies. Content and curricula overview. Unit planning, daily planning, evaluation, etc., and language and concept development.

429 Language Arts/Reading Instruction in Elementary and Middle Schools (3) Language and language development as applied to teaching of oracy (listening-speaking) and aspects of literacy (reading-process/reading and writing). Not open to students with recent course in language arts methods. Prereq: Admission to teacher education.

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

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

443 Elementary and Middle School Mathematics Instruction (3) Procedures for helping children learn mathematics. Unit planning, daily planning, grouping, general factors related to classroom management. Not open to students with recent course in teaching of elementary school mathematics. Cannot apply toward 3-5 degree. Prereq: Admission to teacher education.


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

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

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

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

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

5P
461 Developing Reading Skills in Content Fields (3) Techniques for teaching reading and study skills in content areas of school program. Extensive assessment of textbooks. Middle school and high school. E

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

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

486 Introduction to Instructional Computing (3) Classroom uses of computers, applications for teachers, overview of software and hardware for all grades of all ages. F, Sp.


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

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


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

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


515 Seminar (1-3) Curriculum, instructional technology, elementary education, development of curriculum frameworks as related to goals of student's programs. May be repeated. Maximum 6 hrs. S/NC only. E

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

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

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

519 Educational Specialist Research and Thesis (2) P/NP only. E

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

521 Teaching Social Studies in Elementary and Middle Schools (3) Planning and techniques. Trends in curriculum, development, and generalization of integration of social sciences. Prereq: Course in teaching of social studies or consent of instructor. Sp.

522 Teaching Mathematics in Elementary and Middle Schools (3) Instructional strategies for improving elementary school children's learning mathematics. Examination, development and use of materials for creating active learning environment. Prereq: 443 or equivalent or consent of instructor. F, Su.

523 Diagnosis and Correction of Children's Difficulties in Learning Mathematics (3) Children's difficulties in learning mathematics and procedures for helped classroom teacher correct difficulties. Prereq: 522 or equivalent teaching experience or consent of instructor. F, Su.


525 Strategies, Programs, and Materials for Teaching Elementary Social Studies (3) Analysis of new and innovative social studies program materials and methods. Prereq: Consent of instructor. F.


527 Elementary School Curriculum (3) Examination, evaluation and application of curriculum designs in elementary school. Trends and issues which affect elementary education. Prereq: Consent of instructor. F, Su.

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

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

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

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

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

533 Reading in Middle and Secondary Schools: Research and Theory (3) Analysis of components of effective middle and secondary school reading programs. Attention to research and theoretical bases. Prereq: May be repeated. F, Su.

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

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

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

537 Diagnosis and Correction of Classroom Reading Problems (3) Theories and practical applications of specific reading diagnostic instruments; testing of elementary and/or secondary school students, preparing case study reports, and conducting conferences. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp.

538 Practicum in Diagnosis of Reading Problems (2) Application of learning and teaching methodology in working with elementary and/or secondary school students on one-to-one or small group basis. Prereq: Course in diagnosis and correction of classroom reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp.

539 Practicum in Field Education of Student Teachers (2) Application of learning and teaching methodology in working with elementary and/or secondary school students on one-to-one or small group basis. Prereq: Course in diagnosing and correction of classroom reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Sp.

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

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

542 Development of Educational Thought (3) Historical and philosophical approach to lives and writing of influential figures. Prereq: Consent of instructor. F.

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

544 Survey in Contemporary Philosophies of Education (3) Critical examination of major contemporary educational thought and its philosophical, social, and political implications. Prereq: Consent of instructor. E

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

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

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

548 Topics in International Education (3) Historical, philosophical, social, and political implications of the most influential cultures of local, national, and international significance. E

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

552 Developmental Reading Practicum (2) Diagnosis and teaching children having developmental and corrective reading needs. Prereq: Course in diagnosis and correction of reading problems or consent of instructor. May be repeated. Maximum 4 hrs. Su.

557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Prereq: Course in instructional design and implementation. Prereq: Consent of instructor. Maximum 4 hrs. E

559 Topics in International Education (3) May be repeated. F, Su.

560 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research projects. Overview of qualitative research methods: ethnography, case study, historiography, biography, oral and life history. Prereq: Consent of instructor. F.

561 Educational Statistics (3) Applications of descriptive and inferential statistics to educational and instructional problems. Use of computerized calculators in educational research. Prereq: One year of college mathematics, or satisfactory performance in statistics course, or consent of instructor. F, Su.

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

564 Curriculum for Early Childhood Education (K-3) (3) Theoretical foundations and current research in content and skill areas of curriculum for kindergarten-grade
Experiences in application of principles and practices of curriculum development and instructional improvement. Prereq: Program prerequisites and consent of Instructor. May be repeated. Max. 9 hrs. S/NC only. E

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

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

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

Research Trends in Science Education (3) Analysis of current research trends in science education and relationship of such trends within broader educational community. Prereq: 628.

Cooper, Lee, Ph.D., ORNL
Burghardt, G.M., Ph.D., Psychology
Bunting, Dewey L. (Liaison), Ph.D., Zoology
Amundsen, C.C., Ph.D., Botany
Dimmick, Ralph W., Ph.D., Forestry, Wildlife & Fisheries
Delcourt, Paul A., Ph.D., Geology
Delcourt, Hazel, Ph.D., Geology
Dewey L. Bunting, Director
Dewey L. Bunting, Director
Ecology ........................................... M.S., Ph.D.
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Economics

College of Business Administration

MAJORS

DEGREES

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

William F. Fox, Head

Professors:

Bohm, Robert A. (Liaison), Ph.D. .... Washington (St. Louis)
Bowlby, Roger L., Ph.D. ................. Texas
Carroll, Sidney L., Ph.D. ............... Harvard
Chang, Hui 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
Felker, George R. (Emeritus), Ph.D. .............................. Ohio State
Garrison, Charles B., Ph.D. .......... Kentucky
Herzog, Henry W., Ph.D. .............. Maryland
Jensen, Hans E. (Emeritus), Ph.D. ..... Texas
Lee, Feng-Yao, Ph.D. ................... Michigan State
Mayhew, Anne, Ph.D. .......... Texas
Moore, John R. (Distinguished Prof.) (Emeritus), Ph.D. .......... Cornell
Neale, Walter C. (Emeritus), Ph.D. .... London

Quindry, K. E. (Emeritus), Ph.D. .......... Kentucky
Russell, Milton, Ph.D. ................. Oklahoma
Schiottman, Alan M., Ph.D. ........ Washington (St. Louis)
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
Mandy, David M., Ph.D. .......... Illinois
Mayo, John W., Ph.D. ............... Washington (St. Louis)
Murray, M. N., Ph.D. ............... Syracuse
Phillips, Keith E., Ph.D. .............. Washington

Assistant Professors:

Curry, Amy F., Ph.D. .............. Duke
Rubin, Jonathan D., Ph.D. ........ California (Davis)

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 offers an opportunity to specialize in 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 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 student. The program is designed to give Master's level 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 seniors from the following participating departments: Agricultural Economics and Rural Sociology; Civil and Environmental Engineering; 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 Master's discipline and one course in quantitative methods are required. These requirements must 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 Geography 422. 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

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

MBA CONCENTRATION

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

GRADUATE COURSES

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

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

415 History of Economics (3) Methods of study of historical 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 or equivalent and consent of instructor.

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

435 Industrial Organization Analysis (3) Monopoly and competition in United States economy. Major writing requirement. Prereq: Intermediate Macroeconomics or consent of instructor.

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


472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual and corporate income taxes, social welfare, and state and local taxes. Major writing requirement. Prereq: 201.

482 Introduction to Mathematical Economics (3) Application of basic mathematical tools: calculus, matrix algebra, etc. to major topics in 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 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/NC only. E

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

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

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


525 Economic History of Europe (3) Nature and 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.

573 Managing in a Regulated Economy (3) Economic effects of prudential, regulatory and public utility and environmental regulation on business. Development of decision-making skills in area 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.


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

612 Advanced Microeconomic Theory (3) Prereq: 512 or equivalent.

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: Undergraduate degree in economics or consent of instructor.

624 Economic Development: Western Impact on Asia and Africa (3) Study of consequences of contact between developed world and developing countries of Asia and Africa. Prereq: 21 hrs of upper division undergraduate social science or consent of instructor.


642 Labor History and Legislation (3) Organization of labor as important part of economic and political force in U.S. From Colonial times to present. Evolution of legal status of labor unions and of individual workers as they employ them.

651 Monetary Theory (3) Study of money, credit, and approaches to current policy determination, interest rates, employment, and prices. Prereq: 513.

652 Topics in Monetary Theory (3) Advanced monetary models, issues in monetary theory and policy. Student participation. Prereq: 513.

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 economic structure and growth. Regional income and land 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 externalities 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, approaches to simultaneous equation models with application to current economic research. Prereq: 582 or equivalent.

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

Education

(Graduate of Education)

MAJOR

DEGREE

Education

Curriculum and Instruction.................M.S.
Education

Human Performance and Sport Studies....M.S.
Education

Special Education.........................M.S.
Education

Technological and Adult Education.....M.S.
The College of Education offers an extended teacher-preparation program which features a professional year internship with accompanying coursework and an intercollegiate doctoral program.

**TEACHER LICENSURE AND THE MASTER’S PROGRAM**

For teacher licensure and a Master’s degree in one of the available majors offered in the College, a student must complete the 24 hours associated with the professional year and 12 more credits for the total of 36 semester hours. Course requirements for an M.S. program include:

<table>
<thead>
<tr>
<th>Fall Semester</th>
<th>Spring Semester</th>
<th>Post Internship</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internship</td>
<td>4 hrs</td>
<td>Internship</td>
<td>8 hrs</td>
</tr>
<tr>
<td>Specialty Studies</td>
<td>6 hrs</td>
<td>Clinical Studies</td>
<td>4 hrs</td>
</tr>
<tr>
<td>Analysis of Teaching for Professional Development</td>
<td>2 hrs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prior to the first semester of internship, a student must be admitted to The Graduate School and register as a graduate student to receive graduate credit. Prior to the completion of the first semester of internship, a student must be admitted to a Master’s program within the College of Education in which the degree is to be pursued. See the individual program descriptions for complete details.

