Rural Sociology

GRADUATE COURSES

490 Technological and Community Change (3) Analysis of communications processes whereby new technology, spreads within a farm population and analysis of social institutions related to change in rural communities. Prereq: Rural Sociology or consent of instructor. (Same as Sociology 490). Sp

580 Advanced Rural Sociology (3) Application of sociological concepts and theory to analyzing changing social structure and of rural life in U.S. and developing countries. Demographic changes, rural social and community indicators, and rural development processes. Prereq: 380 or equivalent. (Same as Sociology 580). Sp

593 Special Topics in Rural Sociology (1-3) Current sociological issues involving application of sociological theory. Prereq: 380 or consent of instructor. May be repeated. Maximum 6 hrs. (Same as Sociology 583). E

Agricultural and Biosystems Engineering (College of Agricultural Sciences and Natural Resources)

MAJORS DEGREES

Biosystems Engineering ..................... M.S., Ph.D.
Biosystems Engineering Technology .......... M.S.

C. Roland Mote, Head

Professors:

Bledsoe, B. L., PE, Ph.D. ..................... Oklahoma State
Henry, Z. A., PE, Ph.D. ......................... NC State
Luttrell, D. H. (Emeritus), Ph.D. .......... Iowa State
McDow, J. J. (Emeritus), PE, Ph.D. ...... Michigan State
Mote, C. R., PE, Ph.D. ....................... Ohio State
Sewell, J. I., PE, Ph.D. ....................... NC State
Shelton, C. H. (Emeritus), M.S. .......... VPI
Tompkins, R. D., PE, Ph.D. ............... Tennessee
Wilhelm, L. R., PE, Ph.D. ................. Tennessee
Wills, J. B., M.S. ......................... Tennessee

Associate Professors:

Buscherhoffer, Michael J., Ph.D. .......... Clemson
Freeland, R. S., PE, Ph.D. ................. Tennessee
Grandle, G. F., Ph.D. ....................... Tennessee
Hart, W. E., Ph.D. ............................ Purdue
Wilkerson, J. B., Ph.D. ..................... Purdue
Yoder, D. C., Ph.D. .......................... Colorado State
Yoder, R. E., PE, Ph.D. .................... Colorado State

Assistant Professors:

Burns, R. T., Ph.D. ............................ Tennessee
Hubert, G. J., Ph.D. ......................... Illinois
Raman, D. R., Ph.D. ......................... Cornell
Womac, A. R., Ph.D. ....................... Tennessee

Graduate programs leading to the Master of Science and Doctor of Philosophy with a major in Biosystems Engineering are available to graduates of a recognized curriculum in engineering, mathematics, or one of the physical or biological sciences. A graduate program leading to the Master of Science in Biosystems Engineering Technology is available to graduates in a recognized curriculum in agriculture or other related fields. Each applicant will be advised about 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. A completed departmental data sheet and three completed Graduate School Rating Forms are required in addition to The Graduate School application.

A significant aspect of graduate education beyond formal courses and thesis projects is active participation in the professional community which exists within academic departments at universities. Student/faculty seminars are one of the professionally rewarding activities of the community. Accordingly, all graduate students are encouraged to participate in Biosystems Engineering 505P and other departmental seminars regardless of whether they are registered for seminar credit.

THE MASTER'S PROGRAMS

Biosystems Engineering

Applicants who have not previously earned a degree from an ABET-accredited engineering program must submit scores from the GRE general and engineering subject examinations. Applicants accepted into the program must complete at least 30 semester hours to earn a degree. Of these 30 hours, 20 must be in courses numbered 500 or greater (5 hours of thesis plus 14 hours of other courses). Other specific requirements for the 30 hours are:

Program electives

Thesis 500

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

Biosystems Engineering Technology

Thesis Option: Applicants who have not previously earned a degree from a professionally accredited program within the U.S. must submit scores from the GRE general examination. Applicants accepted into the program must complete at least 33 semester hours to earn a degree. Of these 33 hours, 20 must be in courses numbered 500 or greater (6 hours of thesis plus 14 hours of other courses). Other specific requirements for the 30 hours are:

Program electives

Thesis 500

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

Non-Thesis Option: A non-thesis option in Biosystems Engineering Technology is available to qualified students. Applicants who have not previously earned a degree from a professionally accredited program within the U.S. must submit scores from the GRE general examination. Applicants accepted into the program must complete at least 33 semester hours to earn a degree. Of these 33 hours, 20 must be in courses numbered greater than 500. Other specific requirements for the 33 hours are:

Program electives

Coursework in computational methods

Capstone Experience (project and report, typically 508)

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

THE DOCTORAL PROGRAM

Departmental Requirements

Students applying for admission into the doctoral program must submit evidence of ability to perform independent research to the satisfaction of the faculty of the department. An approved master’s thesis will usually be acceptable for this purpose. Scores on the GRE general and engineering subject examinations also are required for applicants who have not received a degree from an ABET-accredited engineering program.

To earn a degree, each doctoral student must complete at least 75 hours of approved graduate credit (beyond the baccalaureate degree) in Biosystems Engineering and supporting areas (engineering, computational methods, agricultural and biological sciences, and other related areas). Of the 75 hours, 48 must be in courses numbered greater than 500 (including 24 hours of course 600) and 6 hours of courses at UTC numbered greater than 600.

Other specific requirements for the minimum 75 hours are:

- Major subject courses: 18 hours
- Coursework in computational methods, mathematics, computer science, statistics, or any course containing appropriate computational components: 2 hours and 1 lab.
- Program electives: 21 hours
- Seminar (504, 505 or equivalent courses): 3 hours
- 600 Dissertation: 24 hours

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

Biosystems Engineering

GRADUATE COURSES

413 Component Design and Machine Synthesis (3) Synthesis of design: structural, kinematic, power, control-system development; preparation of design drawings, specifications, model of device; written and oral report on project. Prereq: Engineering Design Fundamentals, system design, component and machine synthesis.

422 Food and Process Engineering Technology (3) Fluids and solids, heat and mass transfer.

432 Irrigation and Waste Management System Design (3) Design of irrigation and agricultural water management systems with consideration given to livestock waste characteristics, climate, water quantity, system characteristics, and impact on crop yield and water quality. Prereqs: Soil and Water Conservation and Engineering Lab, 1 hr and 2 labs.

430 Mobile Hydrailic Power System Design (3) Functional and operational characteristics of mobile hydraulic systems; system components; components and application; analysis and synthesis of power transmission and control circuits. Prereqs: Fluid Mechanics or Hydraulics. 2 hrs and 1 lab.

431 Bioprocess System Design and Analysis (3) Design of processes, storage and handling systems for biological materials. Mass and energy balances, product and waste characterization, equipment specifications, economic analysis, safety, and human factors. Design content: 3 hrs. Prereq: Processing Food and Biological Materials. 1 hr and 2 labs.

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

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

504 Professional Development Seminar (1) Planning and executing research program; ethics and professionalism; departmental procedures and resources. (Same as Biosystems Engineering Technology 504.) S/N only. F

505 Professional Communications Seminar (1) Analysis of communication techniques, recent advances and general topics: presentations by students. Should be taken in last full semester before graduation. Prereq: 504. May be repeated in doctoral program. Maximum 2 hrs. (Same as Biosystems Engineering Technology 505.) S/N only. E

510 Similarity in Design and Research (3) Dimensional analysis; governing equations; theory of models; true, distorted, dissimilar models; prediction equations; interpretation of data; applications to machine, soil and water structures, agricultural buildings and other agricultural engineering selected problems. Prereqs: Engineering Science and Mathematics 321, 341, 2 hrs and 1 lab.

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

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

541 Principles of Compost Engineering (3) Comprehensive study of composting: theory and practice; economics of composting; physical, biological and chemical composition; classification; selection and management; design component. Prereq: Thermodynamics.

542 Small Internal Combustion Engines (3) Theory, design, performance, and applications of internal combustion engines.

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

544 Monitoring Hydrologic Phenomena (3) Application of monitoring and control of hydrologic phenomena for prediction and control of current and future conditions; equipment operation and solution of environmental monitoring problems. Prereq: 543. 2 hrs and 1 lab. (Same as Environmental Engineering 544.)

550 Selected Topics (1-3) Lecture/discussion on special topics. Prereq: Consent of instructor. E

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

553 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 553, Environmental Engineering 557, and Microbiology 575.)

565 Soil and Water Conservation and Engineering Lab, 1 hr and 2 labs.

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

580 Special Problems in Biosystems Engineering Technology (1-3) Individual studies of current problems. May be repeated. Maximum 6 hrs.

590 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/N only. E

604 Professional Development Seminar (1) (Same as Biosystems Engineering 504.) S/N only.

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

610 Professional Development Seminar (1) (Same as Environmental Engineering 552.)

620 Computer Simulation of Agricultural Systems (3) Computer simulation of agricultural systems. Design content: 3 hrs. Prereq: Processing Food and Biological Materials. 1 hr and 2 labs.

630 Feedback and Control Systems (3) Differential equations for physical systems: solutions, transfers, and system response. Control of temperature, frequency response, system simulation, and system analysis. Application to agricultural systems. Prereq: 451, Mathe-
Agriculture
(Collage of Agricultural Sciences and Natural Resources)

GRADUATE COURSES

512 Teaching Internship in Agriculture (1) Supervised experience in teaching; test preparation and evaluation of agriculture students. May be repeated. Maximum 6 hrs. E

Animal Science
(Collage of Agricultural Sciences and Natural Resources and College of Veterinary Medicine)

MAJOR

Animal Science ..................................... M.S., Ph.D. 
Vernery Medicine .................................. D.V.M.

Kelly Robbins, Head

Professors:

Barth, K. M. (Emeritus), Ph.D. .......... Rutgers University
Bell, M. C. (Emeritus), Ph.D. .... Okalahoma State University
Bleier, J. K. (Emeritus), Ph.D. .... Ohio State University
Chamberlain, C. C. (Emeritus), Ph.D. .... Iowa State University
Dewar, J. D. (Emeritus), Ph.D. ...... Kansas State University
Godkin, D. J. (Liaison), Ph.D. .... Massachusetts Institute of Technology
Hall, O. G. (Emeritus), Ph.D. .... Iowa State University
Hansard, S. L. (Emeritus), Ph.D. .... Florida State University
Henry, R. W., D.V.M., Ph.D. .... Ohio State University
Lidvall, E. R. (Emeritus), M.S. ...... Tennessee Technological University
McDonald, T. P. (Emeritus), Ph.D. .... Tennessee State University
McLaren, J. B. (Emeritus), Ph.D. .... Auburn University
Miller, J. K., Ph.D. .......... Georgia Institute of Technology
Murphee, R. L. (Emeritus), Ph.D. .... Wisconsin Alumni Research Foundation
Oliver, S. P., Ph.D. .... Ohio State University
Richardson, D. O., Ph.D. .... Ohio State University
Robbins, K. R., Ph.D. .......... Illinois State University
Shirley, H. V. (Emeritus), Ph.D. .... Illinois State University
Schultz, T. W., Ph.D. .... Tennessee State University
Siems, M. H., Ph.D. .... Auburn University
Tugwell, R. L. (Emeritus), Ph.D. .... Kansas State University

Assistant Professors:

Grizzle, J. M., Ph.D. .................. Florida State University
Hollingsworth-Jenkins, K., Ph.D. .......... Nebraska State University
Mathew, A. G., Ph.D. .......... Purdue University
Mendis-Handagama, L. C., Ph.D. ....... Monash University
Schrick, F. N., Ph.D. .......... Clemson University
Smalling, J. D., Ph.D. .......... Texas A&M University

The Department of Animal Science offers graduate programs leading to the Master of Science and Doctor of Philosophy with a major in Animal Science. At the M.S. level, areas of concentration are nutrition, breeding, physiology, (reproductive, mammary, and metabolic), and management with orientation towards beef cattle, dairy cattle, swine, and poultry. Since the department is also a part of the College of Veterinary Medicine, the areas of anatomy, physiology, medical sciences, and transducers are also available. The Ph.D. program offers concentrations in animal nutrition, animal breeding, animal physiology, animal anatomy, and animal management. Specific information can be obtained from the department.

During the first fall term of matriculation in each degree program, all graduate students are required to enroll in 586. All first- and second-year students are required to enroll in 586 each fall and each spring term.

THE MASTER'S PROGRAM

For admission to the M.S. program, a student must have obtained a 3.0 grade-point average on a 4.0 scale (or a 3.0 each term during the junior and senior years) in a completed undergraduate degree program in one of the animal sciences or in a related area. The student must submit evidence (letters of recommendation, personal interview, etc.) that indicates ability to complete requirements for the M.S. Prerequisite courses may be required if the student has insufficient undergraduate background. If the student has an unsatisfactory grade-point average, an examination on a probationary non-degree basis and a minimum of 9 hours of graduate coursework must be completed. The student must submit evidence of ability to complete requirements for the M.S. program.

The program requires the writing of a thesis based on original research; the completion of a minimum of 24 hours of graduate coursework of which at least 14 hours must be taken in courses numbered at or above the 500 level, and 6 hours of thesis. Included in the course requirement are 1 hour of Agriculture 512 and a minimum of 3 hours in statistics. These statistics courses must be chosen from the 400, 500, or 600 level courses approved for use in the Intercollegiate Graduate Statistical Program. The remainder of the coursework will be selected jointly by the student and the major professor depending on the student's major area of concentration and professional objectives.

THE DOCTORAL PROGRAM

For admission to the Ph.D. program, a student must have obtained a 3.0 grade-point average on a 4.0 scale (or a 3.0 each term during the junior and senior years) in a completed undergraduate degree program in one of the animal sciences or in a related area. The student must submit evidence (letters of recommendation, personal interview, etc.) that indicates ability to complete requirements for the Ph.D. program. Prerequisite courses may be required if the student has insufficient undergraduate background. If the student has an unsatisfactory grade-point average, an examination on a probationary non-degree basis and a minimum of 9 hours of graduate coursework must be completed. The student must submit evidence of ability to complete requirements for the Ph.D. program.

The program requires the writing of a thesis based on original research; the completion of a minimum of 24 hours of graduate coursework of which at least 18 hours must be taken in courses numbered at or above the 500 level, and 6 hours of thesis. Included in the course requirement are 1 hour of Agriculture 512 and a minimum of 3 hours in statistics. These statistics courses must be chosen from the 400, 500, or 600 level courses approved for use in the Intercollegiate Graduate Statistical Program. The remainder of the coursework will be selected jointly by the student and the major professor depending on the student's major area of concentration and professional objectives.

THE ADMISSIONS COMMITTEE

The admissions committee will consist of the major professor, a faculty member of Animal Science, who will act as chairperson of the committee, and a minimum of two other faculty members, at least one of whom may be outside of the Animal Science Department. The committee will approve the student's thesis proposal and make a recommendation to the department on the approval of the thesis.
establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. Prereq: Completion of 300-level core courses or equivalent or consent of instructor. 2 hrs and 1 lab. F

483 Pork Production and Management (3) Integration of principles of nutrition, breeding, physiology, and marketing into complete production and management programs. System of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. Prereq: Completion of 300-level core courses or equivalent or consent of instructor. 2 hrs and 1 lab. Sp

484 Poultry Production and Management (3) Integration of principles of nutrition, breeding, physiology, and marketing into complete production and management programs. System of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. Prereq: Completion of 300-level core courses or equivalent or consent of instructor. 2 hrs and 1 lab. Sp

486 Lamb and Wool Production and Management (3) Integration of principles of nutrition, breeding, physiology, and marketing into complete lamb and wool production and management programs. System of industry, enterprise establishment, systems of production, production practices, and improvement programs. Management evaluated in terms of production responses and economic returns. Alternatives evaluated: production responses and economic returns. Prereq: Completion of 300-level core courses or consent of instructor. 2 hrs and 1 lab. Sp.A

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

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

511 Special Problems in Animal Science (1-4) Prereq: Consent of instructor and department head. May be repeated. Maximum 9 hrs. E

520 Animal Physiology (4) Major body systems and interrelationships: nervous, muscle, blood, cardiovascular, kidney, respiratory, gastrointestinal, and endocrine. Concepts of metabolism, temperature regulation, and acid-base balance. Prereq: General undergraduate anatomy and physiology, and biochemistry, or consent of instructor. F.A


530 Animal Nutrition and Metabolism (4) Comparative digestive physiology, digestion, absorption and metabolism of nutrients in ruminant and nonruminant species. Concepts of ancestral, animal, metabolic, and acid-base balance. Prereq: General undergraduate anatomy and physiology, and biochemistry, or consent of instructor. F.A

552 Anatomy of Domestic Carnivores (4) Gross dissection by systems and regions of dog with comparison to cat. Prereq: Completion of 118-1 and 118-2. (Same as Comparative and Experimental Medicine–Veterinary Medicine 552.) F

554 Comparative Hematology (3) Morphology, physiology and development of blood and blood forming organs: similarities and differences, comparative aspects of homeostasis, defenses, and laboratory species. Prereq: Undergraduate physiology and/or consent of instructor. 2 hrs and 1 lab. (Same as Comparative and Experimental Medicine–Veterinary Medicine 554.) Sp.A

571 Design and Analysis of Biological Research (3) Experimental design and procedures; selection of experimental units; analysis and interpretation of data; statistical analysis; significance of covariance; covariates, treatment arrangements, mean separation and regression. Prereq: Plant and Soil Science 471 or equivalent; knowledge of software package on micro- or mainframe computer. (Same as Plant and Soil Science 571.) Sp.

572 Least Squares Analysis (3) Least squares estimation and hypothesis testing procedures for linear models, mixed model methodology, full rank and non-full rank situations; covariance structures; estimation of variance components. Prereq: 571 or equivalent. 2 hrs and 1 lab. F

581 Advanced Livestock Management (3) Objective functions to evaluate alternative livestock management policies. Systems approach to analysis and integration of reproductive management programs, genetic improvement policies, alternative feeding systems, reproductive health, nutrition, management, fertility, mortality, productivity, and economic returns. Prereq: Familiarity with agricultural production systems and diseases. E

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

621 Advanced Topics in Animal Physiology (1-4) Recent advances and concepts, research techniques, current problems. Prereq: Advanced Physiology. May be repeated. Maximum 6 hrs. E

631 Advanced Topics in Animal Nutrition (1-4) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs. E

632 Advanced Mineral-Vitamin Nutrition (4) Chemical forms, digestion, absorption, intermediary metabolism, deficiencies, excesses and reaction of minerals and vitamins. Prereq: 533 or 534, and Biochemistry and Cellular and Molecular Biology 410 or Nutrition 511 or consent of instructor. Sp.A

651 Advanced Topics in Animal Anatomy (1-4) Current and future research methodology, laboratory situation, recent advances in qualitative techniques for gross and microscopic anatomy. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. (Same as Comparative and Experimental Medicine–Veterinary Medicine 651.) E

652 Disorders of the Endocrine System (2) Pathological and physiological aspects of diseases, endocrine glands of various animal species. Prereq: 521 or consent of instructor. (Same as Comparative and Experimental Medicine–Veterinary Medicine 652.) Sp.A

Animal Science–Veterinary Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine
Graduate applications are considered once a year by the Graduate Committee. All application materials must be received in the department by January 15 for admission the following Fall. Because of the structure of first-year studies, M.A. students should plan to begin their studies in the Fall semester.

M.A. Requirements

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

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

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

3. During the first year, comprehensive Graduate Evaluation Examinations (GEEs) are required of all M.A. students and are based on the content of the core courses. These examinations are given as the final examination in each core class (during regularly-scheduled final periods) and are graded by all faculty within the appropriate subdiscipline for each course. At the end of the first year, all M.A. students will be evaluated by the entire faculty and will either be retained or dropped from the program based on their first year's performance and GEE scores.
4. All M.A. students must attend the graduate section of the visiting lecturer program. To ensure compliance with this requirement, each student is required to register for one credit hour of Anthropology 501 in the Fall semester of each year and fulfill all requirements for the course defined by the instructor. Materials covered by visiting lecturers may appear on the GEE.
5. A graduate-level introductory statistics course, usually Statistics 537.
6. In the second year of the program, students pursue their concentration area and undertake thesis research. Coursework will be determined through consultation with the student's advisor and committee (composed of the advisor and at least one other member of the Anthropology faculty along with other mutually-agreed upon members).
7. Successful completion of the thesis and final oral examination. Normally, students will complete and defend their theses during the Spring semester of their second year.
8. Two copies of the thesis are required by the Graduate School. In addition, bound copies of the thesis are to be provided to the department and to all members of the student's M.A. committee.

