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

505 Professional Communications Seminar (1) Lectures, group discussion, and individual study on specialized topics. May be repeated. Maximum 6 hrs. E

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

510 Similitude in Design and Research (3) Dimensional analysis; governing equations; theory of models: true, distorted, or model models; prediction equations; interpretation of data; applications to machinery, soil and water systems, agricultural buildings, and other agricultural engineering related problems. Prereq: Engineering Science 321, 341. 2 hrs and 1 lab. F, A

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. E

541 Principles of Compost Engineering (3) Comprehensive study of composting; survey of installed systems; thermodynamics of composting; biological processes; air and other control. Design component. Prereq: Thermodynamics, heat and mass transfer. F

543 Instrumentation and Measurement (3) Modern instrumentation techniques. Static and dynamic response of instruments; signal conditioning; temperature, moisture, optical radiation, displacement, strain, pressure, velocity, acceleration, and fluid measurements. Prereq: 451 or Electronics and Computer Circuits or equivalent. 2 hrs and 1 lab. (Same as Environmental Engineering 543.) F, A

545 Monitoring Hydrologic Phenomena (3) Application of instrumentation theory to monitoring hydrologic phenomena; strengths and weaknesses of current equipment and techniques; equipment operation and solution of monitoring problems. Prereq: 543. 2 hrs and 1 lab. (Same as Environmental Engineering 545.) S, A

550 Selected Topics (1-3) Lecture/group discussion on specialized topics. May be repeated. Maximum 6 hrs. E

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

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

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

605 Computer Simulation of Agricultural Systems (3) Scientific approach to digital simulation: system definitions and parameters, formulation of models, algorithms and solution techniques, encoding of prediction equations models, algorithms and solution techniques, encoding of prediction equations and output; verification and calibration of simulation models. Prereq: 601, 201 or equivalent. 2 hrs and 1 lab. F, A

620 Feedback and Control Systems (3) Differential equations for physical systems; solutions; transforms, and system response. Types of control, frequency response, system compensation, and system analysis. Application to agricultural systems. Prereq: 631, 201. Math 231, Basic Engineering 201, or equivalent. 2 hrs and 1 lab. F, A

650 Selected Topics (1-3) Lecture, group discussion, and individual study on specialized developments. May be repeated. Maximum 6 hrs. E

Biosystems Engineering Technology

422 Food and Process Engineering Technology (3) Application of basic engineering principles to agricultural and food processes. Prereq: 451, 650. 2 hrs and 1 lab. F

423 Agricultural Machinery and Tractors (3) Selection, matching, and management of agricultural machinery. Tractor power ratings, engine and transmission systems, hydraulic systems, hitching, and ballasting. Field and material capacity, field efficiency, cost analysis, and machinery replacement strategies. Functional analyses of tillage operations, planting and drills, no-till systems, hay harvest systems, forage and small grain harvesting, and cotton harvesting. Prereq: 451, 650. 2 hrs and 1 lab. F

424 Agricultural Waste Management and Pollution Control (3) Concepts of animal manure; sanitation; collection for transport and application. Principles of animal waste management and pollution control. Prereq: Basic Calculus or Finite Mathematics or equivalent. 2 hrs and 1 lab. F, A

425 Small Internal Combustion Engines (3) Theory, concepts, and mechanics of small internal combustion engines; theoretical cycles; selection, operation, adjustment, troubleshooting and repair of single cylinder engines. Prereq: Introductory Physics or consent of instructor. 2 hrs and 1 lab. S, A

426 Agricultural Chemical Application Technology (3) Equipment for application of liquid, solid, and gaseous agricultural chemicals; system components; operational characteristics; materials handling and disposal methods. Prereq: Physics 121 or consent of instructor. 2 hrs and 1 lab. S, A

430 Grain Storage (3) Principles of grain storage, handling, and safety; storage facilities; mechanical systems; equipment; operation of storage facilities. Prereq: 451 or consent of instructor. 2 hrs and 1 lab. S, A

442 Agricultural Science (3) Science of plant production; plant physiology; plant growth and yield; crop production; plant nutrition; crop protection; soil structure; soil fertility; crop water requirements; crop management. Prereq: 451 or consent of instructor. 2 hrs and 1 lab. S, A

444 Agricultural Water Management (3) Principles of crop water requirements; principles of irrigation for crop production; principles of drainage for crop production. Prereq: 451 or consent of instructor. 2 hrs and 1 lab. S, A

451 Principles of Compost Engineering (3) Comprehensive study of composting; survey of installed systems; thermodynamics of composting; biological processes; air and other control. Design component. Prereq: Thermodynamics, heat and mass transfer. F

452 Instrumentation and Measurement (3) Modern instrumentation techniques. Static and dynamic response of instruments; signal conditioning; temperature, moisture, optical radiation, displacement, strain, pressure, velocity, acceleration, and fluid measurements. Prereq: 451 or Electronics and Computer Circuits or equivalent. 2 hrs and 1 lab. (Same as Environmental Engineering 452.) F, A

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

501 Research Problems in Biosystems Engineering (1-3) Individual studies of current problems. May be repeated. Maximum 6 hrs. E

502 Simulation of Agricultural Systems (3) Synthesis and analysis of agricultural systems using computer simulation, philosophy of system simulation, critical path, discrete and continuous systems. Prereq: 506 and scientific computer programming. 2 hrs and 1 lab. F, A

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

505 Professional Communications Seminar (1) Lectures, group discussion, and individual study on specialized topics. May be repeated. Maximum 6 hrs. E

506 Physical Phenomena (3) Properties of materials, fundamentals of hydraulics, principles of electricity, thermal phenomena, applications in biological systems. Prereq: Consent of instructor. F

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

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

514 CAD Applications to Biosystems Engineering (3) Use of CAD software to create designs of components, machinery systems, flow charts, and process diagrams relevant to biosystems. Admission to design program or consent of instructor; proficiency in use of personal computers. F

522 Processing and Environmental Systems (3) Environmental systems in plant and animal production; application of electric power, mechanical equipment, structures, crop processing and materials handling. Prereq: 506. 2 hrs and 1 lab. S, A

532 On-Site Domestic Water Supply and Wastewater Renovation (3) Basic ground water hydrology, selection and design of pumps and delivery systems, and point-of-use water treatment processes; soil-based wastewater renovation principles, and design and operating criteria for on-site wastewater renovation systems. Prereq: 506. 2 hrs and 1 lab. F, A

542 Agriculture and Rural Sociology (College of Agricultural Sciences and Natural Resources)

MAJOR

Agricultural Economics M.S., Ph.D.

Dan McLemore, Acting Head

Professors:

Badenhop, M. B. (Emeritus), Ph.D. Purdue

Brooker, J. R. (Liaison), Ph.D. Florida

Cleland, C. L. (Emeritus), Ph.D. Wisconsin

Eastwood, D. B., Ph.D. Tufts

English, B. C., Ph.D. Iowa State

Keller, L. H. (Emeritus), Ph.D. Kentucky

Klintz, T. H., Ph.D. Kentucky

Leathard, F. O., Ph.D. Wisconsin

McLemore, D. L., Ph.D. Oklahoma State

Moorman, B. R. (Emeritus), Ph.D. Purdue

Martin, J. A. (Emeritus), Ph.D. Minnesota

Mundy, S. D., Ph.D. Tennessee

Ort, R. H., Ph.D. Illinois

Park, W. M., Ph.D. Virginia Tech

Pentecost, B. H. (Emeritus), J.D. Tennessee

Ray, Daryl E. (Bernard Blasingame Chair of Excellence), Ph.D. Iowa State

Riley, J. B., Ph.D. Oklahoma State

Roberts, R. K., Ph.D. Iowa State

Sappington, C. B. (Emeritus), Ph.D. Illinois

Whatley, T. J. (Emeritus), Ph.D. Purdue

Williamson, H. Ph.D. Missouri

Associate Professors:

Jensen, K. L., Ph.D. Oklahoma State

Pompelli, G. K., Ph.D. California (Davis)

Assistant Professors:

Jakes, Paul M., Ph.D. NC State

Larson, J. A., Ph.D. Oklahoma State

The Department of Agricultural Economics and Rural Sociology offers programs of graduate study leading to the Ph.D. and M.S. The doctoral program includes concentrations in agricultural marketing and price analysis, agricultural policy, farm management and production economics, natural resource economics, and rural development. The M.S. program may be completed under a thesis option with concentrations in agricultural economics or rural sociology. A non-thesis
coursework is required. At least 30 hours of statistics are required. Each student must successfully complete a final oral examination.

Non-Thesis Option
A minimum of 36 hours of graduate coursework is required. At least 30 hours must be in courses numbered at or above the 500 level. The program must include a minimum of 21 hours in agricultural economics and 6 hours of quantitative methods. In the Agribusiness concentration, 6 hours of internship are required. In the agricultural economics concentration, 6 hours of economic theory are required. Each student must successfully complete both written and oral comprehensive exams.

Minor
A minor will include 6 hours of coursework in the department, with at least 3 hours in 500- or 600-level courses. The student’s committee must include a member of the faculty from the department who will be responsible for designating courses required for the minor.

THE DOCTORAL PROGRAM
A minimum of 78 hours of graduate credit beyond the B.S. degree, including 24 hours of dissertation research, but excluding any master’s research credit, is required. A minimum of 27 hours of coursework in agricultural economics, 15 hours of economic theory, and 9 hours of quantitative methods are required. The program must include a minimum of 9 hours in courses numbered at or above the 600 level (excluding dissertation credits). Qualifying exams are required in macroeconomic and microeconomic theory. Comprehensive exams include three written exams and one oral exam. The written exams are in general agricultural economics, quantitative methods, and the area of concentration.