**THE DOCTORAL PROGRAM**

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

The program requirements, concentrations and specializations are:

**Requirements**

- **Research Area**
  - Minimum Hours: 14
- **Foreign or Computer Language**
  - (Demonstrate proficiency)
  - Minimum Hours: 6
- **General Core Requirements**
  - History and philosophy of education, (both areas must be represented)
  - Minimum Hours: 4
  - Theory and curriculum (both areas must be represented)
  - Minimum Hours: 4
  - Administrative theory
  - Minimum Hours: 2
  - Trans-college seminar: three consecutive semesters (including summer)
  - Minimum Hours: 3
- **Alternative Core Requirements**
  - Courses in philosophy of science
  - Minimum Hours: 3
  - Trans-college Seminar: three consecutive semesters (including summer)
  - Minimum Hours: 3
  - Seminar in area of specialization
  - Minimum Hours: 3
  - Courses in learning theory/group or independent study
  - Minimum Hours: 3

**Concentrations**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Minimum Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Studies</td>
<td>4 hrs</td>
</tr>
<tr>
<td>Educational and Counseling Psychology</td>
<td>6 hrs</td>
</tr>
<tr>
<td>Educational Leadership</td>
<td>3 hrs</td>
</tr>
<tr>
<td>Educational Policy and Leadership</td>
<td>3 hrs</td>
</tr>
<tr>
<td>Human Performance and Sport Studies</td>
<td>4 hrs</td>
</tr>
<tr>
<td>Special Services Education</td>
<td>2 hrs</td>
</tr>
<tr>
<td>Technological and Adult Education</td>
<td>2 hrs</td>
</tr>
</tbody>
</table>

**Dissertation**

- Minimum Hours: 24

**CONCENTRATIONS**

**Administrative Theory and Practice**

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

**Theories of Curriculum Development and Foundations of Education**

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

**Instructional Theory and Practice**

- Specializations:
  1. Principles and models for instructional improvement
  2. Elementary and early childhood instruction and 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. Technological and adult education
  8. Special education and rehabilitation

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

- Specializations:
  1. Counselor education
  2. Counseling psychology
  3. Educational psychology
  4. School psychology

**Foundations of Human Movement**

- Specializations:
  1. Exercise Science: Adapted Physical Education
  2. Motor Behavior: Motor Control
  3. Socio-Cultural Foundations of Sport: History

**Health Education**

- Specializations:
  1. Public health
  2. Safety

**ACADEMIC COMMON MARKET**

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Education is available to residents of the states of Arkansas (concentration in administrative theory and practice only), South Carolina (concentration in theories and practice of educational and personal adjustment only) and Virginia (concentration in health education only). Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

See College of Education for additional departmental listings.

**GRADUATE COURSES**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>574</td>
<td>Analysis of Teaching for Professional Development</td>
<td>6</td>
</tr>
<tr>
<td>574</td>
<td>Professional Internship in Teaching (1-8)</td>
<td>12</td>
</tr>
<tr>
<td>591</td>
<td>Clinical Studies</td>
<td>4</td>
</tr>
<tr>
<td>592</td>
<td>Trans-College Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

**EDUCATIONAL AND COUNSELING PSYCHOLOGY**

**MAJORS**

- Guidance .................. M.S.
- Educational Psychology ....... M.S., Ed.D
- Educational Psychology and Guidance .... Ed.S.
- Education ........................ Ph.D.

R. Steve McCallum, Head

Professors:

- Davis, K. L., Ed.D .................. Georgia
- DeRidder, Lawrence M. (Emeritus), Ph.D .......................... Michigan
- Dickinson, Donald J., Ed.D .... Oklahoma State
- Dietz, Siegfried C. (Emeritus), Ed.D .......................... Arizona State
- Hector, M. A., Ph.D .......................... Michigan State
- Huck, Schuyler W., Ph.D ............ Northwestern
- McClain, R. S. (Liaison), Ph.D .... Georgia
- McClain, Ed. W. (Emeritus), Ph.D........ Texas
supervised practicum and internship experience counseling and guidance each require recommendation. All programs include thesis and non-thesis options. The program in school psychology requires a minimum of 66 hours. When students are admitted to the Ed.S. programs in educational psychology or school counseling, it is assumed that they have completed a Master's degree equivalent to the one offered at UT Knoxville. In this case, the minimum hours beyond the Master's required to complete the Ed.S. are: educational psychology, 24; school counseling, 22. The specialist programs require supervised practicum and internship experiences with students or clients, either in the public schools or in community human services agencies. A final examination is required of all specialist students.

THE DOCTORAL PROGRAMS

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education. For students applying to the Ph.D. program concentration located in this department, two applications are required: one for the Ph.D. in Education program and one for the department that specifies which specialization is desired (i.e., counseling psychology, counselor education, educational psychology, or school psychology). Applicants for the Ed.D. with a concentration in either counselor education or educational psychology fill out only the departmental application form.

Departmental admissions requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. Hour requirements for a major in Educational Psychology, concentration in educational psychology, 36; concentration in community counseling, 60; and for a major in Guidance, 48. The programs in community counseling and in guidance each require supervised practicum and internship experi-

ences working with clients. A final examination is required of all Master's degree students.

THE EDUCATIONAL SPECIALIST PROGRAM

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

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Departmental admissions requirements include up-to-date scores from the GRE, the departmental admissions application form, letters of recommendation, and a writing sample. The following minimum number of hours is required in each program concentration/specialization: counseling psychology, 96; counselor education, Ph.D., 96, Ed.D., 79; educational psychology, Ph.D., 92, Ed.D., 99; school psychology, Ph.D., 97, Ed.D., 99. The Ph.D. programs are three consecutive semesters of full-time coursework and two consecutive semesters for the Ed.D. The Ph.D. program requires coursework in both a supporting specialization and a cognate area, as well as either foreign language or computer proficiency. Coursework in statistics and research design is a requirement in all doctoral programs. Pre-dissertation research participation is a requirement in the Ph.D. program. The concentrations/specializations in counseling psychology, counselor education, and school psychology each require a year-long practicum sequence and the equivalent of a year's full-time work as an intern in an appropriate counseling setting. The concentrations/specializations in educational psychology and counselor education also require supervised practical experience in classroom teaching. 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.

THE MASTER'S PROGRAMS

Admission requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. Hour requirements for a major in Educational Psychology, concentration in educational psychology, 36; concentration in community counseling, 60; and for a major in Guidance, 48. The programs in community counseling and in guidance each require supervised practicum and internship experi-

ences working with clients. A final examination is required of all Master's degree students.

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

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Admission requirements include up-to-date scores from the GRE, the departmental admissions application form and letters of recommendation. All programs include thesis and non-thesis options. Hour requirements for a major in Educational Psychology, concentration in educational psychology, 36; concentration in community counseling, 60; and for a major in Guidance, 48. The programs in community counseling and in guidance each require supervised practicum and internship experi-

ences working with clients. A final examination is required of all Master's degree students.
556 Internship in Community Agency Counseling (1-6) Supervised postpracticum employment at departmentally approved human services agency. Prereq: Admission to community agency program, 555 and consent of instructor. May be repeated. Maximum 12 hrs. S/C only. E

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

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

565 Approaches to Family Intervention and Counseling (3) (Same as Child and Family Studies 565).

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, Nursing 585, Human Performance and Sport Studies 585, Public Health 585, Psychology 585, Social Work 585, and Sociology 585.)

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


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

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

606 Advanced Seminar in Curriculum and Learning (4) (Same as Curriculum & Instruction 609.)

625 Advanced Study in Personality (3) Studies of personality and group counseling. Prereq: 431 or equivalent. F

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

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

560 Internship 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/C only. F

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


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

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

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

674 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 15 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/C only. E

679 Internship in Counseling Psychology (1-6) Supervised employment in departmentally approved counseling psychology internship sites. Prereq: Admission to counseling psychology doctoral program and consent of instructor. May be repeated. Maximum 12 hrs. S/C only. E

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

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

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

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


691 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

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

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694 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 15 clock hrs required each semester. Prereq: Admission to counseling psychology doctoral program, 555, and consent of instructor. May be repeated. Maximum 6 hrs. E

697 Theory and Practice of Counseling Supervision (3) Theory and practice of supervision in counseling. Prereq: 655, or 674, or consent of instructor. S/C only. E

698 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/C only. E

699 Independent Study (1-15) Independent investigation of problems in educational and counseling psychology. May be repeated. Maximum 15 hrs. S/C or letter grade. E
Educational Administration and Supervision

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

503 Problems in Lieu of Thesis (3-6) May be repeated. S/NC only. E

513 Administrative and Organizational Theory in Education (3) Introduction to theoretical administrative and organizational foundations of management and leadership, supervision and program administration. Review of current and advanced management literature. E

515 Human Relations and Communication in Administration (3) Development and use of effective interpersonal communication skills and channels, intergroup relations, supportive work climates, personnel motivation, conflict management, skills, and role of values, attitudes, and expectations in administration. F

516 Research for School Administrators (3) Descriptive, experimental, and quasi-experimental designs to help students with quantitative research design. Review of technical literature. Introductory to inferential statistics, needs assessments, and evaluation procedures. Sp, Su

518 Educational Specialist Research and Thesis (3) May be repeated. Maximum 6 hrs. P/NP only. E

529 Politics of Education and Educational Environment (3) Community and institutional relations in political context of modern, complex society. Administrator and supervisory competencies: political, social, cultural, and social environments in which schools operate. Prereq: M.S. introductory core or consent of instructor. F

535 Administrative Applications of Micro Computers (3) DOS, word processing, data based management, spreadsheet, databases, and word processing. Design and development of specific administrative application: scheduling, attendance, student record systems, and accounting. F, Su

544 School Finance and Business Management (3) Principles of building level administration. Financial and logical management of programs and projects in individual school setting. Prereq: M.S. introductory core or consent of instructor. F

547 Educational Facility Planning (3) Concepts and skills for development, evaluation, design, construction, maintenance, and operations of quality educational environments and facilities. Prereq: M.S. introductory core or consent of instructor. Sp, Su

548 Introductory Supervision and Personnel (3) Basic concepts of supervision and administrative personnel competencies, building (or micro-organizational) level; interviewing, personnel planning, collecting and maintaining personnel information, supervision of non-instructional personnel, personnel evaluation and placement. Prereq: Introductory M.S. core or consent of instructor. F

553 Strategies of Educational Planning (3) Processes for improving decision-making function through use of both quantitative and qualitative planning techniques. Policy analysis, CPM, PERT, Delphi. Prereq: Introductory M.S. core or consent of instructor. F

554 School Law (3) Logical arrangement of case and statutory materials for public school administrators and teachers; problems concerning law and public education. Prereq: M.S. introductory core or consent of instructor. Sp

580 Internship in Educational Administration (3) Field experience in appropriate educational setting, working directly with administrator. Placement by department assignment. Some on-campus classes in conjunction with 582 or 583.