In addition to the requirements listed above, M.A. students have the option of completing a minor in statistics. The statistics minor requires 9 hours of coursework, normally Statistics 537 and 538 plus one additional course from an approved list.

THE DOCTORAL PROGRAM

In addition to The Graduate School requirements, requirements for the Ph.D. degree with a major in Anthropology, in the appropriate sequence of completion, are as follows:

1. Successful performance on a language examination administered by the appropriate language department. A student electing this alternative should consult with the advisor; or
2. Completion of the second semester of specialized reading (see Special Reading Requirements for details) or graduate students with a grade of B or better.

The department does not accept completion of the intermediate (200 level) sequence of a language as a formal option for fulfilling the language requirement.

Doctoral Comprehensive Examination: Students must successfully complete a written and oral comprehensive exam.

1. Comprehensive Written Examination: When the Ph.D. aspirant has completed all of the foregoing requirements and is judged by the committee to be prepared in the field(s) of concentration, the student will be required to take a comprehensive written examination. The exam will consist of three sections and be given by the student's committee. All three sections must be taken within seven consecutive days.
2. Comprehensive Oral Examination: This examination follows shortly after successful completion of the comprehensive written exam. The major professor acts as chairperson of the committee.

Admission to Candidacy: Upon successful completion of the comprehensive exam and with the formal approval of The Graduate School, the student is admitted to candidacy for the Ph.D. degree. The formal dissertation prospectus must be filed no later than one full semester after advancement to candidacy.

Dissertation Research: This period of research and writing will be under the direct guidance of the candidate's major professor. The major professor will act as chairperson of the candidate's committee. The candidate must earn a minimum of 24 hours in Anthropology 600 and maintain continuous registration until the dissertation is accepted. The option of presenting publishable papers as a dissertation is not a formal option for the Anthropology Department.

Defense of Dissertation Examination: When the dissertation has been tentatively accepted by the committee, a final oral examination will be held. The committee conducts the exam, which is ordinarily held as a colloquium in which the candidate will expound on the nature and significance of his/her contribution to anthropological knowledge as set forth in the dissertation.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.A. program in Anthropology is available to residents of the states of Louisiana (concentration in zoologia only), Virginia (concentration in biological anthropology), or West Virginia. The Ph.D. program is available to residents of Alabama, Louisiana, Mississippi, or West Virginia.

Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.
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 understanding 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 folklife materials from various tribal, peasant, and complex societies. Prereq: 130 or consent of instructor.

413 Dynamics of Culture (3) Major forms of culture change, ranging from evolution and diffusion to religious revivalization and political revolt. Continuity and change in diverse cultural settings through use of archaeological, ethnographic, and contemporary cases. Prereq: 130.

414 Political Anthropology (3) Organization and dynamics of power and politics in both stateless and state-level societies. Role of symbols, ritual, and ideologies in producing and reproducing power relations. Relationship between political and economic structures. Ecological analysis of traditional political forms and systems within modern states. Prereq: Cultural anthropology or consent of instructor.

416 Comparative Social Organization (3) Evolution of social structure in prehistoric and historic societies. Identification and interpretation of archaeological materials. Prereq: Consent of instructor.

418 Ethnography of North America (3) Classic and contemporary studies of traditional societies in North America. Prereq: Consent of instructor.

420 Animal Behavior (3) Social organization and behavior of selected primates: group composition, size, and structure; patterns of mating; other social interactions; communication; and cultural behavior, application of primates to human studies. Prereq: 110 or consent of instructor.

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

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

502 Registration for Use of Facilities (3-15) Required semester when student uses University facilities and/or takes classes off campus. May be repeated. Maximum 18 hrs.

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

504 Primate Behavior (3) Social organization and behavior of selected primates: group composition, size, and structure; patterns of mating; other social interactions; communication; and cultural behavior, application of primates to human studies. Prereq: 110 or consent of instructor.

505 Theoretical Anthropology (3) Development of anthropological theory. May be repeated. Maximum 6 hrs.

506 Developmental Anthropology (3) Development of anthropological theory. May be repeated. Maximum 6 hrs.


508 Advanced Problems in Prehistory (3) (Same as Classics 562.)

510 Method and Theory in Cultural Anthropology (3) Development of theoretical orientations in cultural anthropology: 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: ethnography, 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 societies in U.S. and peasant societies. Prereq: Cultural area course or equivalent. May be repeated. Maximum 6 hrs.

514 Anthropological Research Methods (3) Application of anthropological theory to the study of other traditional societies. Application of anthropologists’ roles, values, and ethical issues in selected case studies. Survey of anthropologists’ work in non-academic settings.

515 Medical Anthropology (3) Cultural impact on disease patterns, theories of disease causation, and modes of therapy. Theoretical and applied aspects of the anthropological study of health and disease. Prereq: Consent of instructor.

517 Forms of Social Inequality (3) Anthropological perspectives on social inequality; racism, class, gender, and race. Inequality engendered by societal role structure. Construction of social systems in historical context and after rise of modern world system. Inequality engendered by societal role structure. Prereq: Consent of instructor.

518 Seminar in Anthropology (3) Approaches to analysis and interpretation of archaeological data, including methods of presenting data. Prereq: Consent of instructor.

519 Seminar in Archaeology (3) Examination and comparison of skeletons of major vertebrate groups. Identification and description of skeletal materials. May be repeated. Maximum 9 hrs.

520 Laboratory Studies in Archaeology (3) Examination and comparison of skeletons of major vertebrate groups. May be repeated. Maximum 12 hrs. Only 3 hrs may count toward 600-level requirement.

521 Seminar in Cultural Anthropology (3) Selected topics, primarily for doctoral students in cultural anthropology. Prereq: Consent of instructor.

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

523 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.

524 Seminar in Prehistory (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.

525 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.

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

561 Quantitative Methods in Anthropology (3) Federal legislation and regulations affecting identification, protection, and management of archaeological resources. Professional ethics and responsibilities and relationship of federal and state agencies, public interest groups, and professional archaeologists in conduct of federally sponsored archaeology. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

583 Skeletal Biology (3) Practical and theoretical approaches to analysis of prehistoric human skeletal remains. Prereq: Consent of instructor.

585 Departmental Electives (3) May be repeated. Maximum 3 hrs.

586 Anthropological Genetics (3) Application of population and quantitative genetic theory to human variation and public health research. May be repeated. Maximum 9 hrs.

587 Method and Theory in Biological Anthropology (3) Current methods of analysis in biological anthropology and of past and current history of theoretical perspectives. Prereq: Consent of instructor.

589 Anthropological Genetics (3) Application of population and quantitative genetic theory to human variation and public health research. May be repeated. Maximum 9 hrs.

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

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

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

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

601 Advanced Graduate Research (1-6) Independent investigation of special problems in anthropology by advanced graduate students. May be repeated. Maximum 15 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. Prereq: Consent of instructor.

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. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

(College of Architecture and Planning)

MAJOR DEGREE

Architecture............................................. M.Arch.

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

Professors:
Anderson, G. I., M.Arch. ......................... Illinois
Conley, G. (Emeritus), B.Arch. ................. Harvard
Davis, Marleen, M.Arch. ......................... Harvard
Grieger, F. S., M.Arch. ......................... Pennsylvania
Kaplan, M., M.Arch. ............................. Harvard
Kelso, R. M., M.S. ........................ Tennessee
Karsavage, J. A., D.Sc. .......................... Southern Cal
Kinzy, S. A., Ph.D. ................................ SUNY (Buffalo)
Lauer, W. J. (Liaison), M.Arch. .................. Iowa State
Lester, A. J. (Emeritus), M.Arch. ............... Virginia
Lizon, Ph., Ph.D. ................................ Pennsylvania
Moffett, M. S., Ph.D. ............................... MIT
Rabun, J. S., M.A. ................................. Texas
Robinson, M. A., M.Arch. ....................... Pennsylvania
Rudd, J. W., M.A. ................................ Northwestern
Shell, W. S., M.Arch. ............................. Columbia
Watson, J.S., M.Arch. ............................ Pennsylvania
Wodehouse, L. M. (On leave), Ph.D. .......... St. Andrews

Associate Professors:
Coddington, J., M.Arch. ............................ Pennsylvania
Davies, T. K., M.Arch. ............................ Cornell
Martelos, W. E., B.Arch. ............................. California
Schimmenti, M. M., M.Arch. ....................... Florida

Assistant Professors:
Almy, D. J., III, M.Arch. ......................... Texas
Fox, L. D., M.Arch. ................................ Cranbrook
French, R. C., B.Arch. ............................. Tennessee
Livingston, M. F., M.Arch. ...................... Wisconsin
Moore-McClellan, T. W., M.Arch. ............... Michigan
Wade, S. M., M.F.A. ................................. Tennessee

MASTER OF ARCHITECTURE PROGRAM

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

Admission Requirements

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

For Track 1 applicants, a bachelor's degree with a 3.0 GPA from a nationally accredited college or university is required. International applicants must have an equivalent 4-year degree and a 3.0 GPA. Candidates with a GPA less than 3.0 may be considered for conditional admission when evidence of exceptional promise is identified. Undergraduate work must include at least twelve semester hours of humanities, a basic understanding of physical sciences, systems and analytical procedures and an understanding of mathematical principles and analytical procedures, as well as a general understanding of the use of computers. The School requires a separate application for Architecture including an essay and three letters of recommendation. A personal on-site interview is desirable but not mandatory. For those applicants from accredited 4+2 architecture programs, a portfolio is required in addition to the above requirements.

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

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

Degree Requirements

Track 1 requires a minimum of 42 semester hours of undergraduate preparation and 60 semester hours of graduate coursework, taking approximately 3-1/2 years of full-time study. A minimum of 4 hours of architectural electives or approved electives from another discipline must be taken at the 500 level or above.

Track 2 requires a minimum of 30 semester hours of graduate coursework.

Both tracks require 6 hours of Thesis 500 with a public presentation and oral defense of the thesis. The program is contingent upon evidence of satisfactory progress toward the degree. Each student's progress will be reviewed each semester by the Graduate Program Committee. Any questions regarding progress will be addressed by the Graduate Program Advisory Committee.

For further information, contact the School of Architecture.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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


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

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; world; Mesoamerica, India, China, Japan.

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

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

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

416 Forms of Utopia (3) Ideas and architectural expressions of Utopian movements. Visionary and fantastic architecture. Concepts of the city of the future.

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 Gothic Revival through twentieth century.

421 History of Landscape Architecture (3) Inte-lectual, societal, and geographical influences that provide theoretical basis for design throughout history. Selected examples of landscape architecture and an analysis of terms design.

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

425 Special Topics in Architecture (1-6) Faculty initiated courses. Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

432 Computer Applications in Design II (3) Advanced computer aided design using three-dimensional modeling software. Design analysis using computer animation, rendering techniques, visualization, and video. Prereq: Computer Applications in Design I or consent of Instructor.

433 Computer Applications in Design III (3) Integration of three-dimensional modeling and technical analysis using computer aided building design. Independent studies under faculty direction. Prereq: Consent of Instructor.

434 Building Energy Analysis (3) Balancing heat flow through external skin of residential and commercial buildings with energy efficiency through energy efficient design features. Architectural program analysis of external and internal environmental design.

435 Advanced Environmental Control Systems (3) In-depth analysis and innovative concepts in the design of heating, ventilating, and air conditioning. Prereq: 434.

436 Architectural Development (3) Principles and practice of architecture as developer. Impact of economics, finance and urban policy on design and development of real property. Open to all students.

437 Advanced Lighting (3) In-depth analysis and innovative concepts in the design of lighting. Prereq: 434.
464 Project and Construction Management (3) Principles, methods, and application of project and construction management in building process. Manager's and construction manager's function, responsibilities, and activities investigated through case studies. Methods and theories of estimating project cost and building cost in current practice. New techniques of cost analysis.

466 Marketing Services (3) Theories of marketing for architectural practice. Case studies. Public relations procedures.

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) Pass/Fail only. E

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

504 Issues in Preservation (3) Architectural issues: preservation, restoration and conservation of historic structures. Prereq: Consent of instructor.

510 Issues in Urban Design (3) Investigations of urban forms, patterns, and attributes that have shaped towns and cities. Prereq: Consent of instructor.

511 Environmental Influences (3) Environmental factors which influence regional character of architecture. Natural forces associated with these factors, cultural interpretation and response regarding importance and impact.

512 Technological Traditions (3) Technological aspects influencing building form. Role of technical aspects of structural, environmental and building infrastructure as integrated systems supporting use and expression of building.

513 Cultural Aesthetics (3) Principles underlying cultural character of architecture. Role of social, political and economic forces which influence interpretation of factors creating building's character.

514 Ethical Imperatives (3) Social, cultural, philosophical and moral issues which impact professional responsibilities. Attitudes, values, and ideas that form basis of profession's ethos.

521 Principles of Architectural Form (3) Historical and contemporary architectural theory through investigation of literature and theory. Role of understanding and the theories of application related to generation of architectural form and space in response to both cultural and environmental factors.

525 Special Topics in Architecture (1-3) Student- or instructor-initiated courses. May be repeated. Maximum 9 S/NC or letter grade.

526 Directed Readings in Architecture (3) Readings on topics of interest: primary texts, history, theory, urban issues, technology, and professional practice. Prereq: Consent of instructor. May be repeated. Maximum 9 S/NC.

528 Topics in Architectural History and Theory (3) Historiographic, ideas and theories in architecture. Prereq: Consent of instructor.

532 Computer Applications for Architecture (3) Advanced use of computers in architecture. Prereq: Consent of instructor.

551 Research Methods (3) Quantitative and qualitative methods of research in architectural inquiry. Systematic study and application of applied and speculative investigations in field of architectural research. Review and identification of techniques and methodologies and applications for architectural research and scholarship.

553 Advanced Topics in Architectural Technology (3) In-depth research and investigation of specific areas of architectural technology: lighting, structure, enclosure, mechanical and other architectural technologies. Prereq: Consent of instructor.

562 Professional Practice (3) Management and organizational theories and practices for delivering professional design services: assessment of building industry and its influence on architecture; 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 factors influencing regional character of architecture. Examination of associated natural forces and cultural interpretation. Readings and discussions; application in design studio to specific projects. Prereq: Principles in Architectural Design, 1 hr and 5 labs.


573 Architectural Design Studio/Seminar III: Cultural Aesthetics (3) Role of cultural influences on architectural form. Investigations into relationships between place and culture and impact on architectural character. Analysis and design with urban context. Readings and discussions: process of formal synthesis in design studio. Prereq: 572. 1 hr and 5 labs.


591 Foreign Study (1-9)

592 Off-Campus Study (1-9)

593 Independent Study (1-9)

Art
(College of Arts and Sciences)

MAJOR

DEGREE

Art ........................................ M.F.A.

Norman Magden, Head

Professors:
Blain, Sandra J., M.F.A ...................... Wisconsin
Brakke, P. M., M.F.A ......................... Yale
Clarke, R. A. (Emeritus), M.S .............. Wisconsin
Cleaver, Dale G. (Emeritus), Ph.D .......... Chicago
Daehnert, R. H. (Emeritus), M.F.A ..... Wisconsin
Darrow, J. F., Ed.D ......................... Illinois State
Feast, Joseph S., M.S ...................... Ohio State
Goldnerstein, M. B., M.F.A .......... Nebraska
Kanney, William C., M.F.A .......... Wisconsin
Lee, B., M.F.A ............................ Yale
Leland, W. E., M.F.A ..................... Tennessee
Livingston, P. R., M.F.A ................. Wisconsin
Lyons, B. (Liaison), M.F.A ............ Arizona State
Magden, Norman, Ph.D. Case Western Reserve
Martinson, Fred, Ph.D ................. Chicago
Metros, Susan E., M.F.A .......... Michigan State
Moffatt, F., Ph.D ......................... Chicago
Peacock, D., M.F.A ...................... Iowa
Riesing, T. J., M.F.A .......... Nebraska
Shetler, F. C., M.F.A .................... Claremont
Yates, S., M.F.A ........................ North Carolina (Greensboro)

Associate Professors:
Habeck, Dorothy, Ph.D ...................... Michigan
LeFeuvre, Richard, M.F.A .......... Rochester IT
Longobardi, Pam, M.F.A ............... Montana State
Neff, A., Ph.D ...................... Pennsylvania
Staples, Carolyn, M.F.A ............. Michigan State
Wilson, D., M.F.A .................. California (San Diego)

Assistant Professor:
Brogden, Sally B., M.F.A ........................ NY State College of Ceramics (Alfred)

Hiles, Timothy, Ph.D ....................... Penn State

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

THE MASTER'S PROGRAM

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

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

Further information is available by writing to the Department of Art.

M.F.A. Requirements

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 faculty may petition to take 3 hours of outside academics as a substitute for 3 hours of art history or 3 hours of concentration area. The petition 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's degree are required in residence. An exception is made for working professional designers who may complete their first 20 hours, with the permission of the faculty, on a part-time basis. 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 for Art 599. Three members of the committee shall be as follows: one from the candidate's concentration area who shall be the major professor, one from art history, and one from a studio discipline outside the concentration area.

Exhibition and Oral Examination: With the completion of all requirements for the M.F.A., the student must produce an exhibition and, in the presence of that work, must satisfactorily complete an oral examination.
Academic Standards
1. First-year evaluation: At the end of the first 2 semesters in residence, the student must present a portfolio for evaluation by the faculty and receive permission to continue in the program.
2. Second-year evaluation: With completion of all coursework, the student must present work for evaluation by the faculty and receive permission to register for Projects in Lieu of Thesis.
3. If, in a review by the student's major area faculty, the student's progress is deemed insufficient, the faculty may recommend a work period without advancement toward the degree, probation with specific goals set for a specific time, or dismissal.

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

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

Art
GRADUATE COURSES
481 Museology I: Museums, Purpose and Function (3) Development of museums of art, history, natural and applied science. (Same as Anthropology 481.)
482 Museology II: Exhibition Planning and Installation (3) Exhibition concept development and implementation. Exhibition design and installation techniques. Publicity, production, matting and framing, shipping and storage. Prereq: 481 or consent of instructor. (Same as Anthropology 482.)
484 Museology III: Field Projects (1-12) Special field projects: restoration, preservation, registration, and other related research on or off campus. Prereq: 481 and 482. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)
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 (3-5) 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
591 Foreign Study (1-15) See College of Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
593 Independent Study (1-15) See College of Arts and Sciences.

Art Ceramics
GRADUATE COURSES
424 Ceramics: Clays and Glazes (3) Clay chemistry, clay bodies, glaze theory and calculation. Formulating, mixing and testing of clay bodies and glaze formulas. Prereq: Ceramics: Portfolio Review.
425 Ceramics: History Seminar (3) History of ceramics through discussion and student presentations. May not be used toward art history requirement. Prereq: Ceramics: Portfolio Review.
426 Ceramics: Kiln Design (3) Designing kilns, traditional and modern refractories, construction methods, and kiln operation. Prereq: Ceramics: Portfolio Review.
429 Ceramics: Special Topics (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.
521 Graduate Ceramics I (2-5) May be repeated. Maximum 10 hrs.
525 Graduate Ceramics II (2-5) May be repeated. Maximum 10 hrs.
593 Independent Study (1-15) See College of Arts and Sciences.
598 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hrs.
599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hrs. S/NC only. E

Art Drawing
GRADUATE COURSES
411 Drawing IV (8) Individualized pursuit of personal drawing techniques and concepts; supplemented by individual and group critiques; weekly life drawing sessions. Prereq: 410. May be repeated. Maximum 12 hrs.
419 Special Topics in Drawing and Painting (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.
511 Graduate Drawing I (2-6) May be repeated. Maximum 10 hrs.
512 Graduate Drawing II (2-6) May be repeated. Maximum 10 hrs.
593 Independent Study (1-15) See College of Arts and Sciences.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hrs.
599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hrs. S/NC only. E

Art History
GRADUATE COURSES
471 History of North American Art (3) Landmarks in painting, architecture, sculpture, and design from prehistoric to 1900.
472 History of 20th-Century American Art (3) Development in architecture, painting, and design from 1900.
473 19th-Century American Painting (3) From West and Copley to emergence of "The Eight."
474 Theory of 20th-Century Art in Europe and America (3) Theoretical basis for modern movement. Analysis and discussion of individual works of art in light of contemporary writings by artists and theorists. Prereq: Western Art I and II, or consent of instructor.
475 History of 19th-Century Painting and Sculpture in Europe (3) France: Neoclassicism, Romanticism, Realism, Impressionism, Fauvism, German Expressionism, Cubism, Futurism, Symbolism, and Copley. Prereq: Medieval and Renaissance European Art I and II, or consent of instructor.
476 History of 20th-Century Painting and Sculpture in Europe (3) Cubism, Futurism, Dada, Surrealism, and Postmodernism. Prereq: Medieval and Renaissance European Art I and II, or consent of instructor.
511 Advanced Graphic Design (3) Theory and techniques of visual problem-solving as applied to advanced applications of graphic design. Prereq: Intermediate Graphic Design II.
533 Advertising Illustration (3) Media and techniques as applied to advertising illustration. Prereq: Black and White Illustration and successful completion of any portfolio review.
541 Editorial Illustration (3) Media and techniques as applied to editorial illustration for books, magazines, and newspapers. Prereq: Black and White Illustration and successful completion of any portfolio review.
546 Graphic Design Practicum (3-12) Practical work experience in graphic design field. Only by prearrangement with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hrs.
552 Graphic Design II (2-6) May be repeated. Maximum 10 hrs.
556 Graphic Design Practicum (3-12) Practical work experience in graphic design field. Only by prearrangement with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 10 hrs.
553 Computer Enhanced Design (2-6) Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.
593 Independent Study (1-15) See College of Arts and Sciences.
595 Visiting Artist Seminar (2) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 8 hrs.
599 Projects in Lieu of Thesis (10) Prereq: All graduate course work and successful second year evaluation by graduate faculty. May be repeated. Maximum 20 hrs. S/NC only. E
Art

GRADUATE COURSES


433 Modern Art and Film (3) History of development and interaction between visual arts and dramatic arts within context of modern art history. (Same as Cinema Studies 477.)