Minor
A minor will consist of a minimum of 9 hours of coursework taken in the department and approved by the minor professor. At least 6 hours of credit in the minor area must be in 500- and 600-level courses.

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.

Agricultural Economics

GRADUATE COURSES

412 Agricultural Finance (3) Micro-finance, financial objectives, acquisition of debt and equity funds, capital investments, capital allocation, credit analysis, borrower and lender loan application analysis, insurance strategies, computer applications, kinds and sources of agricultural credit. Prereq: Introductory Economics. Sp

420 International Agriculture Trade and Marketing (3) Real and monetary aspects of international trade and effect on agricultural commodity flows; partial equilibrium analysis of international markets; institutional aspects of international marketing of agricultural products. Prereq: Intermediate Agricultural Economics or consent of instructor. F

430 Agricultural Policy (3) Values, goals and policy process. Economic rationale and effects of policy. Historical development and current characteristics of commodity, credit, food, and trade policy. Prereq: Intermediate Agricultural Economics or consent of instructor. Sp

442 Agribusiness Management (3) Applications of advanced decision analysis concepts and tools to analyze management decision problems in farm and nonfarm agribusiness settings. Case study work on strategic planning; assessing cost structure using budgeting and breakeven analysis; evaluating profitability, liquidity, and solvency using financial statements; analyzing investments using capital budgeting. Prereq: Farm Business Management and consent of instructor. F

450 Agricultural Industry Analysis and Forecasting (3) Analytical tools for decision making in agricultural sector; analysis of commodity supply and demand conditions; economic modeling; market forecasting; analysis of temporal and spatial patterns. Prereq: Agricultural Microeconomics and Introduction to Statistics or consent of instructor. F

470 Natural Resource Economics (3) Nature of natural resources; economic efficiency as basis for natural resource use; externalities in natural resource use; factors influencing environmental quality; alternative public policy tools for influencing natural resource use or improving environmental quality. Prereq: Introduction to Economics. Sp

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

502 Registration for Use of Facilities (0-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/C only. E

505 Microeconomic Analysis (3) Theory of utility maximization and demand, production, cost, firm behavior, and supply; price in product and factor markets; efficiency and welfare. Prereq: Calculus and Intermediate Microeconomics or equivalent. F

524 Econometric Methods in Agricultural Economics (3) Application of statistical methods to agricultural economic models; estimation of supply, demand and production functions; microeconomic forecasting models; interpretation of results. Prereq: Regression and Correlation Methods or consent of instructor. F

525 Agribusiness Operations Research Methods (3) Applications of operations research methods and concepts for agribusiness. Theoretical background and applications of different techniques with emphasis on applications. Computer and other applications of each technique for relevant agribusiness problems. Prereq: Basic Calculus and 524. Sp

530 Agricultural Policy Analysis (3) Evaluation of public policy as related to agricultural industry and rural areas. Prereq: 505 and Economics 513 or consent of instructor. F

542 Advanced Agribusiness Production Decisions (3) Theoretical and empirical concepts in agricultural resource allocation; evaluation of both static and dynamic issues; decision theory with application to agricultural times; aggregate impact of farm decisions on industry. Prereq: 505 or equivalent. Sp

550 Advanced Agribusiness Marketing (3) Use of economic concepts in agribusiness marketing decisions. Analysis of agricultural markets; buyer behavior in food and fiber markets; competitive environment. Profitability analysis of marketing and distribution decisions; market planning and strategy; product evaluation and new product introduction; pricing decisions. Prereq: 505, Regression and Correlation Methods or equivalent. Sp

570 Advanced Natural Resource Economics (3) Analysis of environmental resource allocation issues; applied welfare economics; external effects and evaluation of public policy. Prereq: 470 and Economics 511 or consent of instructor. F

593 Special Topics in Agricultural Economics (1-3) Topics to be assigned. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/N/C only. E

595 Professional Internship (1-3) Supervised internship experience with appropriate agribusiness firm. 600 Doctoral Research and Dissertation (3-15) P/NP only. E

620 Advanced Quantitative Methods (3) Discussion and evaluation of advanced statistical and mathematical techniques in current agricultural economics research. Prereq: 522, 524, and Economics 681-82, or consent of instructor. Sp

640 Agricultural Supply Analysis (3) Critical evaluation of both theoretical bases and empirical procedures used for estimating agricultural supply relationships using regression techniques, production functions, mathematical programming, firm growth models, and simulation in supply analysis. Prereq: 540 or consent of instructor. F

652 Consumer Demand and Food Consumption (2) Simultaneity of consumer decision making; food demand, constraints on demand. Complete demand system models. Prereq: Economics 511 and 512 or consent of instructor. Sp

670 Seminar in Natural Resource Economics (2) Issues in natural resource economics. Current literature: evaluation of theory, methodology and public policy as related to allocation of natural resources. Prereq: 570 or consent of instructor. Su

Rural Sociology

GRADUATE COURSES

480 Technological and Community Change (3) Analysis of communication processes whereby new technology spreads within a farm population and analyses of social institutions related to change in rural communities. Prereq: Rural Sociology or consent of instructor. (Same as Sociology 480.) Sp

580 Advanced Rural Sociology (3) Application of sociological concepts and theory to analyze changing structure and function 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 sociological theories. Prereq: 380 or consent of instructor. May be repeated. Maximum 6 hrs. (Same as Sociology 593.) E

Agriculture

GRADUATE COURSES

507 Professional Development Seminar (1) Planning and executing graduate research programs; ethics and professionalism; graduate program procedures and resources. (Same as Biosystems Engineering 507, Biosystems Engineering Technology 507, Animal Science 507, Ornamental Horticulture and Landscape De-
Animal Science

(College of Agricultural Sciences and Natural Resources and College of Veterinary Medicine)

MAJOR

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

Kelly Robbins, Head

Professors:
Barth, K. M. (Emeritus), Ph.D. ......... Rutgers
Bell, M. C. (Emeritus), Ph.D. ............ Oklahoma State
Bietker, J. K. (Emeritus), Ph.D. .......... Ohio State
Chamberlain, C. C. (Emeritus), Ph.D. ... Iowa State
Eiler, H. D. V.M., Ph.D. ................. Illinois
Erickson, B. H. (Emeritus), Ph.D. ..... Kansas State
Godkin, J. D. (Liaison), Ph.D. ........... Massachusetts
Hall, O. G. (Emeritus), Ph.D. ............ Iowa State
Hansard, S. L. (Emeritus), Ph.D. ......... Washington, D.C.
Henry, R. W. D.V.M., Ph.D. ......... Ohio
Lidovski, E. (Emeritus), M.S. ......... Washington, D.C.
Masincup, F. B., Ph.D. ................. Kansas State
McDonald, T. P. (Emeritus), Ph.D. ......... Tennessee
McLaren, J. B. (Emeritus), Ph.D. ......... Auburn
Miller, J. K., Ph.D. ................... Georgia
Murphee, R. L. (Emeritus), Ph.D. ........ Wisconsin
Oliver, S. P., Ph.D. .................... Ohio State
Richardson, D. O., Ph.D. ............. Ohio State
Robbins, K. R., Ph.D. .................. Illinois
Saxton, A., Ph.D. ...................... NC State
Shirley, H. V. (Emeritus), Ph.D. ......... Illinois
Schultz, T. W., Ph.D. ................. Tennessee
Sims, M. H., Ph.D. ...................... Auburn
Tugwell, R. L. (Emeritus), Ph.D. ........ Kansas State

Associate Professors:
Backus, W. R., Ph.D. .................... Tennessee
Bell, R. B., Ph.D. ....................... NC State
Grizzle, J. M., Ph.D. ................... Florida
Heitmann, R. N., Ph.D. ............ Maine
Kattes, H. G., Ph.D. ................... VPI
Mendis-Handagama, L. C., Ph.D. .... Duke University
Smith, M. Q., Ph.D. .................... Oklahoma State
Waller, J. C., Ph.D. ..................... Nebraska

Assistant Professors:
Mathew, A. G., Ph.D. ................... Purdue
Schrick, F. N., Ph.D. .................... Clemson
Smalling, J. D., Ph.D. .................. Texas A&M

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, systemic physiology (blood, cardiac, and neural), and histology are also available. The Ph.D. program offers concentrations in animal nutrition, animal breeding, animal physiology, animal anatomy, and animal management. For specific information, contact the department head.

All first-year graduate students are required to enroll in 507 and 509. All first- and second-year students are required to enroll in 506 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 2.0 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, acceptance may be on a probationary basis and a minimum of 9 hours of graduate coursework must be completed the first term with a minimum grade-point average of 3.0 for admission to 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 of courses approved for use in the Intercollegiate Graduate Statistical Program (ICGSP). The remainder of the coursework will be selected jointly by the student and the major professor depending on the student's area of specialization and professional objectives.

The advisory committee will consist of the major professor, a faculty member of Animal Science, who will act as chairman of the committee, and a minimum of two other faculty members, one of whom may be outside of the Animal Science Department. The advisory committee approves the student's coursework and research problem and conducts the final oral examination which consists of a comprehensive written and oral examination.

THE DOCTORAL PROGRAM

The doctoral program requires a minimum of 48 semester hours of coursework beyond the B.S. and a minimum of 64 hours of doctoral research and dissertation. The 48 hours of coursework must include:

1. A minimum of 18 hours in related fields outside of animal science.
2. At least 24 hours credit at the 500 and 600 level, exclusive of doctoral research and dissertation. The 48 hours of coursework must include:

   at the 500 and 600 level in the respective concentration or closely related area. Students in the concentration management must complete Animal Science 581 and 9 hours at the 500 or 600 level in two non-management concentrations for a total of 12 hours (including 581).