EDUCATIONAL ADMINISTRATION AND THE MASTER'S PROGRAM IN

Superintendents, Principals, Community Relations, and Related Areas (3) Community relations in modern educational setting. Teaching techniques, parent-teacher conferences, parent involvement, and related areas of primary interest. Prereq: Consent of instructor. F

581 Internship in Educational Administration (3) Field experience in appropriate educational setting, working directly with administrator. Placement by department assignment. Some on-campus classes in conjunction with 582 or 583.

86 Educational Leadership

Stollar, Dewey H. (Emeritus), Ph.D. ......................... Ohio State
Trusky, Francis M. (Emeritus), Ed.D. .................. Stanford
Ubben, Gerald C., Ph.D. ..................................... Minnesota
Venditti, Fred P. (Emeritus), Ed.D. ...................... Northern Colorado

Associate Professors:

Asker, Jerry W. (Adjunct), Ph.D. ... Ohio State
Connelly, Mary Jane (Liaison), Ed.D. .................. VPI
Gross, Francis M. (Adjunct), Ed.D. ....................... Tennessee
Husen, Peter M., Ed.D. ....................................... Stanford
Mertz, Norma T., Ed.D. ..................................... Columbia

Assistant Professors:

Aper, Jeffrey P., Ph.D. ....................................... VPI
Grubb, James J., M.S. ......................................... Indiana State
High, Katherine N. (Adjunct), Ed.D. .................... Tennessee

Visiting Professor:

Bogue, Grady, Ed.D. .......................................... Memphis State

The Department of Educational Leadership offers graduate programs leading to the Master of Science with majors in Educational Administration and Supervision and in College Student Personnel (higher education). The Specialist in Education, the Doctor of Education with a major in Educational Administration and Supervision, and the Doctor of Philosophy with a major in Education. Specializations may be developed in research, major central office positions, the principalship, and in other educational and social agencies.

The Ed.D. program also offers concentrations in higher education and in educational administration and supervision for practicing administrators. The higher education program combines theory and practice in an innovative demonstration of scholarly study and research. A blend of classroom instruction, individualized advising, and supervised practica and internships allows students to develop a specialization in academic administration, community-college administration, student personnel administration, financial management, and college teaching. The concentration for practicing administrators focuses on K-12 administrators currently in the field.

For additional information, contact the department head.

ADMISSION REQUIREMENTS

General test of the Graduate Record Examination; writing sample if GRE verbal is below 50th percentile; leadership potential judged by activities in organizations; and rating forms or letters of recommendation. The Ed.D. applicant must also interview with all faculty members on campus or elsewhere. Application deadlines are March 15 and October 1.

THE MASTER'S PROGRAM IN EDUCATIONAL ADMINISTRATION AND SUPERVISION

Thesis Option

A minimum of 36 credit hours including 6 hours of Thesis 500 is required. A major consists of a minimum of 18 hours. An internship is highly recommended but not required. A final oral examination is required with a written exam at the option of the committee.

Non-Thesis Option

A minimum of 36 credit hours with a minimum of 18 hours in the major. An internship is highly recommended but not required. A final written comprehensive examination is required with an oral exam at the option of the committee.

Students entering either of these options must complete the introductory core consisting of Educational Administration and Supervision 513, 515, 516, and 535 or a demonstrated computer proficiency. The courses are prerequisites to other courses in the department.

THE MASTER'S PROGRAM IN COLLEGE STU DENT PERSONNEL

This program is designed for individuals interested in entering the field of student personnel administration in colleges and universities and in community or junior colleges. The program has both a thesis and non-thesis option. A minimum of 35 hours, which includes 6 hours of practicum experience, is required in either option.

THE EDUCATIONAL SPECIALIST PROGRAM

Thesis Option

A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 518 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the thesis.

Non-Thesis Option

A minimum of 60 hours beyond the baccalaureate degree including 6 hours of Educational Administration and Supervision 503 is required. Six hours must be in a cognate area within the college and 6 hours outside the college. An internship is highly recommended but not required. A written comprehensive examination is given as well as an oral exam over the problem papers.

THE DOCTORAL PROGRAM

For the Ed.D. program, the minimum hours are determined by the student's doctoral committee. Six to nine hours must be in a cognate area within the college and 6-9 hours outside the college unless the student has a Master's degree in a field outside the College of Education. Two consecutive semesters of 604 must be taken during residence. An internship is highly recommended but not required. A foreign language requirement is at the discretion of the committee. A written comprehensive examination is given as well as an oral exam over the dissertation.

The Department of Educational Leadership also has an Ed.D. program for practicing school administrators. Please contact the department for further information.

The Ph.D. with a major in Education includes concentrations and specializations as listed under Education.

Non-Thesis Option

A minimum of 36 credit hours is required with a minimum of 15 hours in the major. An internship is highly recommended but not required. A final written comprehensive examination is required with an oral exam at the option of the committee.

Students entering either of these options must complete the introductory core consisting of Educational Administration and Supervision 513, 515, 516, and 535 or a demonstrated computer proficiency. The courses are prerequisites to other courses in the department.
644 Educational Finance and Business Management
(3) Contemorary educational finance policies and their influence upon education, nation and citizens. Superintendent team concept, management of school logistical services. Prerequisites: 544 or consent of instructor. F, Su

546 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Prerequisites: 548 or consent of instructor. F, Su

565 State-Federal Relations in Education (3) Interrelationships of national, state, and local responsibilities and organization for education by analysis of traditional legal, fiscal and functional aspects of educational partnerships. Funding partnerships, discussion of grant proposal development processes. F

659 Legal Foundations of Public Education (3) School law; constitutional foundations as they relate to public education at state and local levels. F, Su

658 Conflict Management (3) Social conflict and its management. Causes of interpersonal, intergroup, and organizational conflict, skills and strategies used to manage conflict, conflict management models associated with different sectors of human activity, and current organizational practices for managing destructive conflict. F

670 Values and Ethics in Educational Leadership (3) Examination of moral and ethical dimensions of role of educational administrators. Assistance to current and prospective administrators to deal with dimensions in knowledgeable, reflective and principled ways. (Same as Higher Education 670.)

680 Administration of Complex Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational programs and organizations. Prerequisites: 513 or consent of instructor. Sp

690 Special Topics (1-3) May be repeated. E

693 Independent Study (3) Prerequisites: Consent of supervisory instructor. May be repeated. S/N or letter grade. F, Sp

695 Practicum in Higher Education (1-6) Supervised practicum in selected areas of higher education administration. Prerequisites: Consent of instructor. May be repeated. S/N or letter grade. F

698 Seminar in Higher Education (3) Analysis of administrative and organizational structure, theory and practice in management of American colleges and universities. Prerequisites: 543 or consent of instructor. Su

590 Special Topics (1-3) May be repeated. E

592 Field Problems in Educational Administration and Supervision (3) Topic to be assigned. May be repeated. S/N or letter grade. E

593 Independent Study in Educational Administration (3) Prerequisite: Consent of instructor. May be repeated. E

595 Elementary Principals Seminar (1-3) For in-service training of elementary school administrators. Developments, problems, programs, and trends of elementary schools and management skills of elementary school administrators. Required of elementary school administrator or consent of instructor. May be repeated. S/N or letter grade. F, Sp

596 Middle School Principals Seminar (1-3) For in-service training of middle school administrators. Developments, problems, programs, and trends of middle schools and management skills of middle school administrators. Prerequisite: Presently middle school administrator or consent of instructor. May be repeated. S/N or letter grade. F, Sp

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

604 Seminar in Educational Administration and Supervision (1) Current educational issues, problems and research. Required two consecutive semesters during doctoral residency. May be repeated. S/N only. E

605 Advanced Seminar in Administrative Theory (2) Interdisciplinary seminar. Readings selected by faculty for research and scholarly value from early to current classic theoretical studies and current periodical literature in educational administration. Required of Ph.D. students in Education. Prerequisite: Doctoral student in Education.