435 Cinematography as Art (3) Continued development of concepts and techniques for creation of film as art form: individual projects. Prereq: Introduction to Cinematography/Art and Photography/Media Arts Portfolio Review or consent of instructor. May be repeated. Maximum 9 hrs.

436 Video Art (3) Continued development of concepts and techniques for creation of video works as art form: individual projects. Prereq: Introduction to Video Art and Photography/Media Arts Portfolio Review or consent of instructor. May be repeated. Maximum 9 hrs.

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

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

441 Digital Photography II (4) Continuation of exploration and implications of use of computer in photography. Prereq: Digital Photography I and consent of instructor.

442 Large Format Photography II (4) Studio course that continues exploration of use of large format camera in photography. Prereq: Digital Photography I and consent of instructor.

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

452 Photography II (2-6) May be repeated. Maximum 10 hrs.

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

456 Media Arts II (2-6) May be repeated. Maximum 10 hrs.

531 Photography (12-6) May be repeated. Maximum 10 hrs.

532 Photography II (2-6) May be repeated. Maximum 10 hrs.

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

536 Media Arts II (2-6) May be repeated. Maximum 10 hrs.

577 Studies in Media as Art (3) Selected topics in theory and history of media as art form. Prereq: Modern Art and Film or consent of instructor. May be repeated. Maximum 9 hrs.

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

595 Visiting Artist Seminar (3) Contemporary art issues by different visiting artists. May not be used toward art history requirement. May be repeated. Maximum 12 hrs.

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

Art Painting

GRADUATE COURSES

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


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

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.

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

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

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

Art Printmaking

GRADUATE COURSES

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

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

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

561 Screen Printing I (2-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. May be repeated. Maximum 10 hrs.

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

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

Art Sculpture

GRADUATE COURSES

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

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

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

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

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

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

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

Arrowmont

GRADUATE COURSES

Courses listed below offered periodically only at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated. Upon admission to the M.F.A.
Astronomy
See Physics and Astronomy

Audiology and Speech Pathology

(College of Arts and Sciences)

MAJORS DEGREES

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

Patrick J. Carney, Head

Professors:

Asp, Carl W., Ph.D. Asp, W. F., Ph.D. ... Ohio State
Carney, Patrick J. (Liaison), Ph.D. ... Iowa
Natelev, Igor V. (Emeritus), Sc.D. ... Prague
Peterson, H. A. (Emeritus), Ph.D. ... Illinois
Silverstein, B. (Emeritus), Ph.D. ... Purdue
Wallace, Giorlajean L., Ph.D. ... Northwestern

Associate Professors:

Burchfield, Samuel B., Ph.D. ... Michigan State
Ferral, Charles J., M.A. ... Tennessee
Gordon, Pearl A., Ph.D. ... Tennessee
Krishnan, Ravi A., Ph.D. ... Texas
Thelin, J. W., Ph.D. ... Iowa

Assistant Professor:

Hedrick, Mark, Ph.D. ... Vanderbilt
Ruark, Jacki L., Ph.D. ... Pittsburg
Swanson, Lori A., Ph.D. ... Purdue

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 must meet the academic and practicum requirements for certification by the American Speech-Language-Hearing Association and for Tennessee licensure as an audiologist or speech-language pathologist. An exception to this rule must be approved by the appropriate departmental committee. Enrollment in clinical practicum courses is required for all clinical practice experiences. If the undergraduate preparation does not include sufficient coursework in speech pathology, audiology, psychology, and related fields, the student may be required to make up such deficiencies.

Students may elect either the thesis or the non-thesis option. Students in both programs are required to take 611. The master's program with thesis will include a minimum of 30 semester hours of approved graduate credit in speech/language pathology or a minimum of 33 semester hours of approved graduate credit in audiology, including 6 hours of 500 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least two-thirds of these total hours must be at the 500 or 600 level, including no more than 6 hours of thesis and no more than 6 hours of practicum. Students in the non-thesis option program must present a total of 36 semester hours in the speech/language pathology program or 39 semester hours in the audiology program of approved graduate credit and pass a final written examination.

THE DOCTORAL PROGRAM

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

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

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

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

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT 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, or West Virginia. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

432 Observation of Clinical Practice (1) Prereq: Speech and Language Development, Articulation Disorders, or consent of instructor.

434 Clinical Practice in Speech-Language Pathology (1-4) Prereq: 433 and consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval.

440 Voice Disorders (3) Etiology, diagnosis, and treatment of organic and functional voice disorders. Prereq: 304, 360, or consent of instructor.

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

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

465 Speech and Language of the Culturally Different Child (3) Speech and language differences of children of various minority groups, 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.

494 Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification techniques, characteristics, assistive devices, effects of aging/remediation in the elderly, and audiologic studies. Prereq: Phonetics and Audiology of Speech and 473, or equivalents or consent of instructor.

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

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

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

506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role in speech and language. Prereq: 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 research design, and completion of a proposal and hypothetical pilot research project.

512 Clinical Practice in Audiology (1-4) Prereq: 473 and 494. May be repeated. Maximum 6 hrs.

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

514 Practicum in Verbo-Tonal Habilitation (1-4) Prereq: 494, 595, or consent of instructor. May be repeated. Maximum 8 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) Presentation in audiology and speech pathalogy; laboratory assignments for familiarization of students with instruments for measuring speech and hearing processes.

520 Aphasia (3) Historical review of aphasia literature, theories of brain structures, aphasic classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 506 or equivalent or consent of instructor.

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

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

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

532-33-34 Advanced Clinical Practice in Speech-Language Pathology (1-1, 1-4, 1-4) Prereq: 434 or equivalent and consent of instructor. 334 may be repeated. Maximum 6 hrs each. Consent for less than 2 semester hrs must have prior departmental approval.

535-36-37 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-1, 1-4, 1-4) Prereq: 100 hrs clinical experience, consent of instructor. May be repeated. Maximum 6 hrs each. Consent for less than 2 semester hrs must have prior departmental approval.

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

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


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

543 Amplification Technology (3) Description of hearing aid circuits, components and performance characteristics. Electroacoustic and real-ear analysis of hearing aids. Coupler material and geometry effects. Prereq: 473, 507, and 546 or equivalents or consent of instructor.


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

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

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

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

549 Hearing Science (3) Study of psychoacoustic phenomena and how they relate to perception and diagnostic audiometry. 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: 8 hrs in speech pathology. May be repeated with consent of department. Maximum 0 hrs.

555 Special Problems in Speech-Language Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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

562 Advanced Seminar in Speech and Language (2) Conceptual and practical considerations in evaluation and treatment of hearing loss in infants and children. Prereq: Consent of instructor.

563 Practical Applications of Language Habilitation Techniques (3) Identification and treatment of communicative disorders in children and toddlers: family-centered, developmental, and family systems. Prereq: 461 or equivalent or consent of instructor.

565 School-Age Language Disorders (3) Review of current literature on assessment and intervention techniques for school-age language learners. Prereq: 461 or consent of instructor.

574 Pediatric Audiology (3) Theoretical and practical considerations in evaluation and treatment of hearing loss in infants and children. Prereq: Consent of instructor.

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

577 Vestibular Disorders (3) Anatomy, physiology, and pathophysiology of vestibular system and other systems that contribute to balance. Prereq: 473, 507, and 546 or equivalents or consent of instructor.

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

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

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

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

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

595 The Verbotonal System: Auditory/Speech Perception, psychoacoustic theoretical models, hearing loss, assessment and treatment, cochlear implantation, and SUVRAG amplification/filters for diagnosis/evaluation/remediation of spoken language/listening skills of hearing-impaired children/adults: use of rhythms, movements and suprasegmentals; special auditory tests, acoustic filters, correcting misarticulations through optimal listening; central auditory treatment; second (foreign) language through listening/spoken language; relationship of concepts to conventional concepts/practice; student research reports. Prereq: Phonetics and Acoustics of Speech, 473 and 494 or equivalents or consent of instructor.

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

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

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

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

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

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

611 Experimental Design in Speech and Hearing (3) Analysis of experimental design in theses and related journals. Generation of experimental designs. Prereq: Consent of instructor.

625 Advanced Seminar in Neurologically-based Communication Disorders (3) Prereq: 520, 539, or consent of instructor. May be repeated. Maximum 8 hrs.

629 Advanced Seminar in Speech and Language (2) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

632 Advanced Seminar in Speech and Language (2) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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

655 Doctoral Research (1-4) Participation in ongoing or non-dissertational research. Prereq: Consent of instructor. May be repeated. Maximum 6 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.

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

661 Advanced Seminar: Language Disorders in Children (3) Topics vary. Prereq: 555 or consent of instructor. May be repeated. Maximum 6 hrs.

662 Advanced Seminar: Language Disorders in Children (3) Topics vary. Prereq: 555 or consent of instructor. May be repeated. Maximum 6 hrs.
Aviation Systems
(UT Space Institute)

MAJOR DEGREE
Aviation Systems M.S.

R. D. Kimberlin, Program Chair

Professors:
Collins, F. G., Ph.D. .................... California
Kimberlin, R. D. (Liaison), Ph.D. .......... RWTH (Germany)
Mason, A. A. (Emeritus), Ph.D. .......... Tennessee
Paludan, C. T., Ph.D. .................... Denver
Wu, J. M., Ph.D. ......................... Cal Tech
Young, R. L. (Emeritus), Ph.D. .......... Northwestern

Associate Professors:
Lewis, William D., Ph.D. ................. Tennessee
Solies, U. P., Ph.D. ...................... Tennessee

The University of Tennessee Space Institute offers a program leading to the Master of Science degree in the field of 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 Graduate School admission procedures and grade-point standards. It is expected that the student will have a basic knowledge of computer utilization and statistics; an understanding of aerodynamic fundamentals, aircraft propulsion, and performance; and some understanding of economics.

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

THESS OPTION

The thesis program involves satisfactory completion of the following requirements:

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

NON-THESIS OPTION

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

Research and Development Specialization
1. Twelve hours of 500-level courses in the major field of aviation systems.
2. Six hours in industrial engineering (engineering management).
3. Twelve hours of electives in the major field, mathematics or engineering.
4. 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.
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, Florida, Mississippi, Virginia, 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 only. E


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 major aviation regulatory agencies, organizational structure, administrative and enforcement procedures. Prereq: 501.

506 Aircraft Design (3) Design process, compromises of conflicting requirements, economical, industrial, 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.

559 Measurement Science I (3) (Same as Nuclear Engineering 588, Mechanical and Aerospace Engineering 588.)

589 Measurement Science II (3) (Same as Nuclear Engineering 588.)

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

MAJOR DEGREES

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

John W. Koontz, Head

Professors:
Bagby, R. M., Ph.D. ......................... Illinois
Carlson, J. G. (Emeritus) (Distinguished Prof.), Ph.D. .......... Pennsylvania
Chen, T.-T., Ph.D. ............. Florida
Churchich, Jorge E., Ph.D. .......... Sheffield
Handel, Mary Ann (Distinguished Prof.), Ph.D. .......... Kansas State
Jeon, K. W., Ph.D. .......... London
Joshi, J. G. (Emeritus), Ph.D. .......... Poona
Kennedy, J. R., Ph.D. .......... Iowa
Liles, J. N. (Emeritus), Ph.D. .......... Ohio State
MacCabe, J.A., Ph.D. .......... California (Davis)
Monty, Kenneth J., Ph.D. .......... Rochester
Roth, L. Evans, Ph.D. .......... Chicago
Salo, T. P. (Emeritus), Ph.D. .......... Michigan
Shivars, C. A., Ph.D. .......... Michigan State
Weich, H. G. (Emeritus), Ph.D. .......... Florida
Whitson, G. L., Ph.D. .......... Iowa
Wicks, Wesley D., Ph.D. .......... Harvard
Associate Professors:
Ganguly, R., Ph.D. .................................. Nebraska
Hall, J. C., Ph.D. ....................................... Illinois
Howell, Elizabeth E., Ph.D. ......................... Lehigh
Koontz, John W. (Liaison), Ph.D. .................. Kentucky
McKee, B. D., Ph.D. ..................................... Michigan State Roberts, Daniel M., Ph.D. ......................... California (Davis)
Serspea, Engin H., Ph.D. ............................. Hatcepe

Assistant Professors:
Bruce, Barry, Ph.D. ..................................... California (Berkeley)
Petersen, Cynthia B, Ph.D. ........................... LSU
Proser, R. A., Ph.D. ......................................... Illinois

REQUIREMENTS FOR ADMISSION

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

Otherwise superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the department's Graduate Recruiting Committee.

THE MASTER'S PROGRAM

1. Biochemistry and Cellular and Molecular Biology 511-12, 515-16, and 517.
2. Completion of course requirements as determined by the candidate's faculty committee.
3. Achievement of a 3.0 or better GPA in all courses taken for graduate credit.
4. At least 6 hours of advanced seminar courses from the following: 601 through 611.
5. Six hours of master's research and thesis.
6. A final examination that covers both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

1. Biochemistry and Cellular and Molecular Biology 511-12, 515-16 and 517.
2. At least two approved graduate courses in the life sciences or chemistry, or physics, or other physical science to be determined upon consultation with the mentor and the dissertation committee. No survey courses will be accepted.
3. At least 6 hours of topics offered in 615.
4. Participation in 601 and 603 during the entire period of residence. Participation in one other seminar or journal club each semester in residence.
5. Comprehensive examination, taken before the end of the third year of study.
6. A dissertation reporting the results of original and significant research carried out during the term of candidacy.
7. A final oral examination which will be concerned primarily with the student's dissertation.

Petitioning for Master's Degree

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

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

403 Advanced Genetics Laboratory (2) Experiments illustrating methods in modern genetics; techniques in classical, cytogenetic and molecular genetics. Model organisms, Drosophila and mouse. Prereq: General Genetics and Organic Chemistry.
410 Cellular and Comparative Biochemistry (4) Electroyte behavior, chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthesis; cell structure and function; protein synthesis, and biochemical genetics; regulation of biological processes. Prereq: Organic Chemistry and General Biology. 3 hrs and 1 discussion. F Sp
419 Cellular and Comparative Biochemistry Lab (2) Experiments with enzymes, nucleic acids, and membranes and organelles. Chromatography, kinetics, hybridization, sequencing, and immunological methods. Prereq or coreq: 410. F Sp
421 Cell and Tissue Structure and Function (4) Study of animal cells and tissues at light and electron microscope levels. Prereq: Cell Biology. 2 hrs and 2 labs.
449 Laboratory in Physiology (2) Prereq or coreq: 440 or 445.
465 Human Genetics (3) Genetic and molecular principles and problems of human inheritance. Prereq: General Genetics.
471-81 Biophysical Chemistry (3,3) Physicochemical principles with applications to biological systems. 471 Thermodynamics; chemical equilibrium; acid-base chemistry; transport; stereochemistry; kinetics; enzyme catalyzed reactions. 481-83 Elemental quantitative chemistry; interactions of light with biological molecules; optical and magnetic spectroscopy; light scattering; case studies of selected macromolecules. Prereq: Calculus, Organic Chemistry, General Biology or consent of instructor. (Same as Chemistry 471-81). F Sp
480 Physiology of Exercise (3) (Same as Exercise Science 480.)
Biomedical Sciences

(Office of the Vice Chancellor for Academic Affairs)

MAJOR

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

Raymond A. Popp, Director

Professor:

Ollins, Donald E., Ph.D. ..................... Rockefeller Popp, Raymond A., Ph.D. .............. Michigan

Research Professor:

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

Assistant Research Professor:

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

Shared faculty are drawn from the Oak Ridge National Laboratory.

The University of Tennessee--Oak Ridge Graduate School of Biomedical Sciences, located within the Biology Division of Oak Ridge National Laboratory, offers programs leading to the Master of Science and the Doctor of Philosophy. The National Laboratory is a well-known center of basic research. The school utilizes the staff and facilities of this laboratory and thus brings directly into the mainstream of full-time graduate study in the life sciences the talent and expertise 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 biochemical, biophysical, cancer research, genetics, cellular, developmental, and mammalian genetics, and radiation biology. Included are such subjects as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation and environmental biology, virology, developmental biology, experimental pathology, microbial and mammalian genetics, mutagenesis, structural biology, and genomic analysis.

ADMISSION REQUIREMENTS

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply. Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need preparation in biology, calculus, physics, and organic chemistry. 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:

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 equivalents: Biochemistry (511); Biophysical Biochemistry (514); Genetics (515); Advanced Protein Chemistry and Cellular Biology (512); Computing for the Life Sciences (525); and Survey of Statistical Methods (530).

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

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

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

5. Passing both written and oral comprehensive examinations.

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

7. A final oral examination on the dissertation.

8. A formal seminar or 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 needs 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 or their equivalents:

   Biochemistry (511); Biophysical Biochemistry (514); Advanced Protein Chemistry and Cellular Biology (512); plus the following courses:

   Genetics (515); Survey of Statistical Methods (530); or Computing for the Life Sciences (525).

   Additional credits may be obtained (6 to 15 hours) with electives.

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

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

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

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

6. Passing a final oral examination.

Graduate Courses

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or
coursework and performance. Students spend from three to five years working under the supervision of the student's committee. A written proposal is submitted, followed by a comprehensive examination or oral defense. The student subsequently presents a thesis, which is defended in an oral examination. The requirements for the thesis option consist of:

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 enrollment in Botany 500.
2. Satisfactory completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.
3. Satisfactory completion of two hours at the 600 level.
5. Presentation of a 30-minute departmental seminar.
6. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.

Non-Thesis Option

1. Satisfactory completion of 34 semester hours of approved graduate courses of which 30 semester hours must be in botany including Botany 503. At least two-thirds of the hours must be at the 500 level or higher.
2. Satisfactory completion of two hours at the 600 level.
3. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.
4. Satisfactory performance on a final written examination on all work offered for the degree. The student's committee may also require that an oral examination follow the written examination.

THE DOCTORAL PROGRAM

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

Requirements for successful completion of the Ph.D. are as follows:

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive examination.
3. Presentation of a written thesis and oral defense. The student's committee may require an oral examination follow the written examination.

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 enrollment in Botany 500.
2. Satisfactory completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.
3. Satisfactory completion of two hours at the 600 level.
5. Presentation of a 30-minute departmental seminar.
6. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.

Non-Thesis Option

1. Satisfactory completion of 34 semester hours of approved graduate courses of which 30 semester hours must be in botany including Botany 503. At least two-thirds of the hours must be at the 500 level or higher.
2. Satisfactory completion of two hours at the 600 level.
3. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.
4. Satisfactory performance on a final written examination on all work offered for the degree. The student's committee may also require that an oral examination follow the written examination.

THE DOCTORAL PROGRAM

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

Requirements for successful completion of the Ph.D. are as follows:

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive examination.
3. Presentation of a written thesis and oral defense. The student's committee may require an oral examination follow the written examination.

THE DOCTORAL PROGRAM

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

Requirements for successful completion of the Ph.D. are as follows:

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive examination.
3. Presentation of a written thesis and oral defense. The student's committee may require an oral examination follow the written examination.