   3. A minimum of 1 hour of Agriculture 512 in addition to that required at the M.S. level.

   4. A minimum of 6 hours in 400-, 500-, or 600-level statistics courses approved for the ICGSP.

A minimum of five faculty members will constitute the student's advisory committee, of which at least one must be outside Animal Science. The major professor will be the chairperson.

The student and the major professor select a program of study depending on the student's area of concentration and professional goal. The advisory committee approves the coursework and the dissertation research proposal and determines if there is to be a foreign language requirement. The advisory committee conducts the comprehensive written and oral examination and the final dissertation defense examination.

GRADUATE COURSES

420 Advanced Reproduction (3) Collection, evaluation, and preservation of ox, spermatozoa and embryos; application of methods of natural breeding and techniques of artificial insemination and embryo transfer, hormone and dam evaluation; pregnancy determination; gestation and parturition; infertility; recent advances in andrology. Prereq: 320 or equivalent. 1 hr and 1 lab. F

430 Advanced Ration Formulation (2) Advanced ration formulation for beef and dairy cattle, sheep, horses, swine, poultry, laboratory, zoo, and companion animals. Mathematical and computer approaches to formulating complex rations with constraints. Prereq: 330 or equivalent and introductory computer science course. 2 labs. Sp

440 Advanced Animal Breeding (2) Computer simulation of genetic improvement for multiple traits in swine, beef, and dairy cattle; evaluation of alternative breeding strategies; industrial programs in swine, poultry, sheep, beef, and dairy cattle; breed development, improvement, and utilization. Prereq: 340 or equivalent. 1 hr and 1 lab. F

461 Beef Cattle Production and Management (3) Integration of principles of nutrition, breeding, physiology, and management into complex rearing management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Evaluation and economic returns. Prereq: Completion of 500-level core courses or equivalent or consent of instructor. 2 hrs and 1 lab. Sp

482 Dairy Cattle Production and Management (3) Integration of principles of nutrition, breeding, physiology, and management into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Evaluation and economic returns. Prereq: Completion of 500-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 management into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Evaluation and economic returns. Prereq: Completion of 500-level core courses or equivalent or consent of instructor. 2 hrs and 1 lab. F

484 Poultry Production and Management (3) Integration of principles of nutrition, breeding, physiology, and management into complete production and management programs. Structure of industry, enterprise establishment, systems of production, production practices, and improvement programs. Evaluation and economic returns. Prereq: Completion of 500-level core courses or equivalent or consent of instructor. 2 hrs and 1 lab. F
of production responses and economic returns. Prereq: Completion of 500-level course or equivalent or consent of instructor. 2 hrs and 1 lab. F

486 Lamb and Wool Production and Management (3) Integration of principles of selection, nutrition, breeding, physiology, and marketing into complete lamb and wool production enterprise. Structure of industry, enterprise establishment, systems of production, production responses and economic returns. Alternates evaluating: production responses and economic returns. Prereq: Animal Science sophomore and junior 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/NC only. E

507 Professional Development Seminar (1) (Same as Agriculture 507, Biosystems Engineering 507, Ornamental Horticulture and Landscape Design 507, and Plant and Soil Sciences 507.) S/NC only. F

509 Scientific Communication (1) (Same as Agriculture 509, Ornamental Horticulture and Landscape Design 509, and Plant and Soil Sciences 509.) S/NC only. F

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


522 Advanced Mammalian Reproduction (3) Current topics and "new frontiers" in reproductive biology. Prereq: 322. Sp, A

530 Animal Nutrition and Metabolism (4) Comparative digestive physiology, digestion, absorption and metabolism of nutrients in ruminant and nonruminant species. Concepts and methodologies of animal growth and nutrient requirements; interrelationships, availability and deficiencies of nutrients. Prereq: Animal Nutrition, Feeds, and Ration Formulation or consent of instructor. F

531 Analytical Techniques in Animal Science (3) Principles, concepts and methods applied to characterization and mechanistic study of cells, cell components and biologically active molecules. Demonstration of methodology: nutrient analyses, histology and ultrastructural morphology, immunology, competitive binding assays, protein biochemistry and molecular biology. Prereq: Organic Chemistry and Lab equivalent. 1 hr and 2 lab. S/NC only. Sp

535 Ruminology (2) Anatomy, physiology, and microbiology of ruminant ecosystem: microbial fermentation and metabolism of polysaccharides, lipids and nitrogen. Prereq: 530 or consent of instructor. Sp

538 Nutritional Aspects of Companion Animal Health (2) Nutritional concepts applied to veterinary management of normal and disease states for pets including dogs, cats, horses and exotic species. (Same as Comparative and Experimental Medicine--Veterinary Medicine 538.) Sp

551 Mammalian Organology (3) Microscopic study of structure of organs and major organ systems. Prereq: Embryology, histology and consent of instructor. 2 hrs and 1 lab. (Same as Comparative and Experimental Medicine--Veterinary Medicine 551.) Sp

552 Anatomy of Domestic Carnivores (4) Gross dissection of systems and regions of dog with comparison to cat. Prereq: Consent of instructor. 1 hr and 3 lab. (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 of major domestic 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 models and contrasts, analyses of variance: 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 production management policies. Systems approach to analysis and integration of reproductive management programs, genetic improvement policies, alternative feeding systems, and herd health programs. Consideration of time, risk, and uncertainty in livestock production. Tools, linear programming, as aids in decision-making and resource allocation. Prereq: Management, economics, computer science, statistics. 2 hrs and 1 lab. Sp

598 Seminar (1) Advanced topics in animal science. Required of all first-year students. Course structure and content may change from year to year. Prereq. May be repeated. Maximum 4 hrs. S/NC only. F, Sp

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. May be repeated. Maximum 6 hrs. E

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

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

651 Advanced Topics in Animal Anatomy (1-4) Current and future research methodology, laboratory situation, recent advances in quantitative 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 disorders caused by diseased endocrine glands of various animal species. Prereq: 521 or consent of instructor. (Same as Comparative and Experimental Medicine--Veterinary Medicine 652.) Sp

Animal Science--Veterinary Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Anthropology

(Major of College of Arts and Sciences)

Major

Anthropology.................................M.A., Ph.D.

Jan F. Simsek, Head

Professors:

Bass, William M. (Emeritus), Ph.D. ................. Pennsylvania State University
Faulkner, Charles H., Ph.D. ....................... Indiana University
Jantz, Richard L., Ph.D. ......................... Kansas State University
Kieliep, Walter E., Ph.D. ......................... Missouri State University
Logan, Michael H., Ph.D. ....................... Penn State University
Parmalee, Paul W. (Emeritus), Ph.D. .............. Texas A&M University
Simek, Jan F., Ph.D. ......................... SUNY Binghamton
Wheeler, Margaret C. (Emerita), Ph.D. .............. Yale University

Associate Professors:

Harrigan, Irwin E., Ph.D. ......................... Syracuse University
Howell, Benita J., Ph.D. ......................... Kent State University
Königsberg, Lyle, Ph.D. ......................... Northwestern University
Kramer, Andrew (Liaison), Ph.D. ............... Michigan State University
Schoedl, Gerald F., Ph.D. ................... Washington State University

Assistant Professor:

Marks, Murray K., Ph.D. ....................... University of Tennessee

Research Associate Professor:

Chapman, J., Ph.D. ................................ North Carolina State University

The Department of Anthropology offers both the M.A. and Ph.D. degrees with concentrations in archaeological, bioarchaeological, cultural anthropology, cultural anthropology, and zooarchaeology. Additional information on the Anthropology graduate program may be obtained from the departmental brochure or by contacting the Anthropology Graduate Program.

The Master's Program

Students wishing to enter the Master of Arts degree program with a major in Anthropology should have an undergraduate GPA of 3.5 in the major, 3.3 overall, and hold a bachelor's degree from an accredited university with a major in Anthropology. Applicants with a major in a related field (biology, sociology, geology, classics or geography) will be considered only if they have a formal minor in anthropology or its equivalent (at least five upper division anthropology courses).

All prospective M.A. students must make formal application to The University of Tennessee, Knoxville Graduate School. Copies of the application form, transcripts, and GRE scores that are sent to The Graduate School should also be sent directly to the Department of Anthropology at the same time. In addition, the department requires a letter of intent from the applicant indicating career goals and reasons for selecting the University of Tennessee, three letters of recommendation, and one sample of the prospective student's written work (a class paper or research report); these materials should be sent directly to the Graduate Secretary, Department of Anthropology, SSH 250, University of Tennessee, Knoxville, Knoxville, TN 37996-0720.

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.
Admission: Admission to the Ph.D. program contingent upon completion of ALL requirements prior to that level. Master's thesis candidates at UTK who are conditionally accepted into the Ph.D. program can enroll as doctoral students the semester following conferral of the M.A. degree. Students holding Master's degrees from other institutions must apply by January 15 for admission the following Fall and must begin their studies in the Fall semester.

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

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.

Doctoral Committee: A doctoral committee is appointed following admission to the program. In consultation with this committee, the student defines the future program of study. The committee consists of the student's major professor, at least two additional members of the Anthropology faculty who will be asked to serve on the committee, and a final member who represents the cognate area.

Outside coursework may be taken in a single discipline or distributed across two or more disciplines as appropriate to the individual's program of study.

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

Academic Common Market: An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.A. program in Anthropology is available to residents of the states of Louisiana (concentration in zoarchaeology only), Virginia (concentration in zooarchaeology or cultural 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.
412 Folklore in Anthropology (3) Introduction to anthropological study of folklore, using folklore and folkloric materials from various cultural, peasant, and complex societies. Prereq: 130 or consent of instructor.