610 Internship in Educational Administration (3) Opportunity for doctoral students and advanced graduate students to gain experience in performance of critical tasks of educational administration under supervision of practitioner and University representative. May be repeated at discretion of student's committee. Maximum 12 hrs. S/N or letter grade. E

614 Statistical Methods for School Administrators (3) Descriptive and experimental research methods, parametric and non-parametric statistical techniques used in research in educational settings. F

615 Research Design (3) Statistical methods through multi-variate techniques and applications to research designs. Prerequisites: 614 or consent of instructor. Sp

616 Research Methods (3) Overview of descriptive and experimental research designs: data collection, analysis, and interpretation; survey studies and school surveys. Conduct of survey. Prerequisite: Basic statistics and computer skills or consent of instructor. E

622 Programs for the Professional Preparation of Educational Administrators and Supervisors (3) Exploring designs and methodology for training school administrators at both pre-service and in-service levels. F

628 Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school systems and higher educational institutions. Interdisciplinary discussions of community power structures and special interest groups, based on literature and research from education, sociology, and political science. Field inquiry. Prerequisites: 526, 518 or equivalent or consent of instructor. F

681 Research Design (3) Statistical methods through multi-variate techniques and applications to research designs. Prerequisites: 614 or consent of instructor. Sp

682 Research Methods (3) Overview of descriptive and experimental research designs: data collection, analysis, and interpretation; survey studies and school surveys. Conduct of survey. Prerequisite: Basic statistics and computer skills or consent of instructor. E

683 Seminar in Politics of Education (3) Political theories and practices as they affect operation of public school systems and higher educational institutions. Interdisciplinary discussions of community power structures and special interest groups, based on literature and research from education, sociology, and political science. Field inquiry. Prerequisites: 526, 518 or equivalent or consent of instructor. F

644 Educational Finance and Business Management (3) Contemorary educational finance policies and their influence upon education, nation and citizens. Superintendent team concept, management of school logistical services. Prerequisites: 544 or consent of instructor. F, Su

546 School Personnel Administration (3) Personnel administration functions for professional and supporting staff in educational organizations. Recruitment, selection, placement, personnel policies, employee wage and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation. Prerequisites: 548 or consent of instructor. F, Su

565 State-Federal Relations in Education (3) Interrelationships of national, state, and local responsibilities and organization for education by analysis of traditional legal, fiscal and functional aspects of educational partnerships. Funding partnerships, discussion of grant proposal development processes. F

659 Legal Foundations of Public Education (3) School law; constitutional foundations as they relate to public education at state and local levels. F, Su

658 Conflict Management (3) Social conflict and its management. Causes of interpersonal, intergroup, and organizational conflict, skills and strategies used to manage conflict, conflict management models associated with different sectors of human activity, and current organizational practices for managing destructive conflict. F

670 Values and Ethics in Educational Leadership (3) Examination of moral and ethical dimensions of role of educational administrators. Assistance to current and prospective administrators to deal with dimensions in knowledgeable, reflective and principled ways. (Same as Higher Education 670.)

680 Administration of Complex Organizations (3) Concepts and theoretical formulations to understand, analyze, evaluate, and change complex educational programs and organizations. Prerequisites: 513 or consent of instructor. Sp

690 Special Topics (1-3) May be repeated. E

693 Independent Study (3) Prerequisites: Consent of supervisory instructor. May be repeated. S/N or letter grade. F, Sp

695 Practicum in Higher Education (1-6) Supervised practicum in selected areas of higher education administration. Prerequisites: Consent of instructor. May be repeated. S/N or letter grade. F

698 Seminar in Higher Education (3) Analysis of administrative and organizational structure, theory and practice in management of American colleges and universities. Prerequisites: 543 or consent of instructor. Su

Electrical and Computer Engineering (College of Engineering)

MAJOR

DEGREES

Electrical Engineering .............................. M.S., Ph.D.

R. C. Gonzalez, Head

Professors:
Alessen, Igor, PE, Ph.D. ......................... Wisconsin
Bale, J. Milton, Ph.D. ........................... Georgia Tech
Birdwell, J. Douglas, Ph.D. ..................... MIT
Bishop, Asa O., Jr., Ph.D. ....................... Clemson
Blalock, T. Vaughn, Ph.D. ....................... Tennessee
Bodenheimer, Robert E., Ph.D. ............... Northwestern
Boise, Bimal K. (Conrad Chair of Excellence), Ph.D. ................................. Calcutta
Bouldin, Donald W., PE, Ph.D. ............... Vanderbilt
Gonzalez, R. C. (Distinguished Prof.), Ph.D. ........................................... Florida
Goode, Joseph M., PE, Ph.D. ................. Georgia Tech
Green, Walter L., Ph.D. ......................... Texas A&M
Hoffman, Graham W., Ph.D. .................. Harvard
Hunt, James C. (Distinguished Prof.), PE, Ph.D. .................................... New York
Kennedy, Eldredge J., PE, Ph.D. .......... Tennessee

student services environment. Applicable administrative the human development theory and evaluation assessment techniques. So

593 Independent Study (3) Prerequisite: Consent of supervisory instructor. May be repeated. S/N or letter grade. E

599 Practicum in College Student Personnel (1-6) Prerequisite: Consent of instructor. May be repeated. S/N only. E

610 Administration and Governance of Higher Education (3) Trends, structure and process of collegiate governance. Development of understanding of administrative theory and practice in higher education. Prerequisite: 543 or consent of instructor. F

530 Special Topics (1-3) May be repeated. E

540 College and University Law (3) Legal precedent affecting organizations, administration, and finance of higher education. Academic freedom, faculty tenure, religion, tort liability, administrative law, academic due process and affirmative action in employment. Sp

645 Curriculum and Instruction in Undergraduate Higher Education (3) Content and organization of institutional structures and curricular structure in higher education. F, Su

550 Fiscal Problems in Higher Education (3) Revenue source, appropriation process, budget procedures, cost analysis, and fiscal management in public and independent colleges and universities. Sp

670 Values and Ethics in Educational Leadership (3) (Same as Educational Administration and Supervision 670.)

693 Independent Study (3) Prerequisite: Consent of supervisory instructor. May be repeated. S/N or letter grade. E

695 Practicum in Higher Education (1-6) Supervised practicum in selected areas of higher education administration. Prerequisite: Consent of instructor. May be repeated. S/N only. E

698 Seminar in Higher Education (3) Analysis of administrative and organizational structure, theory and practice in management of American college and universities. Prerequisites: 543 or consent of instructor, Su

Electrical and Computer Engineering 67
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 approved by the student's Master's committee. The 500-level work in electrical and computer engineering courses must include at least 5 hours in the student's major area.
5. A final oral examination covering the thesis and related coursework.

THE DOCTORAL PROGRAM

The Ph.D. with a major in Electrical Engineering may be pursued in the concentration areas of circuit theory, computer, electromagnetics, communication theory, electromagnetism, plasma engineering, power systems, solid-state electronics, and control systems. Applicants must submit scores on the General Graduate Record Exam. A TOEFL score of 580 is required for non-native speakers of English. Additional requirements for the Ph.D. include the following:

1. A Master of Science or Master of Engineering degree.
2. A minimum of 48 semester hours of course work beyond the B.S. excluding thesis, research, and dissertation credit.
3. A minimum of 24 semester hours of work in electrical and computer engineering courses at the 500 and 600 levels.
4. A minimum of 9 semester hours of 600-level coursework. At least 3 semester hours of this work must be in an area other than the student's major area.
5. A minimum of 12 hours of mathematics courses approved by the Electrical and Computer Engineering Graduate Committee. All 12 hours must be at the 400-level or above, and at least 6 hours must be at the 500-level or above.
6. One foreign language if the student's faculty committee feels that a knowledge of a foreign language is crucial to the student's research efforts.
7. Satisfactory performance on both a qualifying and comprehensive examination. The qualifying examination is prepared by the Electrical and computer engineering faculty and consists of a 3-hour written examination in each of four areas. Areas (1) mathematics and transform methods, and (2) basic electrical network analysis, are required of all Ph.D. students. Areas (3) and (4) are usually chosen from two of the graduate course divisions in the department and cover material from undergraduate courses and first year graduate courses. A student who fails the qualifying examination must take and pass the examination the next time it is offered to remain in the Ph.D. program. The qualifying examination is normally taken after the completion of 24 hours of graduate coursework or immediately after completion of a Master's degree. A minimum of 18 hours of graduate coursework must be completed after the student has taken the qualifying examination the first time.

A comprehensive examination is required by The Graduate School. In this department the comprehensive exam is administered by the student's committee; the exam results are reported to the graduate committee for approval; and the exam is filed in the department. The comprehensive exam is given when the student is ready to apply for admission to candidacy.

The exam consists of both written and oral parts. The written part consists of at least two sections: a complete review of the literature in the student's dissertation topic, and a review of the major tools to be used in the dissertation work. The student's committee may require additional written sections. The student must demonstrate a mastery of the dissertation area, ability to think analytically and creatively, skill in using academic resources, and ability to complete the dissertation satisfactorily.

The oral part consists primarily of a professional presentation of a proposal for dissertation work and its defense. The committee may cover additional topics in the oral part.