THE DOCTORAL PROGRAM

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

Requirements for successful completion of the Ph.D. are as follows:

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 600.
2. Satisfactory performance on a written comprehensive examination.
4. Satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 302 or German 332.

5. Satisfactory completion of 6 hours at the 600 level (excluding dissertation).


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

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

MINOR IN ENVIRONMENTAL POLICY

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

GRADUATE COURSES

401-02 Field Studies in Botany (1-3,1-3) Field experience and taxonomy of special plant groups. Topics vary: botany, lichenology, pteridology, arboriculture, mycology, physiology, aquatic vascular plants, systematics, wetland plants, and botanical photography. May be repeated under different topic. Maximum 9 hrs.

403 Plant Evolution (3) Evolutionary biology from plant perspective. Specialization, hybridization, polyploidy, evolution of mating systems, phenotypic plasticity, comparison of characteristics of animals and plant systems. Lectures; paper discussions on primary literature; current research in evolutionary ecology and genetics. Prereq: General Botany or Biodiversity; Organization and Function of the Cell. (Same as Ecology and Evolution Biology 403.)

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

412 Plant Anatomy (3) Cells, tissues and organs: development in vegetative and reproductive structures of vascular plants—seed plants. Prereq: General Botany or Biodiversity; Organization and Function of the Cell or equivalent.

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organs: media preparation and maintenance of cultures. Prereq: General Botany or Biodiversity; Organization and Function of the Cell or equivalent and General Chemistry or equivalent. Recommended prereq: Botany 412: Plants: Evolutionary Survey; Introduction to Plant Physiology; Introduction to Microbiology and Lab: Plant Propagation; and Field and Forage Crops.

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

591 Mycology (4) Intensive survey of fungi, all major classes. Lectures, laboratory and field instruction. 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 on the University campus facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. SNC only. E

503 Non-Thesis Research (2) Library, field, or laboratory research to prepare for thesis. 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. Field and laboratory studies, identification, classification, experimentation. Prereq: 310 or consent of instructor. 3 hrs and 1 lab. F.A

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


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

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

544 Seminar in Botany (1) Readings and discussions of current literature and/or selected topics in botanical research. May be repeated. Maximum 6 hrs. SNC only.

580 Bryophytes and Pteridophytes (4) Taxonomy, physiology, ecology and development of the bryophytes and pteridophytes: field studies and current research. Prereq: 310-20 or consent of instructor. 2 hrs and 2 labs. F.A

582 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various research methods, International news gathering, editing and writing, new packages and student production. Prereq: 410 or consent of instructor.

570 Cable Television and Emerging Technologies (3) History and structure of cable television industry. Cable regulations and programing, entry of telephone companies in distribution video. Analysis of all relevant technologies; direct broadcast satellite, fibre optics cable, high definition television, and other technologies. Prereq: Introduction to Radio, TV and Cable Law or consent of instructor.


550 International Broadcasting (3) Broadcasting systems in other countries. Analysis of international broadcasting organizations. Interpersonal communication and international broadcasting. Development communications and international broadcasting. Prereq: Consent of instructor.

560 Radio & Television Law and Regulations (3) Legal problems faced by broadcast managers. Philosophy of regulatory policy formation. Efforts at self-regulation, Socio-political restraints, effects of laws and regulations, and public pressures on stations, networks, cable and new technologies. Unique situation of broadcasting among media in terms of regulations. Prereq: Consent of instructor or admission to program. F

570 Radio & Television Research (3) Various techniques used by stations and networks in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying research to management decision making. Prereq. Communications 512 or 516, or consent of instructor. So

580 Seminar in Radio and Television (3) Salient issues in broadcasting. Topics vary. International broadcasting, cable television, new technologies, corporate television, educational and public broadcasting, broadcast policy, and new technologies. Prereq: Consent of instructor or admission to program. May be repeated. Maximum 6 hrs. (Same as Information Sciences 581.) F

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

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

598 Internship (3) Full-time (30-40 hrs per week) work experience in news, production, or sales and management with a university-based organization. Educational experience beyond that available at university. Final term paper. No retroactive credit for previous work
Business Administration
(College of Business Administration)

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

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

To obtain application materials, write or call: Office of Graduate Business Programs, Suite 527, Stokely Management Center, College of Business Administration, The University of Tennessee, Knoxville, TN 37996-0552. Telephone: (423) 974-5033. For the executive program, telephone (423) 974-1680.

ACADEMIC COMMON MARKET

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

ACADEMIC STANDARDS

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

THE MBA PROGRAM

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

The MBA program consists of a common first-year core and a wide selection of second year concentration/elective courses. The first-year core develops a general management foundation upon which specialization is developed in the second year electives. The objective of the program is to develop leaders able to enhance the success of their organizations.

The program consists of two 15-credit-hour MBA core courses in the first year and 24 credit hours of concentration/elective courses in the second.

Admission Requirements

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

To be considered for admission, the applicant's file must be complete. A completed file includes a Graduate School Application, transcripts of college work, the MBA program application, two completed characters' recommendation forms, and the Graduate Management Admission Test (GMAT) score report. The first item should reach the Graduate School of Business 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, (2) the last two years of undergraduate work, (3) the GMAT, and (4) recommendations from professors and work supervisors. The admission decision is based on all factors which may make up the total application; therefore, there is no automatic cut-off for either grade point averages or GMAT scores. However, admission preference will be given to applicants with full-time work experience after obtaining the undergraduate degree.

Prerequisites

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

MBA Core

The MBA core consists of two 15-hour courses, one taken each semester. The courses are taught by the MBA core faculty in an integrated fashion and through a year-long simulation requiring students to learn the functional fundamentals (accounting, finance, management, marketing) when they need to apply them to solving a specific business problem. The topics introduced within this course follow three major themes: the functional fundamentals (learned within a cross-functional framework), the role of the firm in society (with attention to stakeholder value, economics, and the ethical/global 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 after completion of the first year. 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/elective 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
- Logics and Transportation Management
- Management Science
- Marketing
- New Venture Analysis and Entrepreneurship Statistics

The remaining elective courses must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the college. Courses outside the College of Business Administration as well as those 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:

- Coursework 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 paper in 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 it as a second concentration in addition to one of the traditional departmental concentrations. Students pursuing this concentration are also strongly encouraged to pursue an international or internationally related internship for the summer between their first and second years of study. Students are expected to participate in a foreign exchange or field experience if at all possible, especially for those with no previous foreign experience. Language training is advised but not required, and beginning language courses are not typically available for graduate credit.

The establishment of a new venture analysis and entrepreneurship is comprised of three specifically designed courses which are interdisciplinary in nature. This concentration strives to build a strong academic foundation for both entrepreneurial and intrapreneurial activities. The new venture analysis and entrepreneurship concentration is offered in recognition of the growing trend in American business today towards new product/venture development. The new venture analysis/entrepreneurship concentration courses may be combined with two elective courses in another area (management 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 Arts and Sciences. Students in this program take their first three years of coursework in Arts and Sciences, and their last two years in the College of Business Administration. Within their first three years, students fulfill all general education requirements for the BA degree, both upper and lower division along with a minor offered by one of the Arts and Sciences departments. They may use one Economics course only to fulfill distribution requirements, and they are required to take a year of calculus as the only prerequisite to the MBA.

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

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

Upon admission, students begin MBA coursework in the fourth year and are awarded a BA degree at the end of that year. Upon successful completion of the 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 a lawyer, or (b) contemplate a career in business management and want to acquire the skills and perspective of a lawyer, or (c) contemplate both a law specialization in business-related law and want to acquire the skills and perspective of the business-oriented manager.

Admission Requirements
Applicants for the J.D.-MBA program must make separate application to, and be competitively and independently accepted by, the College of Law for the J.D., The Graduate School and College of Business Administration for the MBA degree, and by the Dual Program Committee.

Students who have been accepted by both colleges may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both colleges. Such approval will be granted, provided that dual program studies be started prior to entry into the last 28 semester hours of J.D. coursework and prior to entry into the second year of the MBA program. Students interested in entering the dual degree program should submit a letter of application to the Dual Program Committee.

Upon receipt of the dual program 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. 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 a three-consecutive terms completed in one year. Each term requires two residence periods on campus alternating with a continuous program of reading, study, and on-the-job applications off campus. The off-campus work requires substantial and regular contact with program faculty and other participants and includes scheduled assignments to be carried out.

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

**Admission Requirements**

All participants begin and complete the program together within a 12-month period. Sessions begin in January of each year. Final deadline for applications is October 10 of the preceding calendar year. For applicants who wish to make plans early in the preceding year, there is an advance reservation deadline of August 1. International students and students whose native language is not English must meet special requirements for admission to The Graduate School of UT Knoxville, and they are advised to make inquiries well in advance of the program application deadline.

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

For admission to this program, primary consideration is given to the applicant’s work experience 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 first of which will be in some international venue. The third term is comprised of Executive Core III and Manage-
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 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, 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 in an undergraduate business class 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 individual instruction and close student-faculty interaction. Instruction takes the form of regular classes, doctoral seminars, and independent study and research. Students are also encouraged to attend lectures and discussions by visiting scholars throughout the year.

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

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

Doctoral Committee

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

Admission to Candidacy

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

Application for admission to candidacy must include listing of all courses taken in the fields required for the degree (business functional areas, basic disciplines, concentration and cognate areas). 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 do scholarly writing. The dissertation is supervised by the candidate's doctoral committee, which must certify its completion and acceptability after oral defense of the candidate's research effort.

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

GRADUATE COURSES

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

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

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

510 Management of Responsive Service Organizations (3) Management of organizations which respond...


561 Management Project I (3) Company project. Preliminary investigation of a strategic issue (new initiative, project or significant organizational change). Sponsors engage in on-site work with management. An innovative research proposal is written. Faculty will supervise the research work. Prereq: Admission to executive program of MBA and cooperation of sponsoring organization. Coreq: 551.

562 Management Project II (3) Company project. Continuation of 561. Analysis and presentation of research findings. Formats of the project report must be approved by the sponsoring organization. Faculty will supervise the work. Prereq: 561. Coreq: 552.

563 Management Project III (3) Company project. Continuation of 562. Completion of analysis and presentation of research findings. Formats of the project report must be approved by the sponsoring organization. Faculty will supervise the work. Prereq: 562. Coreq: 553.

593 Directed Independent Study (3) Cross-disciplinary topic of mutual interest to student and faculty. Available only by prearrangement with supervising faculty member. May require approval of Director of Graduate Business Programs. May be repeated. Maximum 6 hrs. S/NCR/letter grade.

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

Chemical Engineering

(College of Engineering)

MAJOR DEGREES

Chemical Engineering M.S., Ph.D.

Charles F. Moore, Head

Professors:

Bienkowski, Paul R., Ph.D. Purdue

Bogue, Donald C., Ph.D. Delaware

Counce, Robert L., Ph.D. North Carolina State

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

Cummings, Peter T., (Distinguished Scientist), Ph.D. Melbourne

Frazier, George C., Jr. (Condra Prof.), D.Eng. Johns Hopkins

Hansen, Marion G., Ph.D. Wisconsin

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

Hsu, Hsien-Wen (Emeritus), Ph.D. Wisconsin

Moore, Charles F. (Alumni Prof.) (Liaison), Ph.D.

Parona, Joseph (Emeritus), PE, Ph.D. Northwestern

Prado, John W. (University Prof.), PE, Ph.D. Minnesota

Associate Professors:

Brung, Duane D., Ph.D. Houston

Wang, Tse-Wei, Ph.D. MIT

Weber, Frederick E., Ph.D. Minnesota

Assistant Professors:

Frymier, Paul D., Ph.D. Virginia

Ketter, David J., Ph.D. Minnesota

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

THE MASTER’S PROGRAM

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

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


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

4. A final oral examination covering the thesis, related fields and graduate coursework.

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

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

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

3. A written 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 500 level courses.

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

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

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

GRADUATE COURSES

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


477 Honor Courses: Transport Phenomena (3) Momentum, heat and mass transfer processes, analogies, differential and macroscopic balances, applications involving molecular diffusion, simultaneous mass transfer and chemical reaction. Prereq: Mass Transfer and Separation Processes and consent of instructor.

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


486 Hydrocarbon Processing (3) Chemical and physical properties of selected petroleum and its processes utilized in conversion of raw material into various fuels and selected chemical feedstocks. Prereq: Mass Transfer and Separation Processes, Organic Chemistry.

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 if not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be counted toward degree requirements. May be repeated. S/NC only. E

505 Engineering Analysis (3) Formulation and solution of problems in chemical engineering and materials sciences, ordinary and partial differential equations; types of ODE, PDE and solution techniques; transform methods; conformal mapping; variational methods; introduction to numerical methods. (Same as Materials Science and Engineering 505.)

507 Application of Numerical Linear Algebra in Systems and Control Engineering (3) Fundamental concepts of linear algebra and implementation of solutions to systems and control areas. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of matrix, eigenvalue problems and similarity transformations in solving difference and differential equations. Numerical computational aspects of various algorithms. Application of linear algebra concepts in optimization, control and structural design. Computer projects. Prereq: Stand alone consent of instructor. (Same as Electrical Engineering 507.)

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


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 reaction, mass transfer operations in packed towers and agitated vessels, membrane separations. Equilibrium stage concepts applied to mass transfer operation, emphasizing nonthermal and multiphase transfer systems.

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

561 Process Modeling and Simulation (3) Theories and structures of models and art of simulation. Model development from basic principles. Model development from plant test. Use of models in operation, optimization and control. Prereq: Background in chemical engineering.

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

580 Technical Review and Assessment (3) Preparation of critical review of literature in areas related to chemical engineering. Limited to candidates in nonthesis option. Prereq: Consent of advisor.

581 Industrial Pollution Prevention (3) Principles and practical aspects of industrial waste minimization. Regulatory environment, waste minimization strategies, economic analysis, prudence, case study analysis, alternative waste minimization/management methodologies. Prereq: Graduate standing in engineering or consent of instructor. (Same as Environmental Engineering 581 and Engineering Science and Mechanics 585.)

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

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

600 Doctoral Research and Dissertation (3-15) Prereq: Ph.D. only. E

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

641 Advanced Diffusion Operations (3) Fixed and fluidized bed operations, development in separation processes. Prereq: 542.

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


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

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

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

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

**MAJOR DEGREES**

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

Michael Sepaniak, Head

**Professors:**

Adcock, J. L., Ph.D. .................. Texas
Alexandratos, S. D. (Hochest-Celanese Prof. of Polymer Science, Ph.D.) California
Baker, D. C., Ph.D. .................. Ohio State
Bartmies, J. E., Ph.D. ................. Northwestern
Bloom, J. E. (Emeritus), Ph.D. ........... Boston
Chambers, J. Q., Ph.D. ............... Kansas
Cook, K. D., Ph.D. .................. Wisconsin
Dean, J. A. (Emeritus), Ph.D. ........... Michigan
Eastham, J. F. (Emeritus), Ph.D. .......... California
Fletcher, W. H. (Emeritus), Ph.D. ....... Minnesota

**Assistant Professor:**

Guionchon, G. (Distinguished Scientist), Ph.D. ............... Ecole Polytechnic and Paris VI

Kabakia, G. W. (Robert H. Cole Prof., Distinguished Prof.), Ph.D. ............... Purdue

Kleinfeiler, D. C., Ph.D. ............... Princeton
Kovac, J. D., Ph.D. .................. Utah
Lietzka, M. H. (Emeritus), Ph.D. ........ Wisconsin
Magid, L. J., Ph.D. ................. Tennessee
Magid, R. M., Ph.D. ................. Yale
Pagni, R. M., Ph.D. .................. Wisconsin
Peterson, J. R., Ph.D. ............... California

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

Sepaniak, M. J., Ph.D. ............... Iowa State
Smith, W. T. (Emeritus), Ph.D. .......... Ohio State
VanHook, W. A. (Paul and Wilma Ziegler Prof.), Ph.D. ............... Purdue

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**Chemistry 73**

**Williamson, T. F. (Distinguished Prof.), Ph.D. ............... London**

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

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

**Associate Professors:**

Barnes, C. E., Ph.D. .................. Stanford
Feigere, C. S. (Liaison), Ph.D. .......... Colorado
Schell, F. M., Ph.D. .................. Indiana

**Assistant Professor:**

Badmim, M. D., Ph.D. ............... Massachusetts

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

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

Students majoring in Chemistry for the master's or doctoral degree are required to present as a prerequisite one year each of general, analytical, organic, and physical chemistry with a satisfactory record. At least one normal year of inorganic chemistry is also recommended. Students lacking any of these prerequisites may be admitted with appropriate deficiencies that must be removed without graduate credit. Applicants are required to take the general Graduate Record Examination. Students majoring in Chemistry are required to present as a prerequisite two years of chemistry including quantitative analysis.

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**THE MASTER'S PROGRAM**

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

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

1. Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 500.

2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)

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

4. Sufficient graduate coursework in chemistry (at the 400 level or above) and/or a related field to achieve a total of 30 hours, including one of the following sequences: 530-31-32, 550-51-52, 570-72-73, 590-94-95, or three courses from 510-11-12-20. At least 14 hours of this graduate coursework must be at the 500 level or above.

5. A final oral examination.

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**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 process and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Eighteen additional hours in courses at the 500 level or above including at least one course above 601 and one of the following sequences: 510-512, 550-531, 550-552-555-554, 570-71-72-73 and 590-94-95.
6. A final oral examination.

The Ph.D. program with concentration in chemistry 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 hours can be used to satisfy the 18 hours requirement in Item 5.

GRADUATE COURSES

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, bonding theories, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of molecular orbital theory, characterization, coordination and organometallic chemistry. Prereq: 230. Prereq or coreq: 380 or 381. Sp

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


471-81 Biophysical Chemistry (3.3) (Same as Biochemistry and Cellular and Molecular Biology 471-81.)

473-83 Physical Chemistry (3.3) Students may not receive credit for both 473 and 478 nor for both 481 and 483. 473-83: Principles of gaseous structure, second, and third laws of thermodynamics: chemical equilibria; simple phase equilibria; properties of solutions; introduction to statistical thermodynamics. Prereq: 230-50: Kinetics of chemical reaction: introduction to quantum mechanics and applications to electronic structure of atoms and molecules; molecular spectroscopy. Prereq: General Chemistry, Fundamentals of Physics, and Calculus III. F, Sp

479-89 Physical Chemistry Laboratory (2.1) Experiments on topics discussed in 471-81 or 473-83. Prereq or coreq: Corresponding courses 471 or 473 for 479 and 481 or 483 for 489. 1 lab. F, Sp

484 Advanced Physical Chemistry (3) Chemical dynamics, statistical thermodynamics, quantum mechanics of atomic and molecular systems, crystal structure and solid state. Prereq: 481 or 483. Sp

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

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or facility time before degree is completed. May not be used toward degree requirements. S/N/C only. May be repeated. Maximum 6 hrs. S/N/C only.

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 6 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 electrochemical 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. F

530 Chemical Bonding (3) Valence bond and molecular orbital theory, electronic structure, and molecular properties. Prereq: 1 yr of physical chemistry. F

531 Characteristics of Inorganic Compounds (3) Descriptive chemistry of elements, structure, reactions, kinetics, mechanisms, equilibria, and spectra of coordination complexes, organometallic, inorganic compounds. Prereq: 330. Sp

532 Experimental Methods of Inorganic Chemistry (3) Electron, infrared, Raman, microwave, NMR, ESR, nuclear quadrupole, Mossbauer, mass, and photoelectron spectrosopes for characterization of inorganic compounds. Prereq: 330. F

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

550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, stereochemistry, conformational analysis, 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, radial, and pericyclic reactions; reactive intermediates. Prereq: 550. Sp


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: 655. F

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

573 Chemical Kinetics and Transport (3) Time-dependent phenomena in chemistry: chemical kinetics, chemical dynamics, transport theory. Prereq: 1 yr of physical chemistry. 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: 510-11-12 or consent of instructor. May be repeated. Maximum 12 hrs.

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

650 Selected Topics in Organic Chemistry (3) Topics of current significance. Prereq: Two of 550-51-52 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: Two of 590-51-52 or consent of instructor. May be repeated. Maximum 12 hrs.

Child and Family Studies (College of Human Ecology)

MAJORS

DEGREES

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

Connie Steele, Head


Associate Professors: Allen, Jan, Ph.D. ............... Purdue Serghi, Deborah, Ph.D. .................. Oklahoma State Tegano, Deborah, Ph.D. ............... Virginia Tech

Assistant Professors: Groves, Melissa, Ph.D. ........ Virginia Tech Malia, Julia, Ph.D. .......................... Iowa State Morris, Lane, Ph.D. ...................... Tennessee

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

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

THE MASTER'S PROGRAM

An individual program of study may be designed by the student in collaboration with his or her major professor and committee. The program provides for a concentration in either child development or family studies.