413 Dynamics of Culture (3) Major forms of culture change, ranging from evolution and diffusion to religious revitalization and political revolt. Continuity and change in diverse cultural traditions. Use of anthropological methods and concepts. Examination of anthropological theory, methods, and interpretation of research data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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

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

435 Historical Archaeology Laboratory (3) Laboratory procedures for processing, identification, and interpretation of artifacts from historical sites. Artifactual material from historic East Tennessee sites used for class projects. Recommended prereq: Historic Archaeology.

440 Cultural Ecology (3) Concepts and methods in studying dynamic relationship between prehistoric cultures in present day cultures and their environments: ecological, method, ecology, and use of selected case studies. Prereq: 120, 130, 410, or consent of instructor.

462 Early European Prehistory (3) Origins and evolution of human culture in Europe through beginnings of settled life. Paleolithic and Mesolithic chronology and lifeways. Prereq: 120 or consent of instructor.

463 Rise of Complex Civilizations (3) Development of complex societies in Old World from origins of agricultural economies to rise of States. Mesolithic, Neolithic, Metal and Metal Age lifeways in Africa, Europe, and Asia. Prereq: 120 or consent of instructor.

464 Principles of Zooarchaeology (3) Basic osteological studies of major vertebrate groups; functional use of animals in subsistence and culture identification and interpretation of archaeologically recovered faunal remains; introduction to laboratory use of comparative collections. Prereq: 120 or consent of instructor.

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

480 Human Osteology (3) Overview of human osteology, identification and interpretation of human skeletal remains. Prereq: 110 and consent of instructor. 3 hrs and 1 lab.

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

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

484 Museology III: Field Projects (1-12) (Same as Art 484.)


494 Primate Behavior (3) Social organization and behavior of selected primates: group composition, size, and structure; communication; and cultural behavior, application of primate studies to human ethology. Prereq: 110 or consent of instructor.

500 Thesis (1-15) PNP only; E

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

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

510 Method and Theory in Cultural Anthropology (3) Development of primary theoretical orientations by cultural anthropologists; formulation of research problems and analyses of anthropological data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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

513 Rural Studies in Anthropology (3) Theory, method, and ethnographic research on selected problems and aspects of traditional agrarian groups in U.S. and peasant societies. Prereq: Cultural area course or equivalent. May be repeated. Maximum 9 hrs.

514 Anthropology of Development (3) Application of anthropological theory, methods, and findings to community and national development programs. Analysis 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 pattern, theories of disease causation, and models of therapy. Theoretical and applied aspects of the medical anthropology of health and disease. Prereq: Consent of instructor.

517 Forms of Social Inequality (3) Anthropological perspectives on societies stratified along lines of rank, caste, race, ethnicity, and class; inequalities engendered by tax, social, and castes. STRUCTURAL ANALYSIS of social structures and causes of stratification. Interactions of race and ethnicity with class and gender.

520 Seminar in Zooarchaeology (3) Approaches to analysis and interpretation of archaeological fauna. Intensive reading and discussion of major faunal studies, guides to identification, methods of presenting faunal data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

521 Laboratory Studies in Zooarchaeology (4) Examination and comparison of early and of major vertebrate groups, shells of terrestrial and aquatic molluscs, in relation to animal remains from faunal on geological contexts. Basic osteology and shell characteristics of species encountered in archaeological sites; use of comparative collections. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

522 Seminar in Archaeology (3) Theoretical and practical issues in contemporary archaeology: ethnographic and zooarchaeological research, methods of analysis, dating, and functional interpretation of archaeological assemblages. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

530 Fieldwork in Archaeology (3-8) Practicum in surveying, excavating, processing, and analysis of archaeological data. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

560 Theory in Archaeology (3) Detailed consideration of theory in contemporary archaeology: models of scientific explanation, research design, archaeological data analysis, and theories of interpretation. Prereq: Consent of instructor.

561 Archaeological Resource Management (3) Federal legislation and regulations affecting identification, protection, and management of archaeological resources. Professional ethics and responsibilities and relationships 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.

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

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

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


582 Paleoanthropology (4) Fossil record from origin of hominids to appearance of anatomically modern humans. Functional morphology and phylogenetic relationships of fossil humans. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

583 Skeletal Biology (3) Practical and theoretical approach to analysis of prehistoric human skeletal remains. Demography, vital statistics, pathology, nutrition, and measures of biological relationships as related to population as adaptive unit. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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) PNP only. E

601 Advanced Graduate Research (1-6) Independent investigation of special problems in anthropology by advanced graduate students. May be repeated. Maximum 12 hrs. Only 3 hrs may count toward 200-level requirement.

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

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

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

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

695 Gross Human Anatomy (9) Skeletal, muscular, and cardiovascular systems. Dissection of cadavers. Prereq: 480 or Human Biology. 5 hrs and 5 labs.
Grueger, F., M.Arch. Pennsylvania
Kaplan, M., M.Arch. Harvard
Kelso, R., M.S. Tennessee
Kersavage, J., A. Sc. Southern Cal
Kinzy, S. A., Ph.D. SUNY (Buffalo)
Lauer, W. J. (Liaison).
M.S.Arch. Engr. Iowa State
Lester, A. J. (Emeritus), M.Arch. Virginia
Lizguy, P., 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.Arch. Northwestern
Shell, W. S., M.S.Arch. Columbia
Watson, J.S., M.Arch. Pennsylvania
Wodhouse, L. M. (On leave), Ph.D. St. Andrews

Associate Professors:
Coddington, J., M.Arch. Pennsylvania
Davis, T. K., M.Arch. Cornell
Martella, 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., M.F.A. Wisconsin
Moir-McClean, T. W., M.Arch. Michigan
Ware, S. M., F.A. Tennessee

M A S T E R O F A R C H I T E C T U R E P R O G R A M

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

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

For Track 1 applicants, a bachelor’s degree with a 3.0 GPA from a regionally accredited college or university is required. International applicants must have an equivalent 4-year degree and a GPA of 3.0. Candidates with a GPA less than 3.0 may be considered for conditional admission when evidence of exceptional promise is identified. Undergraduate work must include at least twelve semester hours of humanities, a basic understanding of physical principles, systems, and analytical procedures, and an understanding of mathematical principles and analytical procedures, as well as an 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 an accredited +2 architecture program, 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 exception promise is identified. Submission of a portfolio with a separate application to Architecture to include an essay and three letters of recommendation are also required. A personal on-site interview is desirable but not mandatory.

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

Degree Requirements
Track 1 requires a minimum of 42 semester hours of graduate 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. Retention in the program is contingent upon evidence of satisfactory progress toward the degree. Each student’s progress will be reviewed each semester by the Graduate Program Head. Any questions regarding progress will be reviewed by the Graduate Program Advisory Committee.

For further information, contact the School of Architecture.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on a non-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 throughout 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. Pre-historic times to present throughout world. Folk modes; Indus Valley; Hindu, Buddhist; and Mughal architecture of India, China, and Japan.

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

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

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


417 The International Style (3) Survey of architecture of early modern movement, particularly 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) Intellectual, societal, and geographical influences that provide theoretical basis for design throughout history. Selected examples of landscape architecture in terms of 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 topics. Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. E.

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 to augment building design. Independent studies under faculty direction. Prereq: Consent of instructor.

434 Building Energy Analysis (3) Balancing heat flows through external skin of residential and small and large commercial buildings. Local climate evaluation, site orientation, building design, and energy performance. Prereq: 433.

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

445 Advanced Lighting (3) In-depth analysis and innovative concepts in design of lighting. Prereq: 434.

469 Architectural Development (3) Principles and practice of architectural development. Historical, social, economic, and political influences on design and development of real estate. Open to all students.

484 Project and Construction Management (3) Principles, methods, and application of project and construction management in building process. Project manager’s role and 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.

486 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) 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. Degree completion is required. May not be used toward degree requirements. May be repeated. SNC only. E.
Art

(College of Arts and Sciences)

MAJOR DEGREE

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

Norman Magden, Head

Professors:
Blain, Sandra J. M.F.A. ....................... Wisconsin
Brake, P. M. M.F.A. .......................... Yale
Clarke, R.A. (Emeritus), M.S. .......................... Wisconsin
Cleaver, Dale G. (Emeritus), Ph.D. ............... Chicago
Daenert, R. H. (Emeritus), M.F.A. ................. Wisconsin
Darrow, J. F., Ed.D. .............................. Illinois State
Falsert, Joseph S. (Emeritus), M.S. ............ Ohio State
Goldstein, M. B., M.F.A. .......................... Nebraska
Kennedy, William C., M.F.A. .................... Wisconsin
Lee, B., M.F.A. ..................................... Yale
Leland, W. E., M.F.A. .............................. Tennessee
Livingston, P. R., M.F.A. .......................... Wisconsin
Lyons, B. (Laison), M.F.A. ...................... Arizona State
Magden, Norman, Ph.D. Case Western Reserve
Martinsson, Fred, Ph.D. .............................. Chicago
Maurer, Sue, M.F.A. ............................... Michigan State
Moffitt, F., Ph.D. ..................................... Chicago
Peacock, D., M.F.A. ............................... Iowa
Riesing, T. J., M.F.A. .............................. Nebraska
Stewart, F.C., M.F.A. ............................... Claremont
Yates, S., M.F.A. ................................. North Carolina (Greensboro)

Associate Professors:
Habel, Dorothy, Ph.D. ............................ Michigan
Hiles, Timothy, Ph.D. ............................. Penn State
LeFevre, Richard (Emeritus), M.F.A. ............... Rochester IT
Longobardi, Pam, M.F.A. ....................... Pennsylvania
Neff, A., Ph.D. ............................... Michigan State
Staples, Carolyn, M.F.A. ........................ Ohio State
Wilson, D., M.F.A. ............................... California (San Diego)

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

A minimum of 60 hours is required:
1. Successful completion of 20 hours of studio in a concentration area. An inter-area program must be approved by the graduate faculty only after the second semester in residence. Ten hours of concentration must be in second year courses (512, 514, etc.)
2. A minimum of 9 hours of art history for graduate credit.
3. Eleven hours of electives which may consist of any combination of courses offered by the University for graduate credit.
4. Art 599, Project in Lieu of Thesis (20 hours). A third year of semi-independent study. Student must have completed all other coursework prior to registration.
5. A student with the permission of the area faculty can petition to take 3 hours of outside academics as a substitute for 3 hours of art history or 3 hours of concentration area. The petition is to be presented to the graduate committee for final approval and must 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 critique.