5. Participation in departmental seminars.

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 either the M.S. or Ph.D. Programs. No 200-level or below 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-recursive 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
**Engineering Science and Mechanics**  
*(College of Engineering)*

**MAJOR DEGREES**

**Engineering Science** ................. M.S., Ph.D.

T. G. Carley, Acting Head

**Professors:**

Antar, B. (UTSI), Ph.D. ..................... Texas
Baker, A. J., PE, Ph.D. ..................... New York
Carley, T. G. (Liaison), PE, Ph.D. ....... Illinois
Forrester, J. H., PE, Ph.D. ................. Iowa State
Jendrucko, R. J., PE, Ph.D. ............... Virginia
Keefe, D. R. (UTSI), Ph.D. ................. Florida
Kim, K. H., Ph.D. ......................... NC State
Krieg, R. D., Ph.D. ........................ New Mexico
Landes, J. D., PE, Ph.D. .................... Lehigh
Lee, C. W. (Emeritus), Ph.D. .............. Illinois IT
McCay, M. H. (UTSI), PE, Ph.D. .......... Florida
McCay, T. D. (UTSI), PE, Ph.D. .......... Auburn
Pih, H. (Emeritus), PE, Ph.D. ............. Illinois IT
Remenyik, C. J. (Emeritus), Ph.D. ........ Johns Hopkins
Scott, W. E., Ph.D. ........................ Johns Hopkins
Shahroki, F. (UTSI), Ph.D. ............... Oklahoma
Shobe, L. R. (Emeritus), PE, M.S. .......... Kansas State
Snyder, W. T., Ph.D. ....................... Northwestern
Sollman, O., PE, Ph.D. ..................... Tennessee
Stoneking, J. E., PE, Ph.D. ............... Illinois
Wasserman, J., PE, Ph.D. ................. Cincinnati
Weitsman, Y. J., Ph.D. .................... Rensselaer

**Research Professors:**

Fan, J., Ph.D. ............................... Cincinnati
Morarly, T. F., PE, Ph.D. ................. Illinois

**Associate Professors:**

Boulou, J. A. M., Ph.D. ..................... Stanford
Caruthers, J. E. (UTSI), Ph.D. ......... Georgia Tech
Engels, R. C. (UTSI), Ph.D. .............. VPI
Madokwu, M. S., Ph.D. .................... Drexel
Mathews, A., PE, Ph.D. ................... Illinois
Steinhoff, J. S. (UTSI), Ph.D. ............ Chicago

**Assistant Professors:**

Cezeaux, J. L., Ph.D. ....................... Rensselaer
Iannelli, G. S., Ph.D. ...................... Tennessee
Pionke, C. D., PE, Ph.D. ................. Georgia 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 and interests. Each applicant is advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his/her advisory committee, and must comply with the requirements of The Graduate School. The student's major professor may be selected from a department other than the Department of Engineering Science and Mechanics; however, at least one member of the student's graduate advisory committee must be on the faculty of the Department of Engineering Science and Mechanics. A departmental application is required in addition to The Graduate School application. The names and addresses of four references must be included with the departmental application. The flexibility and interdisciplinary aspect of the program concentrations are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics or in related interdisciplinary studies such as biomechanics.**

**THE MASTER'S PROGRAM**

Two M.S. options are offered: option I requires a thesis, while option II does not. The second plan is restricted to those students who have had significant engineering professional work experience.

In option I, a minimum of 30 semester hours including the thesis is required. In option II, a minimum of 33 hours is required. The requirements include the following:

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**Mathematics**

*Engineering courses* (Major concentration may include but is not restricted to courses offered by the Engineering Science and Mechanics Department.)

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**Related courses** (May include additional courses in mathematics, computer science, or the physical and life sciences as engineering courses.)

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**Thesis**

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*Engineering courses under option II may include advanced laboratory work or special problem work; for example, Engineering Science and Mechanics 581 or analogous courses in other departments.*

A final examination is required under both options covering graduate coursework and the thesis.

**THE DOCTORAL PROGRAM**

Specific departmental requirements for the Ph.D. include:

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the Master's thesis. These shall include a minimum of 24 semester hours in Doctoral Research and Dissertation and a minimum of 48 semester hours in other courses.

2. A minimum of 24 semester hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 500 and above, with at least 9 semester hours of 600-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.

3. A minimum of 12 semester hours in mathematics or computer science in courses numbered 400 and above, exclusive of a first course in ordinary differential equations.

4. Attendance and participation in graduate seminars and colloquia.

5. Two doctoral examinations must be passed to be admitted to candidacy for the Ph.D. in Engineering Science.

After being admitted as a potential candidate for the Ph.D., a qualifying examination must be taken at the first offering after the student has either completed a Master's degree or completed 24 semester hours of graduate credit. The purpose of qualifying examinations are:

a. To determine the qualifications of the student to continue the Ph.D. program, and

b. To identify the areas of strengths and weaknesses to guide the student's graduate coursework and research.

The qualifying examination will be administered by the department's Graduate Studies Committee. The examination will be written and will cover at least four graduate level subject areas. One subject area will be mathematics, and the others will be designated by the student subject to the approval of the department's Graduate Studies Committee.

The comprehensive examination is to be taken by students within 6 credit hours of completion of graduate coursework required for the Ph.D. degree. This examination is to be administered by the student's advisory committee and shall consist of both a written and an oral portion.

6. After successfully passing the qualifying and comprehensive examinations, the student must present the Ph.D. dissertation research proposal to the student's advisory committee and receive committee approval of the proposal before being admitted to candidacy for the Ph.D.

7. A final examination on the student's dissertation and related fields will be taken by the student after completion of the Ph.D. dissertation and course requirements.

**ACADEMIC COMMON MARKET**

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Engineering Science is available to residents of the state of Florida (concentration in biomedical engineering only). Additional information may be obtained from the 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 proc-
423 Fracture-Safe Design (3) Critical review of variables controllable in the fracture-safe design of structures; fracture toughness, fatigue crack propagation, stress-concentration factors. Interpretation of experimental results; class assignments. Prerequisites: Civil Engineering 271, 272, 472, 473. 3 hrs or 4 hrs and 1 lab and 1 1/2 hrs lecture. 1 1/2 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

431 Fundamentals of Vibrations (3) Free and forced vibrations of damped and undamped lumped parameter systems; energy methods; free vibration of continuous bodies. Prerequisites: Civil Engineering 271, 272, 273, 371, 372. 3 hrs or 4 hrs and 1 lab and 1 1/2 hrs lecture. 1 1/2 hrs lecture and 1 1/2 hrs lab.

433 Dynamic Systems (3) Three dimensional dynamics of closed systems, phase portraits; Lagrange's equations; stability; transfer functions. Prerequisites: Dynamic. 3 hrs or 4 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

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. Prerequisites: Introductory course in vibrations or acoustics. 3 hrs and 1 lab. 1 hour lab.

442 Fluid Mechanics I (3) Dimensional and empirical laws of motion, energy, and momentum; frictionless and viscous flow; wave motion, propagation, refraction, reflection, interference, and diffraction. Prerequisites: Civil Engineering 271, 272, 273, 371, 372. 3 hrs or 4 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

461 Experimental Stress Analysis (3) Theory, techniques, and instrumentation for making stress measurements and determining stress-strain relations, strain gages; theory and techniques of brittle coating; methods of correction; improvement of current data. Prerequisites: Civil Engineering 271, 272, 273, 371, 372. 3 hrs or 4 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

463 Photomechanics (3) Introduction to photoelasticity, photoelastic coating method, Morel's method, interferometry and holography. Prerequisites: Physics 232. 2 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

465 Dynamic Data Acquisition (3) Use and calibration of instrumentation for one-dimensional and multi-dimensional dynamic tests; Fourier analysis, transfer function analysis, digital signal processing, transition; experimental parameter estimation with applications to modal vibration analysis. Prerequisites: Civil Engineering 271, 272, 273, 371, 372. 3 hrs or 4 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

470 Clinical Engineering and Bioinstrumentation (3) Function and characteristics of health care delivery systems; hospital engineering and biotechnology; education and research in biomedical engineering; development and management principles for hospital-based clinical engineering program. Biomedical instrumentation system operational characteristics; performance evaluation in clinical engineering; data read-out and storage devices; evaluation of commercially available systems, selection and procurement methods, custom-design techniques; health care facility design; control systems and control programs for hospitals. Ethics issues and professionalism in clinical engineering. Prerequisites: Biomedical engineering. Introduction to Pattern Recognition. 3 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

473 Biomechanics (3) Mechanical properties of living tissues: biomechanics of injury, mechanics of prostheses; material compatibility of prosthetic devices; biomedical problems related to impact. Prerequisites: 321. 3 hrs or 4 hrs and 1 lab. 1 hour lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

479 Design of Artificial Internal Organs (3) Design, development, and evaluation of artificial internal organs; analysis of biologic tissues, their relationships and functions, devices for design optimization; review of currently available devices; federal regulation and ethical considerations. Prerequisites: 341, 342, 343, 344, 345. 3 hrs and 1 lab. 1 1/2 hrs lecture and 1 1/2 hrs lab.

499-95 Special Engineering Science Topics (1-3) Problems related to recent developments and practice. Open to juniors or seniors. Prerequisite: Consent of instructor. May be repeated. Maximum 6 hrs.
stresses. 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.)

581 Special Topics in Engineering Mechanics (3) Mechanics problems related to recent developments. Prereq: Consent of instructor. May be repeated with consent of department.

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

599 Measurement Science II (3) (Same as Nuclear Engineering 599 and Aviation Systems 599.)

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

621 Analysis and Design of Thin Shell Structures (3) Geometrical properties of thin shell theory for arbitrary shell geometry; selected applications of theory in structural engineering. Prereq: 525 or Civil Engineering 562.


624 Viscoelasticity (3) Viscoelastic constitutive relations; isothermal boundary value problems; wave propagation in viscoelastic materials; stability problems; determination of viscoelastic properties. Prereq: 523 and 539 or Polymer Engineering 541.

625 Computational Plasticity and Creep (3) Theory and numerical algorithms used to describe plastic and creep behavior in finite element structural models. Perfect plasticity, kinematic and isotropic hardening; Mroz, mechanical sublayer, and two-surface models; volumetric plasticity models; traditional creep models and unified creep plasticity models. Numerical algorithms, including error maps, and plane stress plasticity algorithms in parallel. Prereq: 539 or 532, and 553.


641 Advanced Topics in Fluid Mechanics and Convective Heat Transfer (3) Convective momentum, heat and mass transfer; boundary layer analysis; stability, transition, turbulence, closure models, Navier-Stokes equations, closure procedures; time- and ensemble-averaging, large scale structures; high-speed flow, reacting, nonreacting, excitation, ionization. Applications in propulsion, lasers, aerodynamics. Prereq: 542.

645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic turbulence, boundary layer analysis, stability, transition, turbulence, closure models, Navier-Stokes equations, closure procedures; time- and ensemble-averaging, large scale structures; high-speed flow, reacting, nonreacting, excitation, ionization. Applications in propulsion, lasers, aerodynamics. Prereq: 542.