The M.S. with a concentration in child development offers two tracks. Track 1 is designed to meet the needs of professionals who work in programs encompassing a variety of early childhood programs. Specializations in human services, early childhood education, early childhood administration, and family development. Thesis and non-thesis options are available for Track 1. Track 2 is designed for students seeking initial teacher licensure in early childhood education (pre-K through grade 3). This program provides an undergraduate degree in child development or equivalent coursework. A non-thesis option is available in Track 2.

Track 1 - All students in the child development concentration must enroll in Child and Family Studies 510, 540, and 571. At least 6 hours in a cognate area outside the department must be completed. Thesis students are required to take: 3 hours of 500-level research methods; 3 hours of 500-level statistics; 6 hours of CFS courses in an area of concentration; 6 hours of thesis credit, and an oral comprehensive examination. Non-thesis students are required to take: 3 hours of 500-level research methods, statistical methods, or interpretation of results and methodologies; CFS 564, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

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

THE PH.D. CONCENTRATION

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

Requirements include:
1. Minimum 10-13 credits in child and family studies required foundation courses: 510, 550, 570, 571 and 630 (child development area) or 634 (family studies area).
2. Minimum of 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;
7. College Professional Seminar, Human Ecology 610;
8. Minimum 8 credits of electives.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state basis. The M.S. in Child and Family Studies (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 wishes to attend on an hourly basis without earning credit. May not be used toward degree requirements. May be repeated. 'S/N only.
505 Development of Interpersonal and Supervision Skills (2) Refinement of interpersonal skills needed to work with families and other professionals. Supervisory training in the student's field. active listening, self-disclosure, relationship building, and negotiation.
510 Survey of Theory and Research in Child Development (3) Theoretical models and research literature in child development (concept through adolescence); application to research intervention and education. Prereq: 9 hrs of either upper division undergraduate or graduate social science or consent of instructor.
512 Survey of Research in Early Childhood Education (3) Current literature and issues in early childhood education. Prereq: 610 or equivalent or consent of instructor.
515 Children in Contemporary Society (3) Theory and research on environmental and developmental issues in contemporary family situations and educational environments for children from infancy through middle childhood. Implications for programs and policy.
520 Curriculum and Program Development in Early Childhood Education (3) Curriculum programming issues in early childhood education; description, analysis and evaluation of curriculum models; teaching methods, administrative style, and supervision of personnel. Experience in designing and evaluating early childhood programs for young children; special needs, infancy-age 8. Prereq or coreq: 510 or 512.
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.
522 Naturalistic Interventions for Parents and Teachers of Young Children (3) Common problems faced by parents and teachers; methods available to modify problem behavior. Prereq: 510 or equivalent or consent of instructor.
525 Seminar on Play (3) Comparison and contrast of theoretical framework and research methodologies on play and developmental perspective on play.
530 Families of Handicapped Children (3) Developmental nature of families' experiences in caring for handicapped children, especially during infancy and early childhood. Prereq: 510 or consent of instructor.
540 Parent-Child Relations (3) Influence of parents on children, influence of children on parents, reciprocal interaction between parents and children, assumptions of systems models, child abuse, and impact of divorce on children. Prereq: 550 or equivalent or consent of instructor.
550 Survey of Theory and Research in Family Studies (3) Use of family conceptual frameworks and application of theoretical models in research and family life programs.
552 Family in Contemporary Social Thought (3) Alternative conceptualizations of family in contemporary social thought. Variations of family construction by race, gender, and social class. Prereq: 550. F,A
555 Children, Divorce and Remarriage (3) Children's and adolescents' adjustment to transitions involved in parental divorce, single-parenthood, and remarriage. F,A
560 Marital Dyad (3) Communication, power, sexuality, marital stability, and marital satisfaction. Prereq: 550 or equivalent or consent of instructor.
563 Family Life Education Programs (3) Planning, implementing, and evaluating programs in marital, parent-child, and family relationships, and -
Civil and Environmental Engineering

(Majors of Engineering)

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

Gregory D. Reed, Head

Professors:
Bennett, R. M., Ph.D., P.E. ................. Illinois
Burdette, E. G. (Fred N. Peebles Prof.), Ph.D. ................. Illinois
Chatterjee, A., Ph.D., P.E. ................. NC State
Davis, W. T., Ph.D., P.E. ................. Tennessee
Deatherage, J. H., Ph.D., P.E. ................. Arizona
Drumm, E. C., Ph.D. ................. Illinois
Ghosh, M. (Goodrich Chair of Excellence), Ph.D. ................. Illinois
Goodpasture, D. W., Ph.D. ................. Michigan State
Greco, W. L. (Emeritus), Ph.D. ................. Michigan State
Heathington, K. W. (Emeritus), Ph.D. ................. Northwestern
Humphreys, J. B. (Emeritus), Ph.D. ................. Texas A&M
Johnson, H. L. (Emeritus), Ph.D. ................. Tennessee
Miller, W. A. (Granger Prof.), Ph.D. ................. Tennessee
P. E. .......... Georgia Tech
Reed, G. D. (Liaison), Ph.D., P.E. ................. Arkansas
Robinson, R. B. (Fisher Prof.), Ph.D. ................. Iowa State
Smoct, J. L., Ph.D., P.E. ................. VPI
Tschantz, B. A. (Condra Prof.), Sc.D., P.E. ................. New Mexico State
Walker, C. R. (Emeritus), M.S. ................. MIT
Wegman, F. J., Ph.D. ................. Northwestern

Associate Professors:
Choi, K. G., Ph.D. ................. Northwestern
Cox, C. D., Ph.D. ................. Pennsylvania
Hansen, J. H. (UTSI), Ph.D. ................. Missouri
Miller, T. L., Ph.D., P.E. ................. Tennessee
Richards, S. H., Ph.D., P.E. ................. Tennessee
Robinson, K. G., Ph.D. ................. VPI

Assistant Professors:
Han, L. D., Ph.D. ................. California
Jackson, N. M., Ph.D., P.E. ................. Oregon State
Mauldin, M., Ph.D. ................. California

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

THE MASTER'S PROGRAM

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

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

Civil Engineering

The Department of Civil and Environmental Engineering offers two options for the Master of Science with a major in Civil Engineering.

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

Non-Thesis Option: A minimum of 30 semester hours, including a 3-hour special research problem 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 major in Civil Engineering, normally a Bachelor's degree in a field of engineering is required. For a student who does not have an engineering background, the following minimum prerequisite courses will be required: Basic Engineering or Computer Science 101; Basic Engineering 121, 131; Engineering Science and Mechanics 231; Statistics 251; Civil Engineering 390, 395, 396; Mathematics 141, 142, 231, 241; Chemistry 120, 130. In general, these must be completed with a B average before courses for graduate credit can be taken.

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

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

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

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

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

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

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

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

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

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

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

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

MINOR IN ENVIRONMENTAL POLICY

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

ACADEMIC COMMON MARKET

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

Civil Engineering

GRADUATE COURSES

421 Portland Cement and Asphalitic Concrete (3) Aggregate properties and tests, tests of portland cement concrete, mix design methods for concrete and asphalt, concrete admixtures, tests of asphalt and asphalt mixes, and nondestructive testing. Prereq: 321, 2 hrs and 1 lab. 451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; application of various engineering principles and techniques to process of planning, locating and design of highway facilities; both geometric and pavement design. Prereq: 210, 251, 352.

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

453 Airport/Highway Planning and Design (3) Airport master planning and railroad engineering, runway configuration, airport design, curve geometry and traffic flow, and transportation systems. Prereq: 210, 251, 352.

541 Analysis of Framed Structures (3) Maximum stress due to moving loads; use of influence lines; lateral forces due to earthquake and storm; and design of structures. Prereq: Structural Analysis I.

546 Principles of Hydrogeology (3) Same as Geology 485.

490 Water Resources Projects Design (3) Coherent development of multiple-purpose reservoir and dam project, data acquisition, spillway and outlet control, software and gravity dam stability analyses, drainage and filters, maintenance and operation principles, and dam safety concepts. Prereq: 390, 395.

491 Urban Drainage Engineering (3) Coherent development of structures and cost control structures. Application of hydrologic and hydraulic principles to design of drainage systems for urban, strip mining, and highway development; design of inlet structures, ditches, culverts, and detention basins; application of commonly-used computer runoff models; evaluation of land-use on streamflow quantity and quality. Prereq: 390, 395.

495 Water Resources Development and Management (3) Principles of water resources project development, planning, and management. Institutional framework: water law, evaluation procedures for comparing and selecting among water resources development alternatives, multi-objective planning, principles of engineering economics, benefit-cost analysis, and cost allocation methods; environmental impact assessment procedures; decisions using risk-based methods; case studies. Prereq: Senior standing.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or equipment. Prereq: Graduate standing. May not apply toward degree. E

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


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 of geosynthetics. Prereq: Introduction to Soil Behavior.


534 Foundation Design (3) Design of foundation systems, both geologic and pavement design. Prereq: 210, 251, 352.

536 Analysis of Framed Structures (3) Maximum stress due to moving loads; use of influence lines; lateral forces due to earthquake and storm; and design of structures. Prereq: Structural Analysis I. Prereq: Structural Analysis II.


542 Construction Management II (3) Management of heavy and civil 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/hygiene safety. Prereq: Graduate standing.

552 Traffic Engineering-Operations (3) Signs, signals and markings; short-term operations; control; signal timing; street design; traffic signals and pedestrian facilities; traffic signal operations; identification and correction of high-accident areas and system deficiencies. Prereq: 551 or 452.

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

554 Urban Transportation Planning (3) Transportation planning in areas urban areas; systematic planning for identifying existing and future problems; traffic surveys and demand studies; evaluation of alternative planning/implementation tools; special topics: urban goods movement, transportation system management. Prereq: 352 and graduate standing.

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

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control programs; roadway 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: 551 and 456.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development plans. Analysis of relationships between various transportation modes and their interaction with other development plans. Prereq: 554 and graduate standing. Prereq: Graduate standing (Same as Planning 537.)
666 Reliability of Constructed Systems (3) Development of safety probability based design codes; Monte Carlo methods; constructed system reliability; evaluation of existing infrastructures. Prereq. 580, 585.

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

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

666 Reliability of Constructed Systems (3) Development of safety probability based design codes; Monte Carlo methods; constructed system reliability; evaluation of existing infrastructures. Prereq. 580, 585. Introduction to Structural Design or consent of instructor.

511 Behavior of Steel Bridges and Buildings (3) Behavior, analysis and design of steel bridges and buildings, with special emphasis on plastic design and other displacement methods; second order effects. Prereq. 571.

571 Behavior of Reinforced Concrete Beams and Slabs (3) Strength and behavior of statically indeterminate reinforced concrete beams and frames; limit analysis; behavior, analysis, and design of reinforced concrete slabs: yield-line theory, finite element solutions, and ACI Code Method. Prereq. 574.

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

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

Environmental Engineering

GRADUATE COURSES

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

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

504 Special Problems in Civil Engineering (3) Advanced problems of current interest. Prereq. Consent of instructor. May be repeated.

590 Special Topics (1-4) Problems and topics related to current developments in field. May be repeated. Maximum 6 hrs. S/NC only.

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

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

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

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

571 Behavior of Reinforced Concrete Beams and Slabs (3) Strength and behavior of statically indeterminate reinforced concrete beams and frames; limit analysis; behavior, analysis, and design of reinforced concrete slabs: yield-line theory, finite element solutions, and ACI Code Method. Prereq. 574.

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

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

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

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

590 Special Problems in Environmental Engineering (3) Advanced study of processes for hazardous waste site remediation: soil vapor extraction, soil washing, chemical decontamination, thermal destruction, bioremediation. Prereq. 556 or consent of instructor.

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

511 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. Prereq. 570.

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

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

575 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 575, Microbiology 575, and Agricultural Engineering 675.)

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

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

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

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

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

571 Behavior of Reinforced Concrete Beams and Slabs (3) Strength and behavior of statically indeterminate reinforced concrete beams and frames; limit analysis; behavior, analysis, and design of reinforced concrete slabs: yield-line theory, finite element solutions, and ACI Code Method. Prereq. 574.

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

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

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

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

590 Special Problems in Environmental Engineering (3) Advanced study of processes for hazardous waste site remediation: soil vapor extraction, soil washing, chemical decontamination, thermal destruction, bioremediation. Prereq. 556 or consent of instructor.

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

511 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. Prereq. 570.

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

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

575 Applied Microbiology and Bioengineering (3) (Same as Chemical Engineering 575, Microbiology 575, and Agricultural Engineering 675.)

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

620 Advanced Surface Water Hydraulics (3) Advanced topics in surface water hydraulics; solutions in St. Venant equations; unsteady flow; channel geometries; sediment transport and hydraulic jump; bed load transport. Prereq. 552. 2 hrs and 1 lab.

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.

561 Special Topics in Classical Civilization (1-3) Advanced tutorial work in Greek and Roman authors in English translation; problems in cultures of Greece and Rome. May be repeated. Maximum 6 hrs. Letter grade or S/NC.

Communications

(College of Communications)

MAJOR

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. In addition to the full-time program, the M.S. degree program is offered on an evening basis in Knoxville and via distance education at Chattanooga on the University of Tennessee at Chattanooga campus.

For application forms and other information about the M.S. and Ph.D. programs in Communications, write to: Associate Dean for Graduate Studies, College of Communications, 426 Communications Building, The University of Tennessee, Knoxville, TN 37996-0347.

ADMISSION REQUIREMENTS

Applicants must meet admission requirements of The Graduate School in addition to the following:

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. An internship in communications law is a prerequisite.

A student's internship experience requires approval by his/her advisor. Credit will be given through Advertising 596, Broadcast 596, or R. 596 on the basis of 3 hours of credit for the equivalent of 15 weeks of full-time professional experience. This credit is to be included in the hour requirements for the M.S. program. Previous professional experience will be evaluated by the student's committee.

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

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

THE DOCTORAL PROGRAM

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

The program is interdisciplinary, consisting of a required core curriculum and recommended coursework. The program is flexible and will accommodate a wide variety of career goals. New students may be
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Communications is available to residents of Arkansas, Kentucky or Louisiana, or residents of the states of Alabama, Georgia, or South Carolina. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

ACADEMIC STANDARDS

A student in the College of Communications whose graduate grade-point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate credit, will be placed on probation. A student on probation will be dropped from the program unless he or her cumulative grade-point average is 3.0 or higher at the end of the probationary period. The probationary period is defined as the next six 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.

GRADUATE COURSES

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

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 for the student's research, but may be used during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

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

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

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

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

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

552 Seminar in Health Communications (3) Problems, and issues of communication in health field. Media's reporting of health issues. Setting of media's "health agenda," the role of media in social marketing efforts; public communication of complex social/moral issues. Prereq: Consent of instructor.

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

560 Seminar in Communications Management (3) Organizational structure and functions of communications corporations: development of objectives, strategies, tactics. Analysis of financial statements and case studies. Prereq: Consent of instructor.

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

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

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

612 Fundamentals of Research (3) Universal research process from refining ideas and problems to reporting results. Causal inference and relative strengths of various research designs. Prereq: Consent of instructor or admission to program. S/NC only.

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; classroom testing and measurement; design of professional curricula, research and extension; program evaluation; grants and contracts in research. Prereq: Consent of instructor or admission to program. S

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

632 Mass Communications History and Historiography (3) Origins and development of mass media in America. Philosophy of history. Historical sources and their verifications. Synthesis and interpretation of data. Prereq: Consent of instructor or admission to program. S

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

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

642 Qualitative Research (3) Theory and application of qualitative research methods to social science and communications research. Theoretical considerations underlying symbiosis as a research strategy. Prereq: Consent of instructor or admission to program. Sp

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

660 Seminar in Communications Management (3) Organizational structure and functions of communications corporations: development of objectives, strategies, tactics. Analysis of financial statements and case studies. Prereq: Consent of instructor.

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

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

692 Seminar in Health Communications (3) Problems, and issues of communication in health field. Media's reporting of health issues. Setting of media's "health agenda," the role of media in social marketing efforts; public communication of complex social/moral issues. Prereq: Consent of instructor.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal
Comparative and Experimental Medicine

(Office of the Vice Chancellor for Academic Affairs)

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
Luzzio, C., M.D., Medical Biology
Potgieter, L. N. D. (Liaison), B.V.Sc.,Ph.D., Veterinary Teaching Hospital
Slauson, D. O., D.V.M.,Ph.D., Veterinary Teaching Hospital

The Comparative and Experimental Medicine degree program (M.S. and Ph.D.) is a 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 experimental pathobiology, infectious diseases, pharmacokinetics, epidemiology, clinical medicine, immunopathology, hematology, aberrant metabolism, oncology, and genetic diseases. The Ph.D. program is open to approved graduate students seeking training in this area and is especially useful for individuals with professional degrees. For the student with undergraduate biological science background, the Comparative and Experimental Medicine program provides an unusual opportunity to study disease processes common in humans and animals from a multidisciplinary perspective. The scope of this intercollegiate program, which pools faculty resources from both veterinary and human medicine, is broadened by faculty members representing animal science and numerous areas of the life sciences. The interdisciplinary training environment includes such diverse support as facilities and personnel at the Veterinary Teaching Hospital, UT Medical Center at Knoxville, the Oak Ridge National Laboratory, the Knoxville Zoological Park, the Hemophilia Clinic, Developmental and Genetic Center, Hematology and Oncology services, and departments of life sciences.

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

ADMISSION REQUIREMENTS

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

Master of Science Degree Program

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

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

Doctor of Philosophy Degree Program

Applicants generally will be expected to have a master's degree in one of the biological sciences and a Graduate Record Examination score of at least 1000 for the quantitative and verbal sections, or a professional degree in one of the medical sciences, (e.g., M.D., D.D.S., D.V.M.).

An individual having a baccalaureate degree with a strong background in the physical and biological sciences may be admitted upon presenting evidence of exemplary performance on the Graduate Record Examination.

Exceptional veterinary students at UT Knoxville may be admitted to the Comparative and Experimental Medicine graduate program but will be enrolled officially as veterinary students. During summers such students may take advantage of registering for graduate courses to be counted as elective courses in the veterinary program.

THE MASTER'S PROGRAM

All students must take at least 4 credit hours in 500- or 600-level courses in basic mechanisms of disease and at least 7 credit hours of 500-level biochemistry or cell biology. See listings under Biochemistry and Cellular and Molecular Biology program for information on these courses. In addition, students must complete a minimum of 8 hours of coursework in a specified discipline, 5 or more hours of molecular genetics, and 6 hours of Thesis 500. Exceptions to accommodate students with specific interests must be approved by the Joint Graduate Coordinating Committee after application, in writing, to the director.

The graduate committee (at least 3 members) is chosen after the first term and must include at least one member from the College of Veterinary Medicine and at least one member from the Graduate School of Medicine. If a minor is declared, one member must be from the minor discipline.

A final oral examination is given at the end of the program.

THE DOCTORAL PROGRAM

All students must take at least 4 credit hours in 500- or 600-level courses in basic mechanisms of disease and at least 7 credit hours of 500-level biochemistry or cell biology. See listings under Biochemistry and Cellular and Molecular Biology program for information on these courses. In addition, students must complete a minimum of 8 hours of coursework in a specified discipline. Exceptions to accommodate students with specific interests must be approved by the Joint Graduate Coordinating Committee after application, in writing, to the director. Areas of emphasis may include hematology, oncology, comparative pathology, comparative pharmacology, toxicology, immunology, genetics, infectious diseases, or biochemistry of disease. At least 24 hours of coursework, including a minimum of 6 hours at the 600 level, and 24 hours of Dissertation 600 are required for a total of 48 hours. For students with professional degrees, a minimum of 18 hours of coursework beyond the professional degree is required for a total of 42 hours.

The doctoral committee (at least 4 members) is chosen during the first year. Three of the four members, including the chair, must be approved by the Graduate Council. Students may conduct research. At least one member must be from the College of Veterinary Medicine and at least one member from the Graduate School of Medicine.

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

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

Comparative and Experimental Medicine--Graduate School of Medicine

GRADUATE COURSES

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

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

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

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

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

541 Molecular Basis for Metabolic Disease (4) Disease at the molecular level. Changes in molecular events in cells that lead to disease and occur as result of disease. Correlation with clinical and pathological states. Prereq: Biochemistry and Cellular and Molecular Biology 409-419 or equivalent. F,Sp

545 Clinical Genetics (3) Human genetic disorders: new developments in cytogenetics, molecular genetics, clinical diagnoses and prevention. Prereq: Biology and genetics background or consent of instructor.