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 599. The committee must consist of one faculty member from the candidate's concentration area (designated as chairperson) and a faculty member from outside the concentration area. The inclusion of an Art History faculty member on each committee is encouraged.

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

Academic Standards

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

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.F.A. program in Art is available to residents of the states of Alabama (concentration in watercolor only) or Arkansas (concentration in graphic design 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 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) Specialized field projects: restoration, preservation, registration, and other related research on or off campus. Prereq: 481 and 482. May be repeated. Maximum 12 hrs.
499 Special Topics (3) Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 12 hrs.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only.
507 Professional Practices: Teaching Internship (1) Individual study in development of skills and methodology in teaching studio courses. For students who are not GTAs. Prereq: Consent of instructor. May not be used toward degree requirements. May be repeated. S/N only.
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.
599 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.

Art Ceramics
GRADUATE COURSES
425 Ceramics: History Seminar (3) History of ceramics through lectures and student presentations. May 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 (2-8) May be repeated. Maximum 10 hrs.
525 Graduate Ceramics II (2-8) 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/N only.

Art Drawing
GRADUATE COURSES
411 Drawing I (4) Individualized pursuit of personal drawing techniques, and concepts: supplemented by individual and group critiques; weekly life drawing sessions. Prereq: 311. May be repeated. Maximum 12 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 (2-8) May be repeated. Maximum 10 hrs.
512 Graduate Drawing II (2-8) 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/N only.

Art Design/Graphic
GRADUATE COURSES
451 Advanced Graphic Design (3) Theory and techniques of visual problem-solving as applied to advanced applications of graphic design. Prereq: Intermediate Graphic Design II.
453 Advertising Illustration (3) Media and techniques as applied to advertising illustration. Prereq: Black and White Illustration and successful completion of any portfolio review.
454 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.
456 Graphic Design Practicum (3-12) Practical work experience in graphic design field. Only by arrangement with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hrs.
459 Special Topics in Graphic Design (3) (Student- or instructor-initiated course offered at convenience of department. Prereq: Determined by department. May be repeated. Maximum 6 hrs.
551 Graphic Design I (2-6) May be repeated. Maximum 10 hrs.
552 Graphic Design II (2-6) 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/N only.

Art History
GRADUATE COURSES
411 Art of Indian Asia (3) History of Indian art: Central Asia and Southeast Asia. Writing-emphasis course.
415 Chinese Art (3) Survey from pre-Shang Dynasty to contemporary movements in China, Taiwan, and Hong Kong. New discoveries. Writing-emphasis course.
428 Early Christian and Byzantine Art to 1350 (3) Art in Italy and the Eastern Empire from the beginnings of Christianity to c. 1350. Mosaic and painting: sculpture and architecture. Writing-emphasis course. (Same as Judaic Studies 428.)
431 Medieval Art of the West, 800-1400 (3) Western European art of the "Dark Ages," Romanesque, and Gothic periods. Writing-emphasis course. (Same as Judaic Studies 431.)
441 Northern European Painting, 1350-1500 (3) From county art of late Middle Ages to Northern Renaissance. Jan van Eyck, Roger van der Weyden, and Durer; early printmakers. Writing-emphasis course.
442 Art of Northern Europe, 1600-1675 (3) Concentrated study of Bruegel, Rubens, Rembrandt, Georges de la Tour, Vermeer, Poussin, and Hals. Writing-emphasis course.
Art


453 Art of Southern Europe, 1575-1700 (3) Concentrated study of Caravaggio, Rembrandt, and Italian Baroque developments in all media. Spanish Baroque painting and sculpture: Velázquez. Writing-emphasis course.

471 History of North American Art (3) Landmarks in painting, architecture, sculpture, and design from prehistory to 1900.

472 History of 20th-Century American Art (3) Developments 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.


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

483 History of American Sculpture (3) American sculpture from prehistory to 1900's.

486 History of Printmaking (3) Prints from 15th century to present. 20th century in Europe and U.S. Prereq.: 172 and 173.

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

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

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

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

519 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.

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

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

529 Photography (3-6) May be repeated. Maximum 10 hrs.

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

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

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

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

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

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

561 Intaglio I (3-6) Introduction to intaglio and combination with other print media. Prereq.: Intermediate Intaglio or consent of instructor. May be repeated. Maximum 12 hrs.

562 Intaglio II (3-6) Individual development of intaglio and combination with other print media. Prereq.: Intermediate Intaglio or consent of instructor. May be repeated. Maximum 12 hrs.

563 Intaglio III (3-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. May be repeated. Maximum 12 hrs.

564 Intaglio IV (3-6) Directed exploration of any or all matrix-based imaging: intaglio, relief, lithography, screen printing, photo-print methods and monoprint. Prereq.: 561.

571 Intaglio Portfolio Review or consent of instructor. May be repeated. Maximum 10 hrs.

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

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

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

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

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

598 Projects in Lieu of Thesis (10) Prereq.: All graduate coursework 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.

598 Projects in Lieu of Thesis (10) Prereq.: All graduate coursework and successful second year evaluation by graduate faculty. Maximum 20 hrs. S/NC only. E.

Art Sculpture

GRADUATE COURSES

411 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.
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. ................... Ohio State
Carney, Patrick J., Ph.D. ............ Iowa
Nabalek, Anna (Emeritus), Ph.D. ....... Poland
Nabalek, Igor V. (Emeritus), Sc.D. .... Prague
Peterson, H. A. (Emeritus), Ph.D. ....... Illinois
Silverstein, B. (Emeritus), Ph.D. ....... Purdue
Wallace, Gloria Jean L., Ph.D. ......... Northwestern

Associate Professors:
Burchfield, Samuel B., Ph.D. .......... Michigan State
Ferrell, 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:
Erickson, Mary E., Ph.D. ............. Southern Cal
Hedrick, Mark, Ph.D. .................. Vanderbilt
McCullough, Gary ..................... Vanderbilt
Ruark, Jacki L., Ph.D. ............... Pittsburgh
Swanson, Lori A., Ph.D. .............. Purdue

THE MASTER’S PROGRAM

A major is offered in Audiology or in Speech Pathology. Admission to these graduate programs is competitive. Both of these graduate programs are accredited by the Council on Academic Accreditation in Speech-Language-Hearing.