651-52 Advanced Topics in Computational Fluid Dynamics (3,3) Approximation theory; analysis of accuracy, convergence, and stability for smooth and non- smooth solutions; shocks, artificial dissipation; two- and three-dimensional, compressible viscous and inviscid flows; potential, Euler and complete Naver-Stokes derivatives, mixed subsonic-supersonic flows. Algorithmic constructions: finite difference, finite element, approximate factorization, flux vector splitting, finite volume, generalized coordinate and adaptive grids; steady flows, including second-order turbulence closure, thin layer and parabolic Navier-Stokes equations; multi-dimensional, turbulent and reacting flows. Computer project. Prereq: 552. (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 matrix methods, plasticity, creep, unified creep-plasticity theory; geometrically non-linear problems, large deflection, stability; shell structures; theory of adaptive behavior; adaptive grids. Prereq: 553. (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.

671 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 671 and Mechanical 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.

English

(College of Liberal Arts)

MAJOR DEGREES

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

Professors:
Bratton, Edward W., Ph.D. .......... Illinois
Carroll, D. Allen, Ph.D. ......... North Carolina
Cox, Don R., Ph.D. .......... Missouri
Drake, Robert W., Ph.D. .......... Yale
Dykeman, Wilma (Adjunct), B.A., Northwestern
Enslow, Allison R. (Liaison), Ph.D. .... Indiana
Finneran, Richard J. (Hodges Chair of Excellence), Ph.D. .... North Carolina
Goslee, Nancy M., Ph.D. .......... Yale
Heffernan, Thomas J., Ph.D. ....... Cambridge
Kelly, Richard M. (Lindsay Young Prof.), Ph.D. .... Duke
Leggett, B. J. (Distinguished Prof.), Ph.D. .... Florida
Lofaro, Michael A., Ph.D. .......... Maryland
Malard, Charles J., Ph.D. .......... Michigan
Penner, A. Richard, Ph.D. ....... Colorado
Reese, Jack E., Ph.D. .......... Kentucky
Sanders, Norman J. (Lindsay Young Prof.), Ph.D. .... Indiana
Scribner, Dorothy M., Ph.D. ........ North Carolina
Shurr, William, Ph.D. .......... North Carolina
Thomas, Joyce Carol, M.A. ......... Stanford
Trahiern, Joseph B., Jr., Ph.D. ....... Princeton
Wheeler, Thomas V., Ph.D. ........ North Carolina
White, Jon M. (Lindsay Young Prof.), Ph.D. .......... Illinois

Associate Professors:
Bosiljevac, Linda D., Ph.D. .......... Oregon
Dumas, Bathyh K., Ph.D. .......... Arkansas
Dunn, Allen, Ph.D. .......... Washington
Garnet, Stanton B., Jr., Ph.D. ....... Princeton

Gill, J. E., Ph.D. .......... North Carolina
Goslee, David F., Ph.D. .......... Indiana
Hutchinson, George, Ph.D. ......... Texas
Keating, Mary, Ph.D. .......... Illinois
Keene, Michael, Ph.D. .......... Texas
Levi, Ilona, Ph.D. .......... Illinois
Mele, Robert, Ph.D. .......... Pennsylvania
Menzel, John, Ph.D. .......... Columbia

Assistant Professors:
Atwill, Janet, Ph.D. .......... Purdue
Barton, Kerri, Ph.D. .......... Texas Christian
Bhatt, Rakesh, Ph.D. .......... Illinois
Bratton, Edward W., Ph.D. .......... Illinois
Brunette, Patsy G., M.A. .......... Tennessee
Bunel, Russel, Ph.D. .......... Tennessee
Dolan, Ph.D. .......... Illinois
Jennings, La Vina, Ph.D. .......... North Carolina
Papke, Mary E., Ph.D. .......... McGill

The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. Thesis and non-thesis options are available for the M.A. as well as a special concentration in writing.

Detailed information about the Master’s and doctoral programs, as well as 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 93 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.

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

Language Requirement: Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:
1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT Knoxville with a grade of B or better.
3. Passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.
4. Passing the Graduate Student Foreign Language Test (GSFLT) as currently administered through the English Department.

Final Examination: A candidate presenting a thesis must pass a one-hour oral examination;
a candidate presenting a creative project must pass a ninety-minute oral examination. The examination consists of a short thesis defense, but chiefly of questions covering the general history of English and American literature, not merely the coursework taken. A reading list of primary works designed to help the student prepare for these questions is available in the office of the Director of Graduate Studies in English.

A non-thesis student must pass a written examination, followed by a one-hour oral examination, both consisting of the same sort of questions as the examination taken by the thesis student.

Residence Requirement: There is no residence requirement for the M.A., but students should attempt to pursue a full-time program whenever possible.

WRITING CONCENTRATION

The Master’s program with writing concentration is intended for those students who plan to do free-lance writing, specialize in teaching writing courses at the college level, or work as professional writers in business or industry.

Requirements

The requirements for the writing concentration are the same as those for the thesis option above with the following exceptions:

Coursework: Writing students may substitute two 400-level writing courses for two 500-level courses. Students must take at least 9 hours in writing and 9 in literature, the remaining 6 to be selected from any English courses at the proper level. Of the courses in writing, at least 3 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 emphasis. However, most of the oral examination should focus upon the literature outlined in the original reading list.

THE DOCTORAL PROGRAM

Requirements

A student must successfully complete a program of study, normally 6 full semesters as outlined below, approved by the candidate’s committee or the Director of Graduate Studies in English.

Coursework: At least 51 semester hours beyond the B.A. to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above (only 3 hours of 593 Independent Study may be applied toward the M.A. and 3 at the M.A.); a special three-hour course in teaching composition; and 12 additional hours at any level, including the 400 level. Up to 6 of these additional hours may be taken in some cognate field or fields such as history, philosophy, French. These courses must be drawn from those approved for graduate credit. All other coursework must be in the English department. In this coursework, students must normally maintain a 3.5 GPA.

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

Language Requirement: A language requirement met in one of the following ways:
1. Two languages approved by the Director of Graduate Studies in English. The requirement for each language may be fulfilled by (a) completion of French 302 or German 332 with a grade of B or better; (b) completion at UT Knoxville of any two courses on the 300 level or above in the foreign language or literature with at least a grade of B in each course; (c) passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville; or (d) passing the Graduate Student Foreign Language Test (GSFSLT) as currently administered through the English Department.
2. One modern language approved by the Director of Graduate Studies in English. This requirement must be fulfilled by passing grade on the language examination given by UT Knoxville and completion of two courses given in the foreign language at the 400 level or above, at least one course to be at the 500 or 600 level. A minimum grade of B must be received in each course.
3. One modern language approved by the Director of Graduate Studies in English and intensive study of the English language. This requirement must be fulfilled by completion of (a), (b), or (c) in option 1, for one foreign language, and completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509. History of the English Language (offered in alternate years only). For the other 3 hours, the student may either complete the history of the language sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the comprehensive examination in linguistics.

Examinations: (1) A 4-hour qualifying examination taken before the end of the first year of Ph.D. coursework; this examination is given three times a year, with the M.A. written examination. (2) A comprehensive written examination which may be divided as the department directs; see the English Department graduate brochure. The comprehensive examination is given twice a year, normally in March and September. Before a student may take it, he/she must have completed all coursework required. A student must also have met all requirements for foreign languages before beginning the first part of the examination.

Dissertation Defense: A one-hour examination on the dissertation and other related areas.

Residence Requirement: Two consecutive semesters as a full-time student. For students not on teaching assistantships, full-time consists of 9 or more hours of coursework and/or dissertation hours each semester. For students on assistantships, full-time consists of at least 6 hours of coursework and/or dissertation hours and 3 hours of teaching each semester.

GRADUATE COURSES

Note: Students enrolling in English graduate courses must first register in the office of the Director of Graduate Studies in 306 McClung Tower.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.

402 Chaucer (3) Reading and analysis of Canterbury Tales and Trosilus and Criseyde in Middle English.

403 Shakespeare I: Early Plays (3) Shakespeare’s dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night, English histories, including Henry IV; and early tragedy, including Hamlet.

405 Shakespeare II: Later Plays (3) Shakespeare’s dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from great tragedies, including Othello, problem plays, including Measure for Measure, and dramatic romances, including The Tempest.

406 Renaissance Drama (3) English theatre between 1550 and 1650 through reading of representative plays by Shakespeare’s contemporaries: Marlowe, Webster, Jonson.

408 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of sixteenth century: Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.

410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of seventeenth century: poetry of Milton, Donne, Marvell, and prose of Browne, Bacon, Walton.

411 Literature of Restoration and Early Eighteenth Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1745.

412 Literature of Later Eighteenth Century: Johnson to Burns (3) Survey of English literature and culture from 1745 to 1800.

413 Restoration and Eighteenth-Century Genres and Modes (3): A major genre or literary mode: drama, novel, poetry, non-fiction prose, satire, romance, or epic, written between 1660 and 1600. 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.

419 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskins, Darwin, and Wilde.

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

421 Modern British Novel (3) Lawrence, Joyce, and Woolf.

422 Women Writers in Britain (3) Literary consciousness and the work of women writers in Britain. (Same as Women’s Studies 422.)

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

432 American Romanticism and Transcendentalism (3)

433 American Realism and Naturalism (3)

434 Modern American Literature (3) World War I to present.
Entomology and Plant Pathology

(College of Agricultural Sciences and Natural Resources)

MAJOR       DEGREE
Entomology and Plant Pathology ...................... M.S.

Carroll J. Southards, Head

Professors:
Bernard, Ernest C., Ph.D. ...................... Georgia
Gerhardt, Reid R. (Liaison), Ph.D. ..... NC State
Hilly, James W., Ph.D. .......................... Ohio State
Johnson, Leander F. (Emeritus). Ph.D. ........... LSU
Ph.D. ................................................. NC State

Associate Professors:
Grant, Jerome F., Ph.D. ...................... Clemson
Gwinn, Kimberly D., Ph.D. .................... NC State
Reddick, Bradford B., Ph.D. .................... Clemson
Windham, Mark T., Ph.D. ........................ NC State

Assistant Professor:
Owley, Bonnie H., Ph.D. ........................ NC State

The Department of Entomology and Plant Pathology offers a graduate program leading to the Master of Science with a concentration in entomology or plant pathology. Students in entomology may specialize in insect biology, insect pest management, or biological control. Students in plant pathology may specialize in soilborne diseases, plant physiobiology, biocontrol of soilborne pathogens, and forest pathology. For specific information, contact the department head.