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

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

611 Advanced Topics in Medical Science (1-3) New developments in biological research applicable to clinical medicine. Primarily for doctoral candidates in Comparative and Experimental Medicine. Prereq: Consent of
Comparative and Experimental Medicine--Veterinary Medicine

GRADUATE COURSES

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

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

501 Special Topics in Comparative and Experimental Medicine (1-4) Specialized experience in comparative and experimental medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

503 Predictive Toxicology (3) Principles and techniques of predictive toxicology: structure-activity relationships, expert systems, neural nets and molecular similarity. Sp, A

505 Laboratory Animal Care and Use (2) Review of basic laboratory animal care and use as prerequisite to conducting research using animal subjects. Compliance issues and techniques. F

506 Experimental Animal Surgery (3) Competence in performing humane surgical modifications of experimental animals. Techniques of anesthesia. Drug administration and postoperative care. Prereq: Embryology, parasitology, physiology and/or consent of instructor. 1 hr and 2 labs. F

530 Wildlife Diseases (2) (Same as Wildlife and Fisheries Science 530,) F, A

536 Toxicology (2) (Same as Veterinary Medicine 536,) F

538 Nutritional Aspects of Companion Animal Health (2) (Same as Animal Science 538,) F

545 Principles of Medical Science (2) (Same as Veterinary Medicine 545,) Sp

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

552 Anatomy of Domestic Carnivores (4) (Same as Animal Science 552,) F

554 Comparative Hematology (3) (Same as Animal Science 554,) Sp, A

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

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

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

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

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

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

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

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

608 Descriptive and Applied Epidemiology (2) Principles of epidemiology and application to diseases of animals. Host-agent relationships, measurement of disease frequency, animal production and disease monitoring and control, field investigations, international health economics. Prereq: Consent of instructor. F

609 Mechanisms of Disease (4) Advanced topics in pathobiology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, and recent advances in the study of normal and pathological responses of various cells, tissues, and organs to injury and other metabolic derangements. Prereq: Consent of instructor. 16 hrs. E

610 Advanced Topics in Comparative and Experimental Medicine (1-3) Specialized in-depth experience in various disciplines. Current and future research methodology, advanced techniques of analysis and interpretation, and applications to experimental medicine. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. E

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

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

613 Comparative Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Computer Science

(College of Arts and Sciences)

MAJOR DEGREES

Robert C. Ward, Head

Professors:

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

Associate Professors:

MacLennan, Bruce J., Ph.D. .......... Purdue
Vander Zanden, Bradley, Ph.D. ....... Cornell
Vose, Michael D., Ph.D. .......... Texas A&M

Assistant Professors:

Beck, Micah, Ph.D. ............... Cornell
Berry, Michael W., Ph.D. .......... Illinois
Gregor, Jens, Ph.D. ............. Aalborg (Denmark)
Jones, Mark T., Ph.D. .......... Duke
Plank, James S., Ph.D. .......... Princeton
Raghavan, Padma, Ph.D. ....... Penn State
Straight, David W., Ph.D. ........ Texas A&M

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 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 worked after earning a Bachelor's degree). The department reserves the right to contact these individuals or other knowledgeable people if additional information is deemed necessary or desirable.

2. The student is expected to have taken the GRE verbal and quantitative general test within
the past three years and to have these scores sent to The Graduate School.
3. The student should satisfy the same background requirements as for the master's program. See the departmental brochure for details.

Original research reported in a dissertation of high quality is emphasized. The minimum hour requirements are 24 hours of course 600 Doctoral Research and Dissertation and 24 hours of graduate courses beyond the equivalent of a master's degree (i.e., beyond 30 graduate credit hours) graded A-F. Computer Science 530, 550, and 580 are required for the degree. At least six hours of 600-level graded courses must be taken in computer science at UTK. The student's advisor and committee will establish the specific course requirements. The comprehensive examination consists of a departmental written examination and a subsequent oral examination conducted by the student committee.

GRADUATE COURSES

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

430 Advanced Topics in Hardware Systems (3) Architecture, computer design, system design, VLSI, computer organization, parallel processors, computer engineering, computer architecture, computer systems organization for serial and parallel architectures. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

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


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

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

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

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

476 Sparse Matrix Computations (3) Solution of large sparse linear systems: graph models, reordering techniques, symbolic factorizations, data structures, numerical algorithms, complexity analysis, parallel algorithms, numerical linear algebra.

480 Foundations (3) Finite automata and regular sets, context-free languages, formal languages and graph theory, and its applications. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

482 Advanced Topics in Theoretical Computer Science (3) Theory of computation, complexity theory, formal languages and graph theory and its applications. Faculty research. Prereq: Completion of core curriculum or consent of instructor. May be repeated. Maximum 9 hrs.

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

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

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

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

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

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


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


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


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

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

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

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

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

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

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

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

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

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


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

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

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

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

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

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

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

670 Advanced Topics in Numerical Mathematics (1-6) Prereq: Consistent of instructor. May be repeated with consent of department.
treatment models in schools, colleges, community agencies, businesses, and private-practice settings.

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

**ADMISSION REQUIREMENTS**

Admission requirements include up-to-date scores from the GRE, the unit admissions application form and letters of recommendation. For the doctoral programs, a writing sample is also required.

**GRADUATE COURSES**

410 Sex Role Development: Implications for Education and Counseling (3) Theories and research concerning development of person's sexual role and its relevance in educational and counseling settings. F, Su

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

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

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


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

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

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

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

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

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

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

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

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

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

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with individual clients. Prereq: Admission to program. 431, 525, 551 and consent of instructor. May be repeated. Maximum 9 hrs. E

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

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

561 Development and Operation of School Counseling Programs (3) Development 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

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

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

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


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

600 Doctoral Research and Dissertation (3-15) May be repeated. Maximum 12 hrs. S/NC only. E

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

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

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

650 Seminar in Counselor Education (1) Professional practice issues related to role and function of counselor-educator. Prereq: Admission to doctoral program in counselor education. May be repeated. Maximum 12 hrs. S/NC only. E

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

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

661 Education Implications of Neuropsychology (3) Theory and assessment. Common syndromes and their behavioral and cognitive manifestations. Prereq: 516; and 541 or equivalent individual assessment course; or consent of instructor. Sp

682 Applied Research Design (3) Planning of empirical investigations, collection of data, and drawing of inferences from evidence gathered. Prereq: Two-course sequence in statistics. F


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

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

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

674 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 135 clock hrs required each semester. Prereq: Admission to counseling psychology doctoral program, 555, and consent of instructor. F

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

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

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

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**Cultural Studies in Education**

(Doctor of Education)

**MAJORS**

**DEGREES**

Education ............................................ M.S., Ph.D.

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

**Professors:**

- Allison, C. B., Ph.D. ................................... Oklahoma
- DeSensi, J. T., Ed.D. .................................. North Carolina (Greensboro)
- Howard, Robert (Emeritus), Ph.D. ............... Ohio State
- Malik, Anand, Ed.D. ................................. Columbia
- Mead, B. J., Ph.D. ..................................... Purdue
- Morgan, W. J., Ph.D. .................................. Minnesota
- Paul, Joan (Liaison), Ed.D. .......................... Alabama
- Bowers, Marjorie G. (Emeritus).......................... Iowa
- Wieland, Richard, Ed.D. ............................. Wayne State
- Wixom, C. A., Ph.D. .................................... Michigan

**Assistant Professor:**

- Wright, Handel K., Ph.D. ............................. Toronto

The Cultural Studies in Education unit participates in graduate programs leading to degrees, majors, and concentrations in: Master of Science Education Social foundations

Human Performance and Sport Studies Motor behavior/sport psychology

**Sociocultural foundations of sport**
goals and processes in education. Differing historical events during formative periods. Role of women and minorities. Structure, influential personalities, and sport governance.

History of American Education (3)
Changing during formative periods. Role of women and minorities. Structure, influential personalities, and sport governance.

History of Games
Modern Olympics, 1896 to date: political, social, and cultural context. Ancient Olympics 776 BC to 393 AD: Panhellenic Games. Examination of various aspects of ancient and modern athletic competition. The main charge of the unit is to examine critically the social practices, institutions, "helping" agencies, and other social sites where disenfranchised and marginalized groups struggle for greater control over their futures.

Graduate Courses

500 Thesis (1-15) Only P/NP. A thesis 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. E

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practice required within a field. Prerequisite: Doctoral research and dissertation. 3 hours. S/NC or letter grade. E

502 Registration for Use of Facilities (3) 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. E


505 History of Olympics: Ancient and Modern (3) Examination of various aspects of ancient and modern athletic competition. Ancient Olympics 776 BC to 393 AD: Panhellenic Games. Modern Olympics, 1896 to date: political, social, and cultural context. Development of structure, influential personalities, and sport governance during formative periods. Role of women and minorities.


514 Advanced Philosophy of Sport (3) Major philosophical theories of sport: liberal, democratic, and Marxist. Thematic, aesthetic, and social-political issues.

515 Social Theories of Sport (3) Liberal, democratic, and Marxist social theories of sport. (Same as Sociology 564.)

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

539 Development of Education Thought (3) Historical and philosophical approaches to education. Plato, Quintilian, Comenius, Rousseau, Pestalozzi, Froebel, Dewey. Prerequisite: Graduate status and consent of instructor. E/S

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

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

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

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

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


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/S

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

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

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

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

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

600 Doctoral Research and Dissertation (3-15) Only. S/NC or letter grade. E

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

604 Seminar in Curriculum and Instruction (3-15) Only. S/NC only. E

607 Advanced Seminar in the Social Foundations of Education (4) Interdisciplinary team-taught seminar. Readings selected by faculty and participants from classic studies and current periodical literature in anthropology, sociology, history, and philosophy of education. Part of general core for Ph.D. program. Prerequisite: Doctoral student in Education.

608 Seminar in Philosophy of Education (3) Selected philosophical issues in education. Prerequisite: 2 courses in history or philosophy of education. May be repeated with consent of instructor. E

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

633 Advanced Motor Behavior (3) In-depth analysis, synthesis, and discussion of contemporary theory and research; development and application of motor control learning, sport psychology, motor development. May be repeated. Maximum 9 hrs.

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

652 Advanced Studies in Educational Anthropology (3) Field research and analysis of specific issues in cultural anthropology and educational anthropology. May be repeated. Maximum 9 hrs.

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

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

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

Ecology and Evolutionary Biology
(College of Arts and Sciences)

MAJOR

DEGREES

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

A.C. Echternacht, Head W.O. Smith, Associate Head

Professors:
Bunting, D. L., Ph.D. ............ Oklahoma State
Burghardt, G. M., Ph.D. .......... Chicago
DeCourcey, G. M., Ph.D. .......... Minnesota
Echternacht, A. C., Ph.D. ........ Kansas
Etnier, D. A., Ph.D. ............ Minnesota
Gavrilovets, S. T., Ph.D. ....... Moscow State
Greenberg, N. B., Ph.D. ....... Rutgers
Gross, J. L., Ph.D. .............. Cornell
Hallam, T. G., Ph.D. ............ Idaho
Harris, W. F., Ph.D. ............ Tennessee
Kot, M. Ph.D. ................. Arizona
Maxson, L. R., Ph.D. ........... California (Berkeley); San Diego State
McCormick, J. F., Ph.D. ......... Emory
McCracken, G. F., Ph.D. ........ Cornell
Pan, M. L., Ph.D. .............. Pennsylvania
Pimm, S. L., Ph.D. ............. New Mexico State
Riehert, S. E., Ph.D. ........... Wisconsin
Sayer, G. S., Ph.D. ............ Idaho
Schultz, T. W., Ph.D. .......... Tennessee
Simberloff, D. (Gore Hunger Chair of Excellence), Ph.D. ....... Harvard
Smith, W. O., Ph.D. ............ Duke
Stacey, G. Ph.D. ............. Texas
Vaughan, G. L., Ph.D. .......... Duke

Associate Professors:
Abumomt, C. C., Ph.D. ......... Colorado
Boake, C. R. B., Ph.D. .......... Cornell
Delcourt, H., Ph.D. ............. Minnesota
Driebe, J. A., Ph.D. ............. Purdue
Fox, D. J., Ph.D. ................ Johns Hopkins
Gittleman, J. L., Ph.D. ........ Sussex (UK)

Assistant Professors:
Cruzan, M. B. C., Ph.D. ......... SUNY (Stony Brook)
Pigliucci, M., Ph.D. ............. Connecticut

Research Assistant Professor:
Grejsmeier, J. M., Ph.D. ........ Alaska

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

The Department of Ecology and Evolutionary Biology offers the Master of Science and Doctor
of Philosophy degrees with a major in Ecology or Zoology; concentrations in behavior, ecology, environmental toxicology, and evolutionary biology.

**REQUIREMENTS FOR ADMISSION**

Applications are accepted once a year. The deadline for receipt of all application materials is February 15th. Applicants may be considered if all application materials are received by that date. Applicants are expected to have established an academic background consistent with a Bachelor's degree in one of the life sciences. They are expected to have completed a minimum of one year of general biology, two years of chemistry including one year of general chemistry, one year of physics, and one year of college-level calculus. Occasionally, applicants who are highly qualified otherwise but lack one of these courses or course sequences will be admitted with the expectation that the deficiency will be made up within the first year of graduate study. Applications are required to submit scores from the Graduate Record Examination (GRE) and successful applicants will usually have a composite score on the verbal, mathematical and analytical sections of the GRE of at least 1500. Submission of scores on appropriate (e.g., biology, mathematics) advanced GRE examinations are recommended but not required. Applicants are also expected to have an overall grade-point average of at least 3.0, and 2.7 or above for all science and mathematics courses, on a 4.0 scale (successful applicants will usually have grade-point average well above these minimal requirements).

Applicants are recommended to contact the Graduate School to make a program of study in ecology and evolutionary biology. The Graduate School requires that the applicant's suitability for graduate work in biology and a statement of professional goals and reasons for applying to this program. Applicants for the doctoral degree are expected to have made prior contact with potential research advisors in the department's graduate program and this approach is recommended for applicants for the Master's degree program as well. Inquiries should be directed to the Chair, Graduate Affairs Committee, Department of Ecology and Evolutionary Biology. The University of Tennessee, Knoxville, TN 37996-1610.

**THE MASTER'S PROGRAMS**

In addition to general requirements of the Graduate School, aspirants for the Master of Science degree are expected to: (1) upon completion of the first semester in residence, take a prescriptive diagnostic examination covering major concepts in ecology and evolutionary biology. The examination may be taken twice and must be passed before the student is admitted to candidacy; (2) complete course requirements as determined by the department and the student's faculty dissertation research committee; and (3) satisfactorily complete and defend a research thesis.

**THE DOCTORAL PROGRAMS**

In addition to general requirements of The Graduate School, aspirants for the Doctor of Philosophy degree are expected to: (1) during the first semester in residence, take a prescrip-
Economics

(College of Business Administration)

MAJORS

DEGREES

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

William F. Fox, Head

Professors:

Bohm, Robert A. (Liaison), Ph.D. ............ Washington (St. Louis)
Browley, Roger L. (Emeritus), Ph.D. ........ Texas (St. Louis)
Carroll, Sidney L., Ph.D. ....................... Harvard (St. Louis)
Cheng, Hui S., Ph.D. ............................ Vanderbilt (St. Louis)
Clark, Don P., Ph.D. ................................. Michigan State
Cole, William E. (Emeritus), Ph.D. ......... Texas (St. Louis)

Travis, Paul C. (J. Fred Holly Chair of Excellence), Ph.D. .................. Pennsylvania
Fox, William F., Ph.D. .............................. Ohio State
Garrison, Charles B., Ph.D. ..................... Kentucky
Herzog, Henry W., Ph.D. ........................... Maryland
Jensen, Hans E. (Emeritus), Ph.D. ............. Texas (St. Louis)

Lee, Yung-Yao, Ph.D. ................................. Michigan State
Mayhew, Anne, Ph.D. ................................. Texas
Mayo, John W., Ph.D. ................................. Washington (St. Louis)
Moore, John R. (Distinguished Prof.) ................................. (Emeritus), Ph.D. ............ Cornell

Neale, Walter C. (Emeritus), Ph.D. .............. London
Russell, Milton, Ph.D. ................................. Oklahoma
Schlotman, Alan M., Ph.D. ............................ Washington (St. Louis)
Spiva, George A. (Emeritus), Ph.D. ............. Texas

Associate Professors:

Gaiger, Jean A., Ph.D. ............................... Iowa State
Glissot, Errol, Ph.D. ................................. Stanford
Kahn, James R., Ph.D. ................................. Maryland
Murray, M. N., Ph.D. ................................. Syracuse

Assistant Professors:

Bates, Peter M., Ph.D. ............................... Virginia
Farmer, Amy L., Ph.D. ............................... Duke
Rush, Jonathan D., Ph.D. ............................. California (Davis)
Stango, Victor O., Ph.D. ............................. California (Davis)
Stanley, Denise L., Ph.D. ............................. Wisconsin

The Department of Economics offers graduate programs leading to the M.A. and Ph.D. The M.A. may be completed by either a thesis or non-thesis option, while the Ph.D. requires successful completion of a dissertation. Applicants to these programs should contact the Director of Graduate Studies, Department of Economics, for further information. The Department also offers an area of concentration for the MBA degree. Students interested in the MBA program should contact the Director of Graduate Business Programs, College of Business Administration.

ACADEMIC STANDARDS

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

STUDENT’S RIGHT TO PETITION

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

THE MASTER’S PROGRAM

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

The non-thesis option requires 30 hours of coursework at the 400 level or above. Of these, at least 24 hours (at least 18 hours of which are in economics) must be at the 500 level or above. Of the remaining 18 hours in economics at the 500 level or above, 12 hours must consist of 511, 512, and 513, and the remaining 6 hours must be in one of the following: Economics of poverty, Economics of inequality, or Economics of crime.

Of the 30 hours, a minimum of 9 hours in courses approved by the department may be taken in fields other than economics. Students electing the non-thesis option are required to pass a final comprehensive examination.

The thesis option requires 30 hours of coursework at the 400 level or above, including at least 24 hours at the 500 level or above, 6 hours of which may be thesis hours. Of the remaining 18 hours at the 500 level or above, at least 15 hours must be in economics and must include 511, 512, 513, and 514. A maximum of 6 hours may be in an area other than economics.
specific field may be taken a third time only with approval of the department.
3. Students are required to complete with a grade of B or better two elective courses in economics at the 500 level or above, outside the core subject areas and outside the fields of specialization.
4. Students are required to complete a doctoral dissertation and to defend it successfully before the faculty.

MINOR IN ENVIRONMENTAL POLICY

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

Students may request admission to the minor following admission to a graduate program in one of the participating departments. In good standing in one of these programs may apply for admission to the minor in environmental policy. The coordinating committee will consider the admission of interested students. Applicants should have a background in both natural and social sciences evidenced by prior coursework or experience.

One course in environmental studies from the student's major discipline and one course in quantitative methods are required. These requirements may be fulfilled before or after admission to the minor. All students admitted to the minor will be required to register for at least three hours of Economics 579, Environmental Policy Research Workshop, and to complete successfully the following:
1. Ecology and Evolutionary Biology 520 or Plant and Soil Science 414 or Geography 453 or an equivalent course approved by the coordinating committee.
2. Six hours of coursework outside the major discipline approved by the coordinating committee.

Doctoral students seeking a minor in environmental policy must also complete, in addition to above, a policy-relevant dissertation approved by the coordinating committee.

BUSINESS ADMINISTRATION CONCENTRATION

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

MBA Concentration: Economics

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

GRADUATE COURSES

400 Special Topics (3) Topics vary. 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 policy. Benefits and costs of development. Major writing requirement. Prereq: Intermediate Macroeconomics or consent of instructor.
415 History of Economics (3) (Same as History 415.)
The College of Education offers the Master of Science, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees in cooperation with eleven individual units:

- Counselor Education and Counseling Psychology (CECP)
- Cultural Studies in Education (CSE)
- Education in the Sciences, Mathematics, Research and Technology (ESMRT)
- Exercise Science (ES)
- Holistic Teaching/Learning (HTL)
- Inclusive Early Childhood Education (IECE)
- Language, Communication, and Humanities Education (LCHE)
- Leadership Studies in Education (LSE)
- Psychoeducational Studies (PES)
- Rehabilitation, Deafness, and Human Services (RDHS)
- Sport and Physical Activity (SPA)

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

For admission, most programs require current scores from the GRE general section, and all require a unit application form and letters of recommendation as indicated on the chart of Majors and Degree Programs. For additional information about the various programs of study and admission, write to the Graduate Center in the College of Education, CA 213, The University of Tennessee, Knoxville, TN 37996-3400, tel. (423) 974-0906, www.utk.edu/advising/advising.html.