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 clinical certification of 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 511. 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, speech-language 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 insights 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 is normally completed over 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 8 semester hours in the topic of major interest;
   b. A minimum of 8 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 M.A. program in Audiology is available to residents of the states of South Carolina. 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.
433 Observation of Clinical Practice (1) Prereq: Speech and Language Development, Articulation Disorders, or consent of instructor.
434 Clinical Practice in Speech-Language Pathology II (1-4) Prereq: 433 and consent of instructor. Enrollment for fewer than 2 hrs must have prior departmental approval.
455 Problems in Speech Pathology (1-3) Prereq: Consent of instructor.
473 Audiology II (3) Basic principles of clinical audiology; pure tone, speech, masking and overview of special auditory tests. Prereq: 371.
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 Appraisal of Speech and Language Disorders (3) Diagnostic procedures for children and adults with speech and language problems indicating observation and practice with diagnostic tests. Prereq: Communication Disorders, Phonetics and Acoustics of Speech, and 433, or equivalents or consent of instructor.
506 Neural Basis 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 audiological processes. Prereq: 473 or equivalent or consent of instructor.
511 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, fundamentals of statistics, application of statistics, and completion of a proposal and hypothetical pilot research project.
512 Clinical Practice in Audiology (1-4) Prereq: 473 and 492. May be repeated. Maximum 9 hrs.
513 Clinical Practice in Audiology: Off-Campus Sites (1-4) Prereq: Consent of instructor.
514 Practicum in Verbo-Tonal Habilitation (1-4) Prereq: 494, 505, or consent of instructor. May be repeated. Maximum 6 hrs.
515 Practicum in Aural Rehabilitation (1-4) Prereq: 473 and 494. May be repeated. Maximum 6 hrs.
517 Instrumentation in Audiology and Speech Pathology (3) Principles of instrumentation in audiology and speech pathology; laboratory assignments for familiarization of students with instruments for measuring speech and hearing processes.
520 Aphasia (3) Historical review of aphasia literature, theories of brain functioning, aphasic classification and terminology, tests and 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 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 neurogenetics: cognitive-limbic systems and speech language patho-physiology rehabilitation issues associated with traumatic brain injury (TBI) related to adult TBI population. Prereq: 506 and 520, or consent of instructor.
526 Dysphagia (3) Clinical diagnosis, evaluation, and treatment of adult swallowing disorders and critical interpretation of research literature on dysphagia. Prereq: 506 or consent of instructor.
531 Seminar on Stuttering (3) Current significant research in stuttering. Prereq: 431 or consent of instructor.
532-33-34 Advanced Clinical Practice in Speech-Language Pathology (1-4, 1-4, 1-4) Prereq: 434 or equivalent and consent of instructor. 534 may be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs. must have prior departmental approval.
535-36-37 Advanced Clinical Practice in Speech-Language Pathology: Off-Campus Sites (1-4, 1-4, 1-4) Prereq: 100 hrs clinical experience, consent of instructor. May be repeated. Maximum 6 hrs each. Enrollment for less than 2 semesters must have prior departmental approval.
536 Advanced Clinical Practice in Speech-Language Pathology: Public Schools (1-4) May be repeated. Maximum 6 hrs. Enrollment for less than 2 hrs. must have prior departmental approval.
539 Motor Speech Disorders (3) Neuromotor organization for speech production; types of motor speech disorders and associated neuromuscular symptomatology; diagnosis and management of motor speech disorders. Prereq: 506.
540 Structural Speech Disorders (3) Etiology, diagnosis and clinical management of craniofacial speech disorders and laryngeotomy. Prereq: 308, 331.
541 Pediatric Oromotor Disorders (3) Evaluation, diagnosis, and management of pediatric oromotor and swallowing disorders. Prereq: 506 or consent of instructor.
542 Hearing Disorders (3) Effects of hearing loss, 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. Electroacoustical and real ear analysis of hearing aids. Coupler material and geometry effects. Practical experience in troubleshooting, repair, and construction of hearing aids. Prereq: 473 and 507 or equivalents or consent of instructor.
544 Amplification for the Hearing-Impaired (3) Speech and/or auditory input. Effects of noise, reverberation, auditory and auditory pathology on speech perception. Strategies for selecting amplification. Psychological considerations. Orientation and counseling. Dispensing models. Prereq: 473, 507, and 543 or equivalents or consent of instructor.
545 Sound Measurement Techniques and Hearing Conservation (3) Techniques of measurement and analysis of sound: hearing conservation in schools and industry. Prereq: Consent of instructor.
546 Advanced Audiology (3) Theoretical bases for behavioral audiology and acoustic immittance measurement. Prereq: 473 or equivalent or consent of instructor.
547 Special Problems in Audiology (1-3) Prereq: 473 or equivalent or consent of instructor. May be repeated. Maximum 6 hrs.
548 Special Study in Audiology (1-3) Special reading, consultation, and research activities in field of audiology. May be repeated. Maximum 6 hrs.
549 Hearing Science (3) Study of psychoacoustical phenomena and how they relate to perception and diagnostic audiology. 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) Significant research in speech pathology. Topics vary. Prereq: 301 in speech pathology. May be repeated with consent of department. Maximum 9 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 3 hrs.
582 Preschool Language Disorders (3) Assessment and remediation strategies for specifically-language-impaired children (ages 3-5). Techniques for special populations. Prereq: 461 or consent of instructor.
583 Practical Applications of Language Habilitation Techniques (3) Idiopathic and acquired treatment of communication disorders in infants and toddlers: family-centered services and family systems. Prereq: 461 or equivalent or consent of instructor.
585 School-Age Language Disorders (3) Review of current therapy 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 infant and preschool populations. Prereq: Consent of instructor.
576 Electrophysiological Assessment of Auditory Function (3) Auditory evoked potentials and their applications. Prereq: 473, 507, and 546, or equivalents or consent of instructor.
577 Vestibular Disorders (3) Anatomy, physiology, and pathology of vestibular system and related systems that contribute to balance. Prereq: Consent of instructor.
578 Psycholinguistic Concepts in Speech Pathology (3) Current concepts and information theory in studying the normal acquisition of language and certain disorders of language. Prereq: Consent of instructor.
582 Speech and Language Services in 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 gaiting process, communication disorders in infants and toddlers: family-centered services and family systems; classroom/speech acoustics, central auditory problems, therapy methods for habilitation and rehabilitation, speech reading, school-based programs, programs for adults and their families, 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. E
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 non-speech and speech stimuli. Prereq: 517.
603 Language Science (3) Seminar of 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) Anatomical and physiological correlates in hearing science. cochlear mechanical function, neurophysiological response and theoretical considerations. Prereq: 507.
609 Seminar in Speech Science (2) Experimental areas: speech physiology, acoustic 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.
610 Seminar in Hearing Science (2) Advanced study of perception of speech: acoustic signal, detectability, pitch, time, signal-to-noise ratio, adaptation, and fatigue. Prereq: 602 or consent of instructor. May be repeated. Maximum 6 hrs.
611 Experimental Design in Speech and Hearing (3) Analysis of experimental design in theories and related techniques for generation of experimental designs. Prereq: Consent of instructor.
626 Advanced Seminar in Neurologically-based Communication Disorders (3) Topics vary. Prereq: 520, 530, or consent of instructor. May be repeated. Maximum 6 hrs.
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/NC only. E

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

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

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

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.

GRADUATE PROGRAMS

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

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

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

THESIS OPTION

The thesis program involves satisfactory completion of the following requirements:

Research and Development Specialization

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

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. Six hours of electives in the major field, mathematics or engineering.
4. Twelve hours of Aviation Systems 500 demonstrating the ability to conduct and report on an independent investigation.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain

Aviation Systems (UT Space Institute)

MAJOR

Aviation Systems ........................................ M.S.

William D. Lewis, Program Chair

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

Associate Professors:
Lewis, William D. (Liaison), Ph.D. , Georgia Tech
Soltes, U. P., Ph.D. ....................... Tennessee

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

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

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

THESIS OPTION

The thesis program involves satisfactory completion of the following requirements:

Research and Development Specialization

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

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. Twelve hours of electives in the major field, mathematics or engineering.
4. Twelve hours of Aviation Systems 500 demonstrating the ability to conduct and report on an independent investigation.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain
Biochemistry and Cellular and Molecular Biology

(College of Arts and Sciences)

MAJOR DEGREES

Biochemistry and Cellular and Molecular Biology M.S., Ph.D.

John W. Koontz, Head

Professors:

Bagby, R. M., Ph.D. ...... Illinois
Carlson, J. G. (Emeritus), Ph.D. ...... Pennsylvania
Chen, T. T., Ph.D. ...... Florida
Churchich, J. E., Ph.D. ...... Michigan
Handel, Mary Ann (Distinguished Prof.), Ph.D. ...... Kansas State
Hochman, Ben (Emeritus), Ph.D. ...... California
Jeon, K. W., Ph.D. ...... London
Josh, 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. ...... Davis (California)
Monty, Kenneth J., Ph.D., Rochester
Roti, L. Evans (Emeritus), Ph.D. ...... Chicago
Salo, T. P. (Emeritus), Ph.D. ...... Michigan
Shivers, C. A., Ph.D. ...... Michigan State
Welch, H. G. (Emeritus), Ph.D. ...... Florida
Whitson, G. L. (Emeritus), 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
Peterson, Cynthia B., Ph.D. ...... LSU
Roberts, Daniel M., Ph.D. ...... California (Davis)
Serperu, Engi H., Ph.D. ...... Hтехчепе

Assistant Professors:

Bruce, Barry, Ph.D. ...... California (Berkeley)
Prosper, 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 8 semester hours of approved biology courses before 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. Participation in 601 and 603 during the entire period of residence. Participation in at least one journal club chosen from among 605-608 for three semesters.
5. Six hours of master's research and a thesis.
6. A final examination that covers both the thesis endeavor and the subject matter of the course requirements.

THE DOCTORAL PROGRAM

1. 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. Participation in at least one journal club chosen from among 605-608 for six semesters.
4. Comprehensive examination, taken before the end of the third year of study.
5. A dissertation reporting the results of original and significant research carried out during the term of candidacy.
6. 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 scientific journal and oral defense of that manuscript before an examining committee of three faculty members appointed by the head of the department, at least two of whom shall be members of the department;
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 the sharing of graduate programs between the states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Biochemistry and Cellular and Molecular Biology is available to residents of the state of Kentucky.
604 Advanced Topics in Biochemistry (3) Concepts related to structural biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

520 Special Topics (1-2) Selected directed readings or special course in topics of current interest. Consult departmental listing for offerings. May be repeated with consent of instructor. Maximum 6 hrs. S/NC only.

525 Graduate Research Participation (1-2) Tutorial laboratory experience. May be repeated. Maximum 12 hrs. E

550 Advanced Concepts in Neurobiology (3) Concepts related to neurobiology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

552 Physiology of Hormones (3) Cellular and organismal action of hormones in invertebrate and vertebrate animals. Prereq: 490 or consent of instructor. Recommended prereq: 410. 2 hrs and 1 lab. Sp

560 Advanced Concepts in Structural Biology (3) Concepts related to structural biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

561 Environmental Toxicology (3) (Same as Ecology and Evolutionary Biology 561.)

562 Introduction to Electron Microscopy (4) Practical application to techniques for preparation of biological samples for viewing in transmission electron microscopy. Use of microscope and ancillary equipment; darkroom techniques, preparation of materials for publication and special project. Admission limited only to departmentally approved graduate students. (Same as Botany 516.) 2-3 hr labs. Sp

564 Introduction to Electron Microscopy-Scanning Electron Microscope (3) Practical introduction to techniques of electron microscopy and to scanning electron microscopy. Use of microscope, introduction to darkroom techniques and digital image processing, preparation of samples for observation, and special project. Prereq: Consent of instructor. 2 hrs and 1 lab. Sp

570 Advanced Concepts in Cellular/Molecular Biology (3) Concepts related to cellular/molecular biology with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

580 Advanced Concepts in Genetics (3) Concepts related to genetics development with information taken from current literature. Predominantly lecture format with student participation. Specific subject area to be announced. Prereq: Consent of instructor. May be repeated.

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 Departmental Seminar (1) Invited speakers. Topics posted in advance. Required every semester in residence. S/NC only. F, Sp

603 Graduate Research Colloquium (1) Seminars and lectures dealing with current advances in fields of biochemistry, biochemical genetics, molecular biology, mechanisms of enzymes, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell ultrastructure and physiology, and related topics. Required every semester in residence. S/NC only. F, Sp

604 Current Topics in Environmental Toxicology (1) (Same as Ecology and Evolutionary Biology 504.) S/NC only. F, Sp

605 Journal Club in Neurophysiology/Physiology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hrs. S/NC only.

606 Journal Club in Structural Biology/Chemistry (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hrs. S/NC only.

607 Journal Club in Cellular/Molecular Biology (1) Readings and discussion based on current literature. May be repeated. Maximum 12 hrs. S/NC only.