THE MASTER'S PROGRAM

Admission Requirements

For admission to the M.S. degree program, a student must meet all requirements for a B.S. degree in agriculture at the University of Tennessee. A minimum of 120 semester hours must be completed, including 36 semester hours at the University of Tennessee with at least a C average. Applicants must have a B.S. degree in agriculture or a related field from an accredited institution. Applicants should have a minimum GPA of 3.0 on a 4.0 scale or a minimum GPA of 3.5 on a 4.0 scale in their last 60 semester hours. Applicants must submit an official transcript, a current résumé, a statement of purpose, and three letters of recommendation. An interview may be required.

Degree Requirements

The program requires a minimum of 33 hours of course work for the master's degree. Students may choose to specialize in entomology or plant pathology.

Graduate Courses


502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when the student uses University facilities or office space. May be repeated. S/NC.

510 Plant Disease Fungi (4) Morphology, taxonomy, and identification of plant pathogenic fungi. Prereq: Introductory plant pathology and physiology. F, A

511 Soilborne Plant Pathogens (3) Causal agents, host-parasite-soil environment interactions, and effects of environment. Prereq: Introductory plant pathology and physiology. F, A

512 Soilborne Plant Pathogens (3) Causal agents, host-parasite-soil environment interactions, and effects of environment. Prereq: Introductory plant pathology and physiology. F, A

513 Soilborne Plant Pathogens (3) Causal agents, host-parasite-soil environment interactions, and effects of environment. Prereq: Introductory plant pathology and physiology. F, A

514 Soilborne Plant Pathogens (3) Causal agents, host-parasite-soil environment interactions, and effects of environment. Prereq: Introductory plant pathology and physiology. F, A

515 Plant Pathology of Soilborne Diseases (6) Morphology and identification of soilborne plant pathogens. Prereq: Introductory plant pathology and physiology. F, A

520 Plant Parasitic Nematodes (4) Morphology, taxonomy, and control of plant parasitic nematodes. Prereq: Introductory plant pathology and physiology. F, A

521 Field Crop and Vegetable Insects (2) Identification and management of insects affecting commercial vegetable crops. Prereq: Introductory plant pathology and physiology. F, A

522 Field Crop and Vegetable Insects (2) Identification and management of insects affecting commercial vegetable crops. Prereq: Introductory plant pathology and physiology. F, A

523 Field Crop and Vegetable Insects (2) Identification and management of insects affecting commercial vegetable crops. Prereq: Introductory plant pathology and physiology. F, A

524 Field Crop and Vegetable Insects (2) Identification and management of insects affecting commercial vegetable crops. Prereq: Introductory plant pathology and physiology. F, A

525 Medical and Veterinary Entomology (3) Morphology, taxonomy, and control of arthropod pests and vectors of diseases. Prereq: Introductory plant pathology and physiology. F, A

530 Integrated Pest Management (3) Principles and application of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic thresholds. Prereq: 321 or 325. F, A

531 Special Problems in Entomology (1-3) Comprehensive individual study of current problems. May be repeated. F, A

532 Special Problems in Plant Pathology (1-3) Comprehensive individual study of current problems. May be repeated. F, A

533 Concentrated Study in Entomology (1-3) Select subjects in entomology for advanced students. F, A

534 Concentrated Study in Plant Pathology (1-3) Select subjects in plant pathology for advanced students. F, A

541 Seminar (1) Review of the literature and current research in entomology and plant pathology. F, A

Environmental Engineering

See Civil Engineering

Environmental Practice

(College of Veterinary Medicine)

MAJOR       DEGREE
Veterinary Medicine ..................... D.V.M.

L. N. D. Potgieter, Head

Professors:
Farkas, W. R., Ph.D. ...................... Duke
Oliver, J. W., D.V.M., Ph.D.  .......... Purdue
Patton-McCord, S., Ph.D.  .......... Kentucky
Potgieter, L. N. D., B.V.Sc., Ph.D. .... Iowa State
Rao, C. F. (Emeritus), D.V.M. .......... Ohio State
Schultz, T. W., Ph.D. .......... Tennessee

Associate Professors:
Frazier, D., D.V.M., Ph.D. .......... NC State
New, J. C., D.V.M. .......... Texas A&M
Orosz, S. E., D.V.M., Ph.D. .......... Ohio State
Reinemeyer, C. D., D.V.M., Ph.D. .... Ohio State
Rohrbach, B. W., V.M.D. .......... Johns Hopkins
Schroeder, E. C., D.V.M. .......... Michigan State

Assistant Professors:
Hahn, K. A., D.V.M.  .......... Purdue
Kania, S., Ph.D. .......... Florida
Ramsey, E. C., D.V.M. .......... California (Davis)

Instructor:
Kennedy, M. A., D.V.M., Ph.D. .......... Tennessee

Clinical Associate:
Clyde, V. L., D.V.M. ......... NC State

Post-Doctoral Research Associate:
Alansari, H. M., Ph.D. .......... Kansas State
Keck, W. J., D.V.M. .......... Michigan State
Lu, X., M.D. .......... China

Residents:
Jones, M. P., D.V.M. .......... Missouri
Finance

(College of Business Administration)

MAJOR

Business Administration ............. MBA, Ph.D.

Harold A. Black, Head

Professors:
Black, Harold A. (James F. Smith, Jr., Prof.), Ph.D. ....................... Ohio State
Dotterweich, William W. (Emeritus), Ph.D. ......................... Pennsylvania

Philippatos, G. C. (Distinguished Prof.), Ph.D. ......................... New York
Shrives, Ronald E. (Wm. Voigt Scholar), Ph.D. ......................... U.C.L.A.
Wansley, James W. (Clayton Chair of Excellence), Ph.D. ........ South Carolina

Associate Professors:
Auer, A. L., Ph.D. ................................ Iowa
Boehm, T. P., Ph.D. ................................ Washington (St. Louis)
DeGeinardo, R. P., Ph.D. ................................ Ohio State
Ehrhardt, M. C., Ph.D. ................................ Georgia Tech
Wachowicz, J. M., Jr., CPA, Ph.D. ......................... Illinois

BUSINESS ADMINISTRATION

CONCENTRATIONS

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

MBA Concentration: Finance

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

Minimum course requirements are three courses: Finance 510 (3 hrs), plus two from the following: 512, 522, 532, and 561.

Ph.D. Concentration: Finance

Minimum course requirements are five Finance seminars 641, 642, 651, 652.

GRADUATE COURSES

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

501 Special Topics in Environmental Medicine (1-3) Principles of environmental medicine: toxicokinetic studies, epidemiology and techniques in molecular biology: atomic absorption, gas chromatography, ultrafiltration, and extractive techniques and radioimmunoassay. Prepr: 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/N only. E

503 Predictive Toxicology (3) Principles and techniques of predictive toxicology: structures-activity relationships, expert systems, neural nets and similar techniques.

505 Laboratory Animal Care and Use (2) Review of basic laboratory animal care and use as prerequisite to conducting research using animals subjects. Compliance with animal care and use guidelines.

506 Experimental Animal Surgery (3) Competence in performing humane surgical modifications of experimental animals. Techniques of anesthesia, drug administration and postoperative care. Prepr: Embryology, parasitology, physiology and/or consent of instructor. 1 hr and 2 labs. F

530 Wildlife Diseases (2) (Same as Wildlife and Fisheries Science 530.)

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

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

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


642 Seminar in Finance II: Theory of the Firm (3) Financial theory of firm and financial decision making under conditions of uncertainty, equilibrium models of firm, option pricing, agency theory, capital structure, economic 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.
THE DOCTORAL PROGRAM

1. Completion of a Master's degree in the field, or a closely related field, or passing a special qualifying examination is required for admission. Scores on the GRE aptitude test are also required.
3. A minimum of 72 hours beyond the Bachelor's degree, excluding credit for the Master's thesis, is required. Of this, 24 semester hours must be 600 Doctoral Research and Dissertation.
4. At least 24 hours of coursework numbered above 500 are required, exclusive of doctoral research and dissertation. At least 6 of the 24 must be courses numbered above 600.
5. A minimum of 6 hours of coursework 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 both written and oral comprehensive examinations prior to admission to candidacy. Major professors will advise candidates on competencies expected. A final oral examination will be 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. 3 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. 3 hrs and 1 lab. F
420 Food Microbiology (2) Physical, chemical and environmental factors moderating growth and survival of foodborne microorganisms; pathogenic and spoilage microorganisms affecting quality of foods and their control. Prereq: Microbiology 210. Coreq: 429. F
430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods. Prereq: Basic statistics. 2 hrs and 1 lab. F
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 (3) Science and technology of processing dairy products. Physical, chemical, and microbiological changes that occur during manufacture. Prereq: Principles of Chemistry, Introduction to Organic and Biochemistry. General Microbiology. 3 hrs and 1 lab. F, A
460 Meat Products Technology (4) Processing methods for making cured, smoked, fresh, flaked and formed products. Effect of processing methods on product characteristics. Prereq: 360 or consent of instructor. 3 hrs and 1 lab. F, A
470 Food Crop Products (3) Food products from plants, types, manufacturing systems, quality attributes and utility. Prereq: 3 hrs biological science. 3 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. 3 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 for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E
503 Problems in Lieu of Thesis (2-3) May be repeated. S/N only. E
510 Instrumental Analysis of Food (3) Modern instrumental methods for control of food manufacturing processes. Prereq: 410-11. 2 hrs and 1 lab. F
511 Color and Flavor of Foods (3) Chemical basis, measurements, and reactions involved in color and flavor changes in foods. Manufacture and application of materials used to modify color and flavor. Prereq: 410-11. 2 hrs and 1 lab. F
520 Food and Industrial Fermentations (3) Microbiology, biotechnology and food-related fermentations involving dairy products, meat, cereals, fruits and vegetables. Production of food ingredients and by-products. Prereq: 420-29, 440. 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. 1 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 oils and oil products 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 6 hrs. F, Sp
593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 6 hrs. E
600 Doctoral Research and Dissertation (3-15) P/NP only. E
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 toxicants 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

FORESTRY

Wildlife and Fisheries Science.............. M.S.