**The Master's Programs**

**College Student Personnel** Students who major in College Student Personnel (LSE) are prepared to enter the field of student personnel administration in colleges, universities, and community or junior colleges.

The program has both a thesis and non-thesis option. A minimum of 36 hours, which includes 6 hours of practicum experience, is required in either option. Students must complete a minimum of 12 hours in Higher Education courses.

**Counseling**

The master's degree with a major in Counseling offers concentrations (with abbreviated unit designations) in:

- Community counseling (CECP)
- Rehabilitation counseling (RDHS)
- School counseling (CECP)

The program includes thesis and non-thesis options. The concentration in community counseling requires completion of 36 hours of coursework plus supervised practicum and internship experiences working with clients. The concentration in rehabilitation counseling is fully accredited by the Council on Rehabilitation Education, Inc. and requires 54 semester hours, including internship. A minimum of 12 hours of Rehabilitation, Deafness and Human Services courses is required. The concentration in school counseling requires 48 hours of coursework, including supervised practicum and internship experiences working with clients. A final examination is required of all students.

**Education**

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

**Track 1 - Concentrations (with abbreviated unit designations) are available in:**

- Art education (LCHE)
- Curriculum (ESMRT)
- Early childhood special education (IECE)
- Education of the deaf and hard of hearing (RDHS)
- Elementary education (HTL and IECCE)
- English education (LCHE)
- Foreign language/ESL education (LCHE)
- Instructional media and technology (ESMRT)
- Mathematics education (ESMRT)
- Modified and comprehensive special education (HTL)
- Reading education (HTL)
- Science education (ESMRT)
- Social foundations (CSE)
- Social science education (HTL)

The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. The non-thesis option requires the completion of 35 hours of coursework (56 hours for special education concentrations). Both options require a minimum of 12 hours in the major discipline (18 hours for special education concentrations).

**Track 2 - Concentrations (with abbreviated unit designations) are available in:**

- Art education (LCHE)
- Early childhood special education (IECE)
- Education of the deaf and hard of hearing (RDHS)
- Elementary teaching (HTL and IECCE)
- Modified and comprehensive special education (HTL)

The thesis option requires completion of 36 hours, plus 6 hours of Thesis 500 for a total of 42 hours. The non-thesis option requires 36 hours, including 24 hours of prescribed licensure coursework and 12 hours in the academic discipline as approved by the student's committee.

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

**Educational Psychology**

The master's degree with a major in Educational Psychology is offered with concentrations (with abbreviated unit designations) in:

- Adult education (PES)
- Individual & collaborative learning (PES)

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

**Human Performance and Sport Studies**

The master's degree with a major in Human Performance and Sport Studies offers concentrations (with abbreviated unit designations) in:

- Exercise science (ES)
- Motor behavior/sport psychology (CSE)
- Sociocultural foundations of sport (CSE)
- Sport administration (SPA)

Both programs include thesis and non-thesis options. The non-thesis option requires 32 hours, including a project, and a course in research design or an approved specialized research class. The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. Both options require a minimum of 12 hours of sport studies, exercise sciences, or sport administration courses.

**Leadership Studies in Education**

The master's degree program with a major in Leadership Studies in Education offers a concentration in educational administration and supervision (LSE), requiring a minimum of 30 hours, including 6 hours of Thesis 500, for the thesis option, or 33 hours for the non-thesis option.

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

**The Specialist in Education Program**

The Educational Specialist degree program with a major in Education encompasses concentrations (with abbreviated unit designations) in:

- Curriculum (ESMRT)
- Educational administration & supervision (LSE)
The Doctor of Education Program

The Ed.D. program with a major in Education is available in the following concentrations (with abbreviated unit designations):

- Adult education (PES)
- Curriculum (ESMRT)
- Educational administration and supervision (LSE)
- Educational psychology (Collaborative learning) (PES)
- Educational research (ESMRT)
- Elementary education (HTL)
- English education (LCHE)
- Exercisescience (ESMRT)
- Foreign language/ESL education (LCHE)
- Higher education (LSE)
- Instructional media and technology (ESMRT)
- Mathematics education (ESMRT)
- Reading education (HTL)
- Science education (ESMRT)
- Social science education (HTL)

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

The concentrations in adult education and educational psychology require the completion of a minimum of 69 hours beyond the baccalaureate degree. Coursework is required in statistics and research design. Comprehensive examinations in the concentration, supporting specialization, and cognate areas, as well as an oral examination on the dissertation, are required.

The requirements for the concentrations in educational administration and supervision and higher education are determined on an individual basis by each student's doctoral committee.

Coursework requirements include a 6-9 hour cognate within the college and a 6-9 hour minimum external to the college. Additional course requirements include completion of two consecutive semesters of Leadership Studies in Education 604 during residence. Though an internship is highly recommended, it is not required. A foreign language requirement is at the discretion of the committee. An alternative residency, which includes a two-year, on-campus, continuous enrollment in LSE 606, Leadership Forum, is available for qualified students.

THE DOCTOR OF PHILOSOPHY PROGRAM

The intercollegiate Ph.D. program with a major in Education provides seventeen concentrations. The units participating in the Ph.D. program are Counselor Education and Counseling Psychology; Cultural Studies in Education; Education in the Sciences; Mathematics, Research, and Technology; Exercise Science; Holistic Teaching/Learning; Inclusive Early Childhood Education; Language, Communication, and Humanities Education; Leadership Studies in Education; Motor Behavior/Sport Psychology; and Rehabilitation/Deafness, and Human Services.

The program requirements are:  

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Minimum Hours</th>
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<tbody>
<tr>
<td>Research Area</td>
<td>15</td>
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<tr>
<td>Foreign or Computer Language (demonstrate proficiency)</td>
<td>6</td>
</tr>
<tr>
<td>General Core Requirements</td>
<td></td>
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<tr>
<td><strong>Option A</strong></td>
<td></td>
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<tr>
<td>—History and philosophy of education, (both areas must be represented)</td>
<td>4</td>
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<tr>
<td>—Learning theory and curriculum (both areas must be represented)</td>
<td>4</td>
</tr>
<tr>
<td>—Administrative/Leadership theory</td>
<td>2</td>
</tr>
<tr>
<td>—Trans-college seminar: two consecutive semesters</td>
<td>2</td>
</tr>
<tr>
<td><strong>Option B</strong></td>
<td></td>
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<tr>
<td>—Philosophy of education</td>
<td>3</td>
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<tr>
<td>—History of education</td>
<td>3</td>
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<tr>
<td>—Administrative theory</td>
<td>3</td>
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<tr>
<td>—Learning theory</td>
<td>3</td>
</tr>
<tr>
<td>—Curriculum theory</td>
<td>3</td>
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<tr>
<td>—Trans-college seminar: two consecutive semesters</td>
<td>2</td>
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<tr>
<td><strong>Option C</strong></td>
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<tr>
<td>—Philosophy of science</td>
<td>3</td>
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<tr>
<td>—Trans-college seminar: two consecutive semesters</td>
<td>2</td>
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<tr>
<td>—Seminar(s) in primary concentration</td>
<td>3</td>
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<tr>
<td>—Learning theory/group dynamics or independent study in this area</td>
<td>3</td>
</tr>
<tr>
<td><strong>Concentrations</strong></td>
<td></td>
</tr>
<tr>
<td>—Primary Concentration: A minimum of 15 hours normally selected from one or two specializations within the primary concentration</td>
<td>15</td>
</tr>
<tr>
<td>—Supporting Concentration: A minimum of 9 hours selected from a concentration other than the primary concentration</td>
<td>9</td>
</tr>
<tr>
<td>—A minimum of 6 hours selected from outside the college in addition to the designated research courses</td>
<td>6</td>
</tr>
<tr>
<td>—Dissertation</td>
<td>24</td>
</tr>
</tbody>
</table>

The guidelines for each program may be consulted for further requirements.

**TEACHER LICENSURE**

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

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

| Fall Semester | 574 Analysis of Teaching for Professional Development | 2 hrs | 575 Internship | 4 hrs | 576 Specialty Studies | 6 hrs | 90 Education | 1 |
Further details concerning the teacher licensure program and the Track 2 master's degree program are available through the College of Education Graduate Center (Claxton Addition, Room 211).

MINOR IN GERONTOLOGY

Graduate students in the units of Counselor Education and Counseling Psychology, Exercise Science, Foreign Language/ESL Education, sports, or Psychoeducational Studies, may pursue a specialized minor in gerontology. This interunit/interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Counseling is available to residents of Alabama (concentration in rehabilitation counseling only). The M.S. program in Education is available to residents of the states of Kentucky (concentration in education of the deaf and hard of hearing only). The M.S. program in Human Performance and Sport Studies is available to residents of Arkansas, or Georgia or South Carolina (concentration in motor behavior/sport psychology only) and Alabama, South Carolina, or Virginia (concentration in sport administration only). The Ph.D. program in Education is available to residents of the state of Arkansas (concentration in counseling psychology, educational administration and supervision/neger education, educational psychology, or school psychology). Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

510 Advanced Educational and Clinical Procedures (3-6) Integration of advanced educational and clinical procedures; skills and knowledge for implementing instruction and for consulting with other persons in treatment of exceptional individuals. May be repeated. Max. 6 hrs.

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

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

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

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

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

574 Analysis of Teaching for Professional Development (2) Strategies to develop the analysis of teaching. Prereq: Consent of Ph.D. program coordinator. May be repeated. Maximum 12 hrs. S/NC only. E


576 Practicum in Classroom Teaching (1-8) Teaching and teaching-related experiences in elementary and secondary school settings. Specific hours and school level assignment determined by licensure or certification requirements. May not be used toward degree requirements. May be repeated. Maximum 12 hrs. S/NC only. E

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

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

601 Trans-College Seminar (1) Introduction to Ph.D. program in Education: research requirements, meaning of scholarship in academe and issues/problems in education. Minimum of two consecutive semesters preceding or followed by summer term required of all Ph.D. students. Prereq: Admission to Ph.D. program or consent of Ph.D. program coordinator. May be repeated. Maximum 3 hrs. May not be used to meet 600 requirement. S/NC only.

618 Interpretation and Application Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction and instruction and instructional technology. Prereq: Consent of instructor. F

635 Teacher Education in America (3) For students preparing to enter teacher education. Brief historical development, program analysis and evaluation, current issues, and future directions. F

Education in the Sciences, Mathematics, Research, and Technology

DEGREES

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

574 Analysis of Teaching for Professional Development (2) Strategies to develop the analysis of teaching. Prereq: Consent of Ph.D. program coordinator. May be repeated. Maximum 12 hrs. S/NC only. E


576 Practicum in Classroom Teaching (1-8) Teaching and teaching-related experiences in elementary and secondary school settings. Specific hours and school level assignment determined by licensure or certification requirements. May not be used toward degree requirements. May be repeated. Maximum 12 hrs. S/NC only. E

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

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

601 Trans-College Seminar (1) Introduction to Ph.D. program in Education: research requirements, meaning of scholarship in academe and issues/problems in education. Minimum of two consecutive semesters preceding or followed by summer term required of all Ph.D. students. Prereq: Admission to Ph.D. program or consent of Ph.D. program coordinator. May be repeated. Maximum 3 hrs. May not be used to meet 600 requirement. S/NC only.

618 Interpretation and Application Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction and instruction and instructional technology. Prereq: Consent of instructor. F

635 Teacher Education in America (3) For students preparing to enter teacher education. Brief historical development, program analysis and evaluation, current issues, and future directions. F

Education in the Sciences, Mathematics, Research, and Technology

GRADUATE COURSES

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

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

496 Teaching Science Grades 7-12 (3) Methods, materials, recent trends in science and environmental education programs for secondary schools. Prereq: Admission to teacher education. F

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or for faculty time before degree is completed. May not be used
507 Introduction To Data Processing in Curriculum and Instruction (3) Analysis of current activities in educational computerization and data processing. Curricular, instructional, research, and classroom management applications from microcomputers to super computers. Prereq: Consent of instructor. E


601 Seminar in Mathematics Education (3) Current issues influencing instruction in mathematics in elementary and secondary schools. Related teaching methodologies. Opportunities for work on special problems. Prereq: 485 or equivalent.


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

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

696 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.

### Electrical Engineering

#### (College of Engineering)

**MAJOR DEGREES**

**Electrical Engineering**

- M.S., Ph.D.
- R.C. Gonzalez, Head

Professors:

- Alexell, Igor (Emeritus), PE, Ph.D., M.S., Ph.D., Tennessee
- Bailey, T. Milton, Ph.D., Michigan State
- Birdwell, T. Don, Ph.D., MIT
- Bishop, A. O., Jr., Ph.D., MIT
- Blalock, T. Vaughn, Ph.D., Tennessee
- Bose, Bimal K., Pe, Ph.D., Georgia Tech
- Boyd, Donald W., PE, Ph.D., Vanderbilt
- Buchanan, Richard A., PE, Ph.D., Georgia Tech
- D. Penley, Ph.D., Vanderbilt
- Fish, John L., Ph.D., M.S., Ph.D., Chicago
- Green, Walter L., Ph.D., Florida
- Hung, James C., Distinguished Prof., PE, Ph.D., New York
- Kennedy, Eldredge J., Ph.D., M.S., Ph.D., Tennessee
- Lawler, Jack S., Ph.D., M.S., Ph.D., Chicago
- Leffel, W. O., Ph.D., M.S., Ph.D., Tennessee
- Neff, Herbert P., PE, Ph.D., Auburn
- Pace, Marshall O., Ph.D., Georgia Tech
- Pierce, J. Frank (Distinguished Prof.), PE, Ph.D., Pittsburgh
- Roberts, M. J., Ph.D., Vanderbilt
- Roth, J. Reece, Ph.D., Florida
- Symonds, Frederick W., Ph.D., M.S., Ph.D., Ohio State
- Tillman, James D. (Emeritus), Ph.D., M.S., Ph.D., Auburn
- Weaver, Charles H. (Emeritus), PE, Ph.D., Wisconsin
The Department of Electrical Engineering and the Department of Nuclear Engineering jointly offer a master's degree program in the field of fusion energy. Students may have the option of pursuing a master's degree in the field of fusion energy, including those who have earned degrees at U.S. institutions. Specific departmental requirements for the Ph.D. include the following:

1. A Master of Science or Master of Engineering degree.
   a. A minimum of 24 semester hours of work in electrical engineering courses at the 500 and 600 levels.
   b. A minimum of 9 semester hours of 600-level coursework. At least 3 semester hours of this work must be in an area other than the student's major area.
   c. A minimum of 12 hours of mathematics courses approved by the Electrical Engineering Graduate Committee. All 12 hours must be 400-level or above, and at least 6 hours must be at 500-level or above.
3. Three foreign language proficiency tests. A knowledge of a foreign language is crucial to the student's research efforts.
4. Satisfactory performance on both the qualifying and comprehensive examinations.
5. Participation in departmental seminars.

Many of the electrical 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 Engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. programs. No 400-level course may be used toward a graduate degree in Electrical Engineering except when required by the program.

400 Senior Design (5) Major design project focusing on professional practice, accumulated background of curricular components, and recent developments in field. Prereq: Completion of required junior EE courses.

411 Digital Signal Processing and Filter Design (3) Discrete time signals and systems, sampling, discrete Fourier transforms, analog filter characteristics, nonrecursive and recursive filter design, and CAD tools for filter design and experiments on projects. Prereq: Frequency-Domain Analysis of Signals and Noise, Linear Systems Analysis, Systems and Power Lab.


432 Electronic Amplifiers (4) Feedback amplifier principles: wideband versus low-pass designs; audio power amplifier design; linear regulated power supply design and switching regulator design principles. Implementation of radio frequency amplifier design; oscillator principles. Laboratory experiments and design projects. Prereq: 431.

441 Digital Communication (3) Discrete Fourier transform, binary and M-ary signaling, digital communication in presence of noise, matched filtering and equalization, introduction to information theory. Prereq: Analog Communication Amplitude and Frequency Modulation.

442 Communication System Design (4) Application of communication theory to system design. Development of communication system. System simulation utilizing a graphical programming language, hardware and software design and simulation. Construction and performance evaluation of a complete analog or digital transmitter and receiver or significant sub-systems. Prereq: 441.

443 Antennas and Propagation (3) Linear antennas, arrays, other simple antennas. Antenna gain, impedances, communication link parameters. Wave propagation in earth bound free space, earth’s troposphere and ionosphere. Reflections from earth, effects on link reliability. Prereq: Transient Analysis, Fields, Analog Communication Amplitude and Frequency Modulation.

444 Microwave Circuits and Electronics (3) Scattering wave description of circuits: isolators and amplifiers, couplers and power dividers, circulators, phase shifters. Loading and interconnection of systems. Power generation and amplification and transmission and solid state and hybrid) design techniques. Microwave switching, filtering, and multiplexing devices, Transmission line and waveguide components, Projects. Prereq: Senior standing.


463 Physics of Fusion Energy (3) High temperature plasma physics relevant to fusion plasmas, principles of fusion reactors, and engineering and physics constraints on fusion reactor design. Prereq: Senior standing. Non-majors require consent of instructor. (Same as Nuclear Engineering 463.)

464 Fusion Technology (4) Principles and phenomenology of tokamak reactors, alternate magnetic confinement schemes, magnetic mirror, stellarator, tokamak, stellarator, fusion reactor design studies. Design project integrating material in 463 and 464. Prereq: 463 or equivalent. (Same as Nuclear Engineering 464.)

465 Principles of Industrial Plasma Engineering (3) Plasma physics and technology relevant to industrial applications of plasmas. Basic principles of kinetic theory, electrodynamics, and plasma physics; sources of electrons, ions, and ionizing radiation; DC electrical discharges and sources; RF plasmas and plasma sources. Prereq: Senior standing.

466 Applications of Industrial Plasma Engineering (4) Plasma treatment of surfaces; ion interactions with solid surfaces; plasma depositions and etching; plasma processing; plasma chemistry; electrical breakdown, switchgear, and corona; plasma lighting devices; application of electron and ion beams in microelectronics and research and development plasma systems. Prereq: 465. Consent of instructor. (Same as Nuclear Engineering 465.)


472 Introduction to Digital Image Processing (3) Basic methods for digitizing, storing, processing, and displaying images. Information procedures for image enhancement, restoration, edge detection, and segmentation. Prereq: Senior standing. Non-majors require consent of instructor.


490 Special Topics (3) Recent developments and current practice. Prereq: Senior standing.

491 Special Topics (3) Basic design and current practice. Prereq: Completion of all junior electrical engineering courses or consent of instructor. May be repeated. Maximum 3 hrs.

495 Senior Seminar (1) Current topics. Prereq: Completion of all junior Electrical Engineering courses or consent of instructor. S/NC or letter grade.

500 Thesis (1-15) PNP 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 Modern Transform Methods (3) Frequency-domain transform methods, relevant fundamentals of complex variables theory. Applications to transform, its inversion with residues, and its relation to the Fourier transform and series. Sampling theory. Two-sided z-transform and linear invariant systems. The discrete Fourier transform and its inversion by residues. The discrete Fourier transform and its application to frequency spectrum. Spectral analysis as applied to response of systems to random signals.

504 Random Process Theory for Engineers (3) Probability and random variable as approached by set theory. Statistical averages and transformations of random variables. Random processes, stationarity, correlation functions and temporal analysis, power spectrum and spectral analysis as applied to response of systems to random signals.

505 Digital Signal Processing (I) (3) Discrete-time signals and systems, fourier transform, discrete-time filters, and fast convolution, design of FIR filters and IIR filters.

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


511 Linear Systems Theory (3) State space models of linear dynamical systems, linear algebra, state transition matrix, matrix exponential, controllability, observability, realization theory, and stability theory. Prereq: 502.

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


519 Control Systems Design II (3) Digital control, variable structure control, state-space design of SISO systems, use of estimators and observers, comparison of classical and state-space methods of control system design, considerations for control system instrumentation. Prereq: 518.


523 Power Electronics and Drives (3) Forced commutated inverters, alternating current inverters, current-fed inverters, direct drive system modeling, vector control of induction machines, parameter variations, control principles of synchronous machines.