511 Advanced Topics in Medical Science (Same as Comparative and Experimental Medicine, Graduate School of Medicine 511.)

515 Special Topics in Biochemistry, Cellular, and Molecular Biology (3) Biochemical and biophysical methods of enzyme catalysis, gene expression, membrane structure and function, metabolic regulation, physical biochemistry, molecular genetics, cell ultrastructure and physiology, and related topics. Prereq: 511-12 or consent of instructor. May be repeated. Maximum 9 hrs.

Biomedical Sciences

Office of the Vice Chancellor for Academic Affairs

MAJOR

DEGREES

Biomedical Sciences Ph.D.

Raymond A. Popp, Director

Assistant Research Professor:

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

Olins, Donald E., Ph.D. Rockefeller

Research Professor:

Popp, Raymond A., Ph.D. Michigan

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, ORNL, 1060 Commerce Park, Oak Ridge, Tennessee 37831.

THE DOCTORAL PROGRAM

1. Satisfactory (B grade or better) completion of the following core courses or their equivalent: Biochemistry (511); Biophysical Biochemistry (514); Genetics (515); Computing for the Life Sciences (525); and Survey of Statistical Methods (530).

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

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

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

5. Passing both written and oral comprehensive examinations.

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

7. A final oral examination on the dissertation.

8. A formal seminar presentation of the dissertation research.

GRADUATE COURSES

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

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

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

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

530 Survey of Statistical Methods I (3) Same as Statistics 530.

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

543-45-49 Graduate Research Participation (3,6,9) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

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

600 Doctoral Research and Dissertation (6-15) PrN only. May be repeated.

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

660 Mammalian Genetics (3) Known genetic variants affecting each organ system of experimental mammals, especially laboratory mice. Inheritance and phenotypical affect on each organ system of experiment animals. Prereq: 515.

Botany
(College of Arts and Sciences)

MAJOR DEGREES

Botany M.S., Ph.D.

Edward E. Schilling, Head

Professors:
Caponetti, J. D., Ph.D. ........................................ Harvard University
Clebsch, E. C. (Emeritus), Ph.D. ........................................ Duke University
DeSelm, H. R. (Emeritus), Ph.D. ........................................ Ohio State University
Evans, A. M. (Emeritus), Ph.D. ........................................ Michigan State University
Herron, W. R. (Emeritus), Ph.D. ........................................ Vanderbilt University
Hickok, L. G., Ph.D. ........................................ Massachusetts Institute of Technology
Holton, R. W., Ph.D. ........................................ Michigan State University
Hughes, K. W., Ph.D. ........................................ University of Utah
Pollack, B. C., Ph.D. ........................................ North Carolina State University
Peterson, R. H. (Distinguished Professor), Ph.D. ........................................ Ohio State University
Cokela Schilling, E. E. (Liaison), Ph.D. ........................................ Indiana University
Schwarz, O. J., Ph.D. ........................................ North Carolina State University
Walne, P. L. (Benwood Distinguished Professor), Ph.D. ........................................ Texas A&M University

Associate Professors:
Amundsen, C. C., Ph.D. ........................................ Colorado State University
Smith, D. K., Ph.D. ........................................ Tennessee State University
Wolford, B. E. (Curator), Ph.D. ........................................ Tennessee State University

Assistant Professors:
Pigliucci, M., Ph.D. ........................................ Connecticut State University
von Armin, A. G., Ph.D. ........................................ East Anglia (UK)

Lecturer:
McFarland, K. D., Ph.D. ........................................ Tennessee State University

The Department of Botany offers the Master of Science and Doctor of Philosophy degrees with concentrations in anatomy, biology, cytology, cytogenetics, ecology, genetics, lichenology, morphology, mycology, phytobiology, physiology, psychology, pteridology, and taxonomy.

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

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

ADMISSION REQUIREMENTS

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

1. Bachelor's degree: a B.A. or B.S. from an accredited college or university and a cumulative grade-point average of 2.5 or better (on a 4.0 scale), with evidence of ability to do work of graduate quality.

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

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

4. Physical sciences: general inorganic chemistry: 8 semester hours; organic chemistry. Physics highly recommended.

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

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

THE MASTER'S PROGRAM

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

Thesis Option

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

1. Satisfactory presentation of a written proposal 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 503.

2. Successful completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.

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


5. 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 36 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 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 proposal 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. Preparation of a dissertation on more cognate areas outside of the department totaling 6 hours of graduate credit with at least a B average.

4. Satisfactory performance on an examination in one modern foreign language (see Graduate Coordinator) or an A or B in French 303 or German 332.

5. Satisfactory completion of 6 hours of 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 laboratory experience 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 Field Studies in Botany (1, 3-1, 3) Field experience and taxonomy of special plant groups. Topics vary: myology, lichenology, phytosociology, agrostology, mycology, phycology, aquatic vascular plants, synanthrophy, woody 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 animal and plant systems. Lectures, paper discussions on primary literature; current research in evolutionary ecology and genetics. Prereq: General Botany or equivalent. Organization and Function of the Cell. (Same as Ecology and Evolutionary Biology 403.)

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

431 Plant Ecology (4) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in ecosystems. Species interactions and competition. Lectures, labs: at least two weekend field trips. Prereq: Field Botany of equivalent. (Same as Ecology and Evolutionary Biology 431.) Sp

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. Prereq: introduction to Microbiology and Lab; Plant Propagation; and Field and Forage Crops.

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

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when 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 Non-Thesis Research (2) Library, field, or laboratory research under supervision of staff member. Not for thesis candidates. May be repeated. Maximum 4 hrs. E

506 Phyology (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) and photomicrography, drawing, graphics and video for recording and presentation for research and publication of data in pictorial and graphic form.

510 Introduction to Electron Microscopy - Transmission Electron Microscopy (4) (Same as Biochemistry and Cellular and Molecular Biology 562.)


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 8 hrs. S/NC only.

560 Bryophytes and Pteridophytes (4) Taxonomy, phylogeny, ecology and development morphology: field studies and current research. Prereq: 310-20 or consent of instructor. 2 hrs and 2 labs. F, A

562 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various research methods, lab, equipment, adaption, procedural, gas chromatography, atomic analyzers, microscopy, culture methods, use and detection of radiotopes. Prereq: Chemistry 350, 380; Physics 121, 122. May be repeated. Maximum 5 hrs. S/NC only.

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

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

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

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

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

GRADUATE COURSES

September, 1990

Assistant Professor: Wilkinson, Jeffrey, Ph.D. --------------- Georgia

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

GRADUATE COURSES

440 Corporate Video (3) Special requirements of business, educational and governmental uses of video. Management, budgeting, planning, producing and evaluating projects. Prereq: 430 or consent of instructor.


460 Broadcast News Operations (3) Production of news programs for broadcast on television stations. Electronic news gathering, editing and writing news packages and studio production. Prereq: 410 or consent of instructor.

470 Cable Television and Emerging Technologies (3) History and structure of cable television industry. Cable regulations and programming. Entry of telephone companies in distribution video. Analysis of all relevant technological, public policy, and commercial issues. 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, economic, and public policy issues. Prereq: Consent of instructor or admission to program. F, E

570 Radio & Television Research (3) Various techniques and consultants in broadcast research. Applied audience research. Deciding which methods to use, interpreting results, and applying research to management decision-making. Prereq: Communications 512 or 612, or consent of instructor. Sp

580 Seminar in Radio and Television (3) Sallent topics in broadcasting. Topics vary. International broadcasting, cable television, new technologies, corporate television, education and public broadcasting, and society. Prereq: Consent of instructor or admission to program. May be repeated. Maximum 6 hrs. (Same as Information Sciences 591.) F


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

598 Internship (3) Full-time (30-40 hrs/wk) work experience in news, production, or sales and management with non-university professional organization. Educational experience beyond that available at university. Final term paper. Prereq: Radio and Television. F, Sp


900 Seminar in Radio and Television (3) Sallent topics in broadcasting. Topics vary. International broadcasting, cable television, new technologies, corporate television, educational and public broadcasting, and society. Prereq: Consent of instructor or admission to program. May be repeated. Maximum 6 hrs. (Same as Information Sciences 591.) F
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 the Graduate School Application, transcripts of prior college work, the MBA program application, two completed applicant recommendation forms, and the Graduate Management Admission Test (GMAT) score report. The first items should reach The Graduate School one month before the MBA application deadline to allow for processing. Additional information is required by The Graduate School for international students.

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

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

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

The remaining elective courses must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the college. Courses outside the College of Business Administration as well as courses listed in the Graduate Catalog, numbered below 500 may be included in this block only with written prior permission 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 submitted toward MBA degree requirements within the following limits:

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

Elective Area: 3 hours.

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

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

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

BUSINESS ADMINISTRATION

For a complete listing of MBA program requirements, see above. MBA Concentrations: Global Business, New Venture Analysis and Entrepreneurship. 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 in the MBA program. Students are expected to participate in a foreign exchange or field experience if at all possible, especially for those with no previous foreign experience.

Language training is advised but not required, and beginning language courses are not typically available for graduate credit.

The concentration in new venture analysis and entrepreneurship is comprised of three specifically designed courses which are interdisciplinary in nature. This concentration strives to build a strong academic foundation for both entrepreneurial and intrapreneurial activities. The new venture analysis and entrepreneurship concentration is offered in recognition of the growing trend in American business today towards new product/venture development. The new venture analysis and entrepreneurship concentration comprises at least two 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 the lawyer and the business-oriented manager, (b) contemplate a career in business management and want to acquire the skills and perspective of a lawyer, or (c) contemplate a career as a lawyer specializing in business-related law and want to acquire the skills and perspective of the business-oriented manager.