MAJORS

DEGREES

Forestry............................................. M.S.

Wildlife and Fisheries Science.............. M.S.
THE MASTER'S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor's degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must also have taken the general Graduate Record Examination (GRE). Graduate School rating forms or letters of recommendation from three individuals familiar with the applicant's academic ability are required. The department also has an application that must be submitted at the time of application to The Graduate School.

thesis Option

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

2. A graduate committee of no fewer than 3 faculty members must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis requirement, a minimum of 24 hours of graduate coursework is required. This work must be approved by the student's committee and at least half of the minimum 36 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 for 3 semesters.

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

Non-Thesis Option (Forestry only)

1. Thirty-five hours of graduate coursework of which 23 must be at the 500 level or above is required.

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

3. Three hours of Forestry 511 are required.

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

5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 28 hours of approved study.

A concentration in managing natural resource organizations is available under the non-thesis option with a major in Forestry. The minimum core requirements include: Forestry 511, 570, and in addition 6 hours of Forestry courses to be selected in consultation with the student's committee; Political Science 564, Management 554 and Planning 550. 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.

Forestry

GRADUATE COURSES

422 Forest and Wildland Resource Policy (3) Policy formulation; control of natural resource damage; forest and wildland law and regulation; theory of conflict resolution, formal and informal resolution. Prereq: Senior standing.

423 Wildland Recreation Planning and Management (3) Planning processes; master 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.

432 Wood Adhesives and Glued Wood Products (2) Theory and practice of adhesive bonding of wood; wood-substrate adhesive interfaces for bonding; principles of adhesion; wood adhesives; gluing of solid wood and composite wood manufacturing processes; laboratory manufacture and/or testing of adhesives, adhesive bond strength and glued-wood product performance; day field trips. Prereq: Wood Preparation, Use and Wood Identification, or consent of instructor. 1 hr and 2 labs.

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

435 Wood Drying and Preserving (2) Discussion of wood moisture relationship; introduction to commercial wood drying equipment and practices. Prereq: specification, and disposal of preserved treated wood. Day field trips. Prereq: Wood Properties and Use and Wood Identification, 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 be used toward degree requirements. May be repeated. S/NC only. E.

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resources management. Identify, analyze and prepare written reports. Topical and report topics approved by the graduate committee. Available only to students in non-thesis option for M.S. in Forestry. E.

512 Seminar (1) Current development in forestry. Required of all graduate students in residence in Fall. May be repeated. Maximum 2 hrs. S/NC only. E.

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 sciences, 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, as applied to forest resource management. Prereq: Senior-level forest management or consent of instructor. Sp.A.

540 Genetics in Forestry (3) Genetic improvement of forest resources, including tree testing for genetic variability; tree breeding; development of seed orchards; hybridization; tree cytology and tissue culture; 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 Organization (3) Theory and application of resource 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 characteristics, silvicultural practices and systems applied to commercially important hardwoods and softwoods. In-depth analysis of silvicultural principles involved and tools used, prescribed fire, periodic fires, insect and disease management; computer modeling of stand dynamics, structure, growth and yield. Prereq: Undergraduate silviculture completed; consent of instructor. 3 and 2 labs.

581 Cytophenetics (3) Chromosome structure and behavior during mitotic and meiotic divisions in relation to structural changes, genetic controls, hybridization, speciation, and ploidy. Laboratory, normal and abnormal meiotic processes and somatic chromosomes from plants.
and animals. Prereq: Biology 220 and at least 6 additional hrs in biological sciences. (Same as Botany 581.) Sp,A

585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory, fixed and variable plot sampling, lidar sampling, regression estimators; multistage and multiphase sampling. Growth and yield predictions for even-aged and uneven-aged forests. Prereq: Land Measurement Techniques and Forest Resources Inventory or consent of instructor. F,A

590 Advanced Topics in Forestry (1-3) Recent advances and concepts; research techniques and analysis of current problems. Consent of instructor. May be repeated. Maximum 6 hrs. 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. Effects of land-use practices on wildlife. Prereq: Principles of Wildlife and Fisheries Management or General Ecology. Applicable to majors in Forestry and 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 in 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. Prereq: 6 hrs of biological sciences or consent of instructor. Not available to students in forestry or wildlife and fisheries science. 4 hrs and 1 lab for six weeks. Sp

535 Environmental Impacts to Natural Ecosystems (3) Current environmental problems impacting natural ecosystems: climatic change, acid deposition, air pollution, species declines, and introductions of exotic species. Management strategies and methodologies to mitigate environmental problems. Weekend field trips. Prereq: 416 or equivalent or consent of instructor. Applicable to majors in Forestry and in Wildlife and Fisheries Science. Sp

540 Seminar on Integrated Resources Management in Biosphere Reserves (2) MAI program, UNESCO-sanctioned global conservation initiative. Analysis of integrated resources management practices that demonstrate concept of sustainable development. Environmental policy and evaluation of science to management practice. Applicable to majors in Forestry and in Wildlife and Fisheries Science. Sp

Wildlife and Fisheries Science

GRADUATE COURSES

440 Wildlife Techniques (2) Methods of wildlife damage control and wildlife habitat management, identification of wildlife field sign, wildlife capturing techniques and management plan preparation. Weekend field trips. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

442 Fisheries Techniques (2) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques; age determination and incremental growth analysis; stream assessment; equipment and instrument development and utilization; and industry reports; selected topics. 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 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, endangers birds, and bird pests. Current principles and practices of 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 issues for decision-making and application of methodologies in practice of wildlife and fisheries management. Seminars by ethicists, wildlife and fisheries scientists and managers, and foresters to acquaint students with diverse perspectives of ethical behavior in practice of wild and fisheries management. Lectures, panel discussions, and case studies. Team taught. Prereq: Senior standing. Sp

500 Thesis (1-15) F,P,N,F 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. F

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 policies, case histories. Sp,A

525 Endangered Species Management and Conservation of Biodiversity (2) Status, ecology and management of endangered species and plant species. Historical aspects, policy implications and philosophical issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor. Sp

530 Wildlife Diseases (2) Necropy of birds and mammals. Recognition of various diseases and methods of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr biology, 444 or 445, or consent of instructor. (Same as Environmental Practice 530.) 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) Characteristic, assumptions, and current technologies for fish and wildlife population analysis. Methodologies, methodology, and goals of analysis. Use of computers. Prereq: Animal Science 571 or Statistics 538 or consent of instructor. A

550 Fish Physiology (3) Mechanisms of circulation, excretion, osmoregulation, and neural/hormonal control of freshwater and marine fishes. Practical applications of fish physiology in water pollution assessment, fish culture and management. Prereq: Senior or graduate standing in biology or fisheries science. F,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: 443, 444, 445, or consent of instructor. May be repeated. Maximum 6 hrs. E

French

See Romance Languages

Geography

(College of Liberal Arts)

MAJOR

DEGREES

M.S., Ph.D.

Sidney R. Jumper, Head

Professors:

Aiken, Charles S., Ph.D. .................. Georgia
Bell, Thomas L., Ph.D. ....................... Iowa
Foresta, Ronald, Ph.D. ..................... Rutgers
Hammond, E.H. (Emeritus), Ph.D. ...... California
Jumper, Sidney R. (Liaison), Ph.D. .... Tennessee
Long, Robert G. (Emeritus), Ph.D. .... Northwestern
Minkel, C.W., Ph.D. ...................... Syracuse
Paludan, C.T. (UTSI), Ph.D. ........... Dakota
Pulsipher, Lydia, Ph.D. ............... Southern Illinois
Rafael, Bruce, Ph.D. .............. Northwestern
Schmudder, Theodore H., Ph.D. .... Wisconsin
Wilbanks, T.J. (Adjunct), Ph.D. ....... Syracuse

Associate Professors:

Blasing, T.J. (Adjunct), Ph.D. ............. Wisconsin
Brinkman, Leonard W., Jr., Ph.D. ...... Wisconsin
Brown, Marilyn (Adjunct), Ph.D. ...... Brown
Brown, Marilyn (Adjunct), Ph.D. ...... Ohio State
Harden, Carol P., Ph.D. .................. Colorado
Horn, Sally P., Ph.D. ................. California
Rehder, John B., Ph.D. ............... Louisiana State

Assistant Professors:

Liu, Cheng (Adjunct), Ph.D. ...... Tennessee
McKeown-Ice, Rosalyn (Adjunct), Ph.D. Oregon

The department offers the Master of Science and Doctor of Philosophy degrees. The Master's degree emphasizes development of professional competence as a geographer and offers opportunities to gain substantial depth in a concentration or a major technique. An emphasis in geographic information systems is available for students who have appropriate backgrounds in mathematics and computer science. The doctoral program is for those who have demonstrated proficiency in conducting independent research. The department is particularly well-qualified to direct graduate work in location analysis, transportation geography, urban and rural geography, and the geography of the natural environment (especially biogeography, geomorphology, and biological conservation). The faculty is qualified to direct students from a variety of approaches ranging from historical and humanistic to rigorously analytic and GIS-based.

THE MASTER'S PROGRAM

The department offers the thesis and non-thesis options for the Master of Science. Both options require a minimum of 30 semester hours beyond the completion of a sound undergradu-