531 Advanced Analog Electronics I (3) Physical operation of modern electronic devices: semiconductor devices, bipolar and field effect transistors, insulating and MOS-FETs, Small-signal equivalent circuits and noise models of active devices. Project laboratory. Prereq: 431, 432, 435, or consent of instructor.


541 Electromagnetic Fields (3) Maxwell’s equations, special relativity, wave reflection and transmission, generalization and special case solution of wave equations. Prereq: Math 404.


545 Introductory Microwave Networks and Components (3) Matching and transmission for lumped and distributed microwave networks. Component and system parameter measurements by modern network analyzers. Electronic oscillators and amplifiers, frequency conversion, microwave filters, microwave antennas, time delay lines, parametric devices, mixers, switches.


552 Digital System Design II (3) State identification and state determination of digital systems. Design of digital system architecture design; microprogramming and interrupt control. Prereq: 551.

561 Plasma Diagnostics I (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high-background plasmas.
624 Electrical Insulation (3) Principles, testing, and case studies. Basic principles of dielectric losses, charging, conduction, and breakdown in vacuum, gas, liquid, solid, and composite insulation systems. Testing with low- noise instrumentation, pulse height analysis, optics, acoustics, and bridging. Associated statistics and distributed parameter effects. Case studies drawn from active research, power systems, electronic circuits and devices, shielding, and stress grading. Prereq: 503, 504, and consent of instructor.

631 Advanced Topics in Electronic Instrumentation I (3) Based on particular interests of students. Fundamental physical processes in instrumentation transducers: thermoelectric, magnetic/electric, electromechanical and quantum-mechanical devices. Prereq: 531-32 and consent of instructor.


643 Detection and Estimation Theory (3) Detection theory, coding theory, system identification. Signals with unknown parameters; optimal filter synthesis, adaptive systems; sequential detection; suboptimal detection. Prereq: 634 or consent of instructor.

644 Coding and Information Theory (3) Structure of algebraic and probabilistic codes. Linear codes, convolutional codes, error-correcting codes, decoding methods, identification schemes: deterministic, stochastic, and hierarchical methods. Prereq: 643.

651 Computer-Aided Design of VLSI Systems I (3) Fabrication of microelectronic devices; computer architecture design; algorithmic state machines; partitioning; structured design methodologies. Prereq: 551-2 or consent of instructor.

652 Computer-Aided Design of VLSI Systems II (3) Computer-aided design tools; design and implementation of custom very large scale integrated (VLSI) circuits; design for testability, testing of fabricated chips. Prereq: 651.

663 Advanced Plasma Physics I (3) Basic concepts of high-temperature plasma physics. Magnetic hydrodynamics, geometry, density, size, and structure. Prereq: Physics 541-2, 461-2 or 563-4, or consent of instructor. (Same as Physics 663.)

664 Advanced Plasma Physics II (3) Plasma heating and radiation phenomena. Advanced topics of current interest. Must be taken in sequence. Prereq: 663.

671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, autonomous systems. Prereq: 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereovision, shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning, and navigation. Prereq: 672.

691 Advanced Graduate Seminar (1-3) Research in department. May be repeated. S/NC or letter grade. Prereq: 692 Special Topics (1-3) Advanced topics of current interest to Ph.D. students in Electrical Engineering. May be repeated. Maximum 9 hrs.

632 Advanced Power Electronics and Drives (3) Phase-controlled, cycloconverters, cycloconverter-fed ac drives, resonant converters, vector and scalar control of synchronous machines, static Kramer drives, static Scherbius drives, VSCF generation, modern control theory in ac drives.
The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. Thesis and non-thesis options are available for the M.A. as well as a special concentration in writing.

Detailed information about the master's and doctoral programs, and about individual graduate courses, may be obtained by writing 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 500-600 level (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 6 hours for graduate credit at any level, including the 400 level. In this coursework, students must maintain at least a 3.0 GPA.

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

Language Requirement: Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:

1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT Knoxville with a grade of B or better.
3. Passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.

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 in 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 10 English courses at the M.A. level at the proper level. Of the courses in writing, at least 3 hours must be taken at the 500 level; additional 500-level courses are strongly recommended.

Writing Projects: One of the following writing projects for six hours of credit:

1. A thesis, usually 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. (of which at least 24 semester hours must be beyond the M.A.) to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above. Of the 30 hours of 593 Independent Study required for the non-thesis student, 3 must be taken at the 500 level or above. Of the 6 hours of additional coursework, at least 3 must be taken at the 500 level or above. Of the 30 hours of coursework, at least 9 must be taken in English language courses with grades of B or better, at least three of which must be taken in 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 300 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. 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 related areas.

Residence Requirement: Two consecutive semesters as a full-time student. For students not on teaching assistantships, full-time consists of 9 or more hours of coursework and/or dissertation hours each semester. For students on assistantships, full-time consists of at least 6 hours of courses and dissertation hours and 3 hours of teaching each semester.

GRADUATE COURSES

Note: Students enrolling in English graduate courses must first register in the office of the Director of Graduate Studies in 306 McClung Tower.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.

402 Chaucer (3) Reading and analysis of Canterbury Tales and Troilus and Criseyde in Middle English.

404 Shakespeare I: Early Plays (3) Shakespeare's dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night; English histories, including Henry IV; and early tragedy, including Hamlet.

405 Shakespeare II: Later Plays (3) Shakespeare's dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from great tragedies, including Othello; problem plays, including Measure for Measure; and dramatic romances, including The Tempest.
406 Renaissance Drama (3) English theatre between 1590 and 1640 through reading of representative plays by Shakespeare's contemporaries: Marlowe, Webster, Jonson.

409 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of sixteenth century authors: Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.

410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of seventeenth century: poetry of Milton, Donne, Marvell; and prose of Browne, Bacon, Walton.

411 Literature of Restoration and Early Eighteenth Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1745.

412 Literature of Later Eighteenth Century: Johnson to Burns (3) Survey of English literature and culture from 1745 to 1800.

413 Restoration and Eighteenth-Century Genres and Modes (3) A major genre or literary mode: drama, novel, poetry, non-fiction prose, satire, romance, or epic, written between 1660 and 1800. May be repeated.

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

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

416 Victorian Poetry and Prose I (3) Tennyson, Pre-Raphaelites, Carlyle, Newman, and Mill.

417 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskins, Darwin, and Wilde.

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

421 Modern British Novel (3) Lawrence, Joyce, and Woolf.

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

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

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

433 American Realism and Naturalism (3) Literature from the Civil War to World War I to present.

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

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


441 Southern Literature (3) Southern writing from colonial period through twentieth century: frontier humorists, local color writers, and Southern literary renaissance.

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

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

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

452 Modern British and American Drama (3) O'Neill's works as precursors to modern dramatists: Williams, Miller, Albee, and representatives of Black theater, Bulgins and Baraka.

453 Continental Drama (3) Selection of plays (in English translation) by major European writers from late Renaissance to present: twentieth-century achievement.

454 Twentieth-Century International Novel (3) Joyce, Camus, Kafka, Nabokov.

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

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

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

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

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

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

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

471 Sociolinguistics (3) Study of language in relation to society. Empirical and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 471 and Sociology 471.)

472 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 472.)

474 Teaching English as a Second or Foreign Language (3) Major issues surrounding teaching ESL/EFL: political/cultural, teaching ESL/EFL, introduction to second language acquisition; learner variables in language learning; traditional and innovative approaches to ESL/EFL: basic features of American English grammar necessary for teaching ESL. Prereq: Second year of foreign language or consent of instructor. (Same as Linguistics 474.)

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

476 Second Language Acquisition (3) How humans learn second languages. Theoretical models and research: differences between first and second language acquisition; learner variables; socio-cultural factors; and implications for second language instruction. (Same as Linguistics 476.)

479 Literary Criticism (3) Historical survey of major works of literary criticism.

480 British and American Ballad and Folk Tale (3) Popular ballads and folktales of English, Scottish, and North American tradition.

481 Studies in Folklore (3) Topics vary. May be repeated with different topics. May be repeated. Maximum 6 hrs.

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

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

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

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

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

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

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

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

496 Rhetoric of Legal Discourse (3) Application of basic principles of persuasive writing to legal materials. Issue identification and argument through written position papers, briefs, and memoranda. Critical reading and discussion. Introductory research techniques. No prior legal knowledge necessary. Prereq: Advanced Expository Writing or consent of instructor.

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

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

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

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

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

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

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

513-14 Readings in Medieval Literature (3) Reading and analysis of selected masterpieces of Old and Middle English literature and their Continental sources in Modern English.

520-21 Readings and Analysis in Selected Areas of Literature: Seventeenth- and Eighteenth-Century Prose, Poetry, and Drama (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

530-31 Readings in English Literature of the Restoration and Eighteenth Century (3,3) Topics vary: genre, theme, literary movement, or other coherent emphasis.

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

550-51 Readings in American Literature from the Colonial Period to the Present (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

552 Readings in Black American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis.
Entomology and Plant Pathology

560-561 Readings in Twentieth-Century Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.
575 Introduction to Contemporary Criticism (3) Introductory survey of twentieth-century literary criticism from New Criticism to present.
580 Fiction Writing (3) Advanced fiction projects under supervision of instructor and time for independent study. Prereq: Extensive background in reading and writing fiction. May be repeated, Maximum 6 hrs.
581 Colloquium in Poetry Writing (3) Major poetic project or continuation of project begun in 483. Individual consultation with instructor supplementing class analysis; readings in contemporary poetry and theory. Prereq: 483 or consent of instructor. May be repeated. Maximum 6 hrs.
582 Special Topics in Writing (1-3) Topics vary. May be repeated. Maximum 6 hrs. Enrolment by consent of director of graduate studies only.
583 Special Topics in Literature (3) Topics vary: genres, modes, and other literary subjects not in standard period divisions.
585 Issues in Invention, Style, and Audience (3) Theoretical perspectives on the contemporary in rhetoric and composition.
586 History of Rhetoric I (3) Survey of rhetoric from Sophocles to Ramanus.
587 History of Rhetoric II (3) Survey of rhetoric from Bacon to present.
588 Readings in Applied Rhetoric (3) Content varies: Writing across curriculum, writing centers, technical communication, text linguistics.
590 Topics in Critical Theory (3) Topics vary.
591 Foreign Study (1-15) See College of Arts and Sciences.
592 Off-Campus Study (1-15) See College of Arts and Sciences.
593 Independent Study (1-15) See College of Arts and Sciences.
594 Film History, Rhetoric, and Analysis (3) Film as narrative art form: historical development of film; the "rhetoric" of film; critical approaches to film study; genre, auteur, formalist, and historical; critical analysis of individual films.
600 Doctoral Research and Dissertation (3-15) P/NP only. E
610 Studies in Old English Language and Literature (3) Old English grammar with readings in prose and poetry. F.A
611 Studies in Beowulf (3) Translation and critical study of Beowulf. Prereq: English 610 or consent of instructor. Sp.A
620 Studies in Medieval English Literature (3) Seminar in literature and literary genres of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year.
621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer's writings. Prereq: Previous course in Chaucer.
640-41 Studies in Restoration and Eighteenth-Century Literature (3,3) Topics vary: Swift, satire, Restoration literature, Johnson and Boswell, Addison and Steele, Restoration drama, Dryden.
650 Studies in English Romanticism (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
651-52 Studies in Victorian Literature (3,3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.
660-61/62 Studies in American Literature (3,3,3) Southern literature before 1830, frontier, regionalism, women's literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawtrey, Melville, Whalin, Dickinson, James, and Twain.

Entomology and Plant Pathology

(Majors in Agricultural Sciences and Natural Resources)

MAJOR

Entomology and Plant Pathology

DEGREE

M.S.

Carroll J. Southards, Head

Professors:

Bernard, Ernest C., Ph.D. ............. Georgia
Gerhardt, Reid R. (Liaison), Ph.D. .... NC State
Hilty, James W. (Emeritus), Ph.D. .... Ohio State
Hessayon, Leander F. (Emeritus). . . . Ph.D.
Lambdin, Paris L., Ph.D. .................. Clemson

Southards, Carroll J., Ph.D. .......... NC State

Associate Professors:

Grant, Jerome F., Ph.D................ Clemson
Gwinn, Kimberly D., Ph.D. .......... NC State
Reddick, Bradford B., Ph.D. ....... Clemson
Windham, Mark T., Ph.D. ............ NC State

Assistant Professor:

Owlnley, 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 crop entomology, medical and veterinary entomology, insect biology, insect pest management, or biological control. Students in plant pathology may specialize in fungal and stem fungus diseases, soilborne pathogens, disease physiology, biocentric control, plant nematology, or virology. 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 of The University of Tennessee Graduate School and must have completed (1) general botany or biology, 8 hours; (2) advanced biological sciences, 8 hours; (3) general inorganic chemistry, 6-8 hours; (4) organic chemistry, 3 hours. In addition, three completed rating forms and a written statement of career goals and interest in entomology or plant pathology are required.

Degree Requirements

The program requires a written thesis based on original research and the completion of a minimum of 24 hours of coursework for graduate credit, approved by the student's advisory committee. Included in the course requirements are two acceptable seminar presentations for 1 hour each. An oral final exam must be passed to the satisfaction of the advisory committee after the thesis has been completed. A minor is not required but may be selected at the option of the student. The minor will include at least 6 hours and not more than 10 hours of graduate-level credit in the minor department. The student's committee shall include a member of the faculty from the minor department to assist in designating courses required for the minor.

Graduate Courses

410 Diseases and Insects of Ornamental Plants (2) Symptoms, identification, and management of diseases and insect pests that affect plants in greenhouse, nursery, and landscape environments. Prereq: Plant Pathology or Economic Entomology or consent of instructor. Sp.A
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-19) Required for the student not otherwise registered during any semester when student uses University facilities and for faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E
510 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant pathogenic fungi. Identification of plant pathogenic fungi. Prereq: 313 or consent of instructor. 3 hrs and 2 labs. (Same as Ornamental Horticulture and Landscape Design 511.) F.A
512 Soilborne Plant Pathogens (3) Causal agents, host-plant-soil environment interactions, epidemiology, and biological, cultural, and chemical control. Prereq: Plant Pathology or consent of instructor. 2 hrs and 1 lab. F.A
514 Bacterial Plant Diseases (4) Morphology, taxonomy, ecology, physiological, and genetics of bacterial plant pathogens; infection and disease development, pathogenesis and resistance; diagnosis, detection, effect of environment, and management of bacterial plant diseases; beneficial plant-bacterial interactions. Prereq: Plant Pathology or consent of instructor. 3 hrs and 1 lab. F.A
515 Physiology of Plant Disease (3) Biochemical and physiological events involved in host-pathogen interactions. Mechanisms of disease resistance. Prereq: Introductory plant physiology and pathology, or consent of instructor. F.A
520 Plant Parasitic Nematodes (4) Morphology, taxonomy, ecology, and management of plant parasitic nematodes, host-parasite relationships. Prereq: 6 hrs biological science or consent of instructor. 2 hrs and 2 labs. Sp.A
521 Plant Virology (3) Symptomatology, epidemiology, and management of virus infection; structure, morphology, replication, transmission, purification, characterization, and classification of plant viruses; reservoirs; plant pathogenic viruses, mycoplasmas and spiroplasmas. Prereq: 313 or consent of instructor. 3 hrs and 1 lab. Sp.A
523 Field Crop and Vegetable Insects (3) Identification, biology and management of insects affecting commercial vegetable and home garden crops. Prereq: 321 or basic entomology course. 1 hr and 1 lab. F.A
Exercise Science

Exercise Science (College of Education)

MAJORS

DEGREES

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

W. Liemohn, Leader

Professors:

Capen, Edward K. (Emeritus), Ph.D. .... Iowa
Howley, Edward T., Ph.D. ....................... Wisconsin
Kozar, Andrew J., (University Prof.), Ph.D. Michigan
Liemohn, W. P., Ph.D. ............................. Iowa
Namey, D. M., M.D. ............................. Washington (St. Louis)
Rickett, Ian R. H., Ph.D. ........................ Brown
Walch, Hugh (Emeritus), Ph.D. ................. Florida

Associate Professor:

Bassett, David R., Jr., Ph.D. ..................... Wisconsin

Assistant Professors:

Thompson, Dixie, Ph.D. ............................ Virginia
Zhang, Songning, Ph.D. ............................... Oregon

The Exercise Science unit participates in graduate programs leading to degrees, majors, and concentrations: Master of Science in Human Performance and Sport Studies Exercise science

Doctor of Philosophy

Education

Exercise science

See Education under Fields of Instruction for full description of all degree requirements.

The unit promotes and integrates scientific research, education, and practical applications of exercise science to maintain and enhance health, fitness, performance, and quality of life. The unit offers an undergraduate major in Exercise Science that will prepare students for careers in fitness and provide the science-based background needed for application to graduate programs in exercise science, physical therapy, rehabilitation, public health, exercise psychology, and training.

ADMISSION REQUIREMENTS

Applicants are required to complete the unit applications which will be sent to all persons upon their initial inquiry about the program. This is in addition to The School Graduate application.

The following retention policy applies to all applicants seeking a degree in the Exercise Science unit:

1. Graduate students are required to maintain an overall 3.0 GPA.
2. Any student who fails below this standard will be advised in writing by the unit leader and his/her advisor.
3. If a student's overall GPA remains below 3.0 for a second semester, the student will have his/her degree status revoked.

GRADUATE ASSISTANTSHIPS

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

GRADUATE COURSES

480 Physiology of Exercise (3) Functions of body in muscular work: physiological aspects of fatigue, training and adaptation to environment. Prereq: Human Physiology or General physiology. 2 hrs and 1 lab. (Same as Biochemistry and Cellular and Molecular Biology 480.)

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

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

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


508 Research in Exercise Science (3) Research for writing of thesis and for use of university resources; presentation of research through free communications and poster presentations; calculation and interpretation of statistical analysis, and use of computer software.

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


513 Biomechanics of Orthopaedic Rehabilitation (3) Effect of physical activity on bone and soft tissue development, anatomical and mechanical implications of exercise, theoretical bases for rehabilitative programs.

516 Therapeutic Exercise (3) Therapeutic exercise programs designed for specific clients: neurologic disorders, orthopedic problems, injuries. Coreq: McKenzie, neutral spine; based on specific biomechanical considerations: eccentricities, closed kinetic chain; and more general in nature. Feldenkrais, myofascial release.

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

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

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

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

565 Advanced Physiology of Exercise (3) Quantitative approaches to current and critical issues in exercise physiology. Prereq: 480 and 563.


568 Physical Activity and Positive Health (3) Review of clinical, experimental, and epidemiologic evidence concerning relationship and effects of exercise on health-related components of fitness. Prereq: Elementary statistics, 480 and 414 or equivalents. (Same as Public Health 568.)

569 Fitness Testing, Programming, and Leadership for Diverse Populations (2) Clinical experience in selecting, administering, and evaluating exercise tolerance tests on cycle ergometer and treadmill. Individual fitness programs for diverse populations. Practice in leading variety of activities aimed at improved fitness. Prereq: 480 and 414. (Same as Public Health 569.)

570 Cardiac Rehabilitation Practicum (1-3) Supervised experiential opportunity in hospital-based exercise programs for patients with cardiac and pulmonary disorders. Use of telemetry monitoring, leading safe exercise regimens for patients with cardiac and pulmonary disorders. Prereq: 480 and 567. Coreq: 569. May be repeated. Maximum 6 hrs.

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

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

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

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

622 Directed Independent Research (3-6) Prereq: Doctoral student or consent of instructor. May be repeated. S/N or letter grade.

681 Seminar in Exercise and Applied Physiology (1) Selected topics in exercise and environmental physiology. Prereq: 563 and 565. May be repeated with consent of instructor.

684 Research Participation in Applied Physiology (1-6) Participation in research with faculty members whose interests coincide with those of student. S/N only.
Food Science and Technology

(College of Agricultural Sciences and Natural Resources)

MAJOR DEGREES

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

Clark J. Brekke, Head

Professors:

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

Associate Professors:

Christen, G. E., Ph.D. .................. Missouri
Loveday, H. D., Ph.D. .................. Kansas State
Mount, R. J., Ph.D. .................. Ohio State

Assistant Professor:

Beattie, S. E., Ph.D. .................. Oregon State
Golden, D. A., Ph.D. .................. Georgia
Hubert, G., Ph.D. .................. Illinois
van Laack, R. L., Ph.D. .................. Utrecht

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

Graduate School rating forms or letters of recommendation from at least three people are required. Respondents should be familiar with the applicant's scholastic ability and professional potential.

THE MASTER'S PROGRAM

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

Thesis Option

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

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

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

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

Non-Thesis Option

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

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

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