Admission Requirements

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

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

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

Curriculum

A dual program candidate must satisfy the graduation requirements of each college. Students withdrawing from the dual program before completion of both degrees will not receive credit toward graduation from either college for courses in the other college, except as such courses qualify for credit without regard to the dual program.

The College of Law will award up to 9 semester hours of credit toward the J.D. for acceptable performance in approved graduate-level courses offered by the College of Business Administration. The College of Business 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.

Awards 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.

DUAL M.S.-MBA PROGRAM

The College of Business Administration and the College of Engineering offer a coordinated program leading to the conferral of the Master of Business Administration degree (concentration in manufacturing management) and the Master of Science degree with a major in Industrial Engineering (concentration in manufacturing systems engineering). The dual program saves the student one or two semesters over the time that would be required to earn both degrees independently.

The establishment of the dual program addresses the critical need for personnel trained in both engineering and management who can integrate this increasingly complex body of knowledge in achieving the efficient operation of manufacturing and production firms. The program is designed to accommodate the interests of student who desire a career leading to a leadership position in a manufacturing organization.

Admission Requirements

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

Students will initially apply for the MBA program, indicating on that application the intent to pursue the dual M.S.-MBA program in manufacturing (refer to the MBA program for separate instructions). During the second semester of the first year, students will revise through The Graduate School to the M.S. program with a major in Industrial Engineering beginning Fall semester of the second academic year. Students accepted for both degree programs will be assigned by the Dual Program Committee advisors who will be responsible for course approval and supervision of the student's progress through the dual program.

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

Curriculum

The curriculum in the first academic year of the dual M.S.-MBA program is the two-semester core of the MBA program (two 15-hour courses, one each semester). A 1-hour seminar course each semester in manufacturing will also be taken concurrently during the first two semesters (not for graduate credit). A 3-hour design or industrial problem project course will be completed in the summer term of the first year. This will summer internship in industry, and the project will be academically supervised by a faculty member associated with the dual program.

During the second year, 27 hours of coursework will be completed in the manufacturing systems engineering concentration in Industrial Engineering plus an additional 9 hours of graduate courses in the College of Business Administration acceptable in meeting the requirements of the MBA program. Fifteen hours will be taken each during each of the first two semesters of the second academic year. A culminating 6-hour integrated case study of major previous experience, and a final examination as required by the Dual Program Committee, will be taken during the second session of summer term of the second year.

The dual degree candidate must satisfy the curriculums and graduation requirements of the Department of Industrial Engineering and the College of Business Administration. Dual degree candidates must complete the dual program before completion of both degree programs will not receive credit toward graduation in either degree program for courses in the other degree program, except as such courses qualify for credit towards the other degree program. The M.S. and the MBA degrees will be awarded upon successful completion of both degree programs.

Approved Dual Credit

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

PROFESSIONAL MBA PROGRAM

The professional MBA is provided for fully employed individuals. The weekend track of the MBA results in the same Master of Business Administration degree as the full-time MBA and part-time MBA.

The professional program is three consecutive semesters completed in 18 months. Classes meet all day on Saturdays and occasionally on Friday evening and/or Sunday afternoon. It offers an integrated core curriculum with an applied project in each semester. The program begins in the fall semester with an intensive week of classes, then continues with weekend classes throughout the following calendar year. The final fall semester also includes an intensive week of courses in addition to weekend classes.

Admission Requirements

Applications are accepted for fall semester only. The application deadline is April 15. For admission to the program, consideration is given to (1) applicant's academic record with particular attention to the last two years of undergraduate work and previous graduate work, (2) scores on the GMAT and the Test of English as a Foreign Language (TOEFL) for those whose native language is not English, (3) work experience and other activities that demonstrate potential for leadership, and (4) recommendations from supervisors. The admission decision is based on all factors which make up the total application; therefore, there is no automatic cut-off for either grade-point averages or GMAT scores.

Prerequisites

There are no specific course prerequisites for admission. However, undergraduate courses and work experience should demonstrate ability with both qualitative and quantitative work.

Transfer Credits

Because of the fully integrated nature of the professional MBA core curriculum, no credit hours may be transferred as substitutes for core curriculum.

Other Requirements

Other requirements are the same as those for the full-time MBA program.

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 objectives of the program is to provide advanced management skills to individuals who play key roles in leading their organizations.

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

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

Admission Requirements

All participants begin and complete the program together in one twelve-month period. Sessions begin in January of each year. Final deadline for applications is October 10 of the preceding academic year. For admission to the program, the applicant must have a bachelor's degree and 10 or more years of work experience.

Applications must submit a complete application file including the Graduate School Application, official transcripts of prior college work, the executive MBA program application with recommendations from supervisors, and the Graduate Management Admissions Test (GMAT) score report. Transcripts from other institutions and other work experience must be evaluated by a faculty member in the sponsoring organization.

To be considered for admission, the applicant must have a bachelor's degree and 10 or more years of work experience. Applicants should submit a complete application file including the Graduate School Application, official transcripts of prior college work, the executive MBA program application with recommendations from supervisors, and the Graduate Management Admissions Test (GMAT) score report. Transcripts from other institutions and other work experience must be evaluated by a faculty member in the sponsoring organization.
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 Management Project III. It includes two residence sessions.

The core courses are a full-term curriculum with reading and study, case work and problem solving, as well as analyses and applications within the sponsoring organization during the off-campus periods. The topics introduced within these courses follow five major themes: the functional fundamentals (learned within a cross-functional framework); continuous improvement from a systems-thinking perspective; the role of the firm in the global environment; organizational culture and change management; and personal and team development.

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

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

Executive MBA in Taiwan
The executive MBA taught in Taipei, Taiwan is designed for professionals residing in Taiwan and other countries. Its target audience and objectives are the same as those on the Knoxville campus, except that the sequence of material has been changed to accommodate the schedules of faculty teams traveling to Taiwan. The executive track of the MBA in Taiwan results in the same Master of Business Administration degree as the full-time MBA and executive MBA on the Knoxville campus.

The executive MBA in Taiwan is three semesters of 15 credit hours each, including the same core and project courses described for the Knoxville program. Between each semester, there is a term when students are not enrolled. The program begins in the Summer term, continues in Spring semester of the following calendar year and is completed in the Fall semester of that same year. All participants begin and complete the program together.

Each semester is comprised of two periods of concentrated class work with a continuous program of reading, study and on-the-job applications between class periods. The class will meet occasionally during the semesters in which they are not enrolled for purposes of discussing the readings and assignments and for assisting one another. The first five periods will be taught in Taiwan. The sixth class period is a three-week residency on the Knoxville campus.

Admissions Requirements for the Executive MBA in Taiwan
To be considered for admission, the applicant must have the equivalent of a U.S. 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, and the executive MBA program application with a recommendation from their company. Admission to the program is competitive. Primary consideration is given to the applicant's work history and the recommendation from the applicant's manager, and applicants will be evaluated on their ability to operate on a par with other high achieving participants.

Each international participant who has not taken the Test of English as a Foreign Language (TOEFL) within the previous two years must take and pass it with a score of 550 or higher. This test may be taken after enrolling in the program but must be successfully completed prior to the international study period in the U.S. To allow for registration, delivery of scores and receipt of the I-20, participants should arrange to take the TOEFL at least 5 months before the international study period.

Executive MBA for Physicians
The physician track of the executive MBA is custom designed for physicians. Its objectives are the same as the generalized executive track of the MBA on the Knoxville campus. The curriculum content is like that of the Knoxville executive MBA, except that it is focused on executive education within the health care industry. The physician track of the executive MBA program results in the same Master of Business Administration degree as the full-time MBA and executive MBA programs on the Knoxville campus.

The physician program is three semesters of 15 credit hours each, including the same core and project courses described for the Knoxville program. The program begins in the Spring semester, continues into the Summer term, and is completed in the Fall semester of that same year. All participants begin and complete the program together.

Each term begins with one intensive residential period of concentrated class work with subsequent interactive sessions between faculty and students using distance learning technologies. In addition, a fourth and final residential period at the end of the Fall term will conclude the educational experience.

Admission Requirements for the Executive MBA for Physicians
To be considered for admission, the applicant must have an M.D. degree and 5 or more years of work experience. Applicants must submit a complete application file including the Graduate School application, official transcripts of prior college work, and the executive MBA program application. Admission to the program is competitive. Applicants will be evaluated on their ability to operate on a par with other high achieving participants and on their future management potential.

Program of Study
The executive MBA 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 consists of coursework, writing, and research. The third year usually focuses on completion of the dissertation research and writing. It is emphasized that the Ph.D. program of study is structured for full-time students only. Upon acceptance of a student by a particular departmental faculty, the student is expected to remain in residence until the dissertation has been completed and all requirements are met for completion of the Ph.D.

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

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

- Accounting
- Finance
- Logistics and Transportation

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

Admission Requirements
Students seeking a Ph.D. degree must be accepted for acceptance by the College of Business Administration to The Graduate School. Actual admission is based on the applicant's overall standing compared with other applicants and with the number of vacancies in each department. All candidates should be received by the College of Business Administration by 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.

Transfer Credits
Students seeking a Ph.D. degree must be accepted for acceptance by the College of Business Administration to The Graduate School. Actual admission is based on the applicant's overall standing compared with other applicants and with the number of vacancies in each department. All candidates should be received by the College of Business Administration by March 1. Late applications are considered only if space is available.

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

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

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

- Accounting
- Finance
- Logistics and Transportation

Ph.D. program:
Management (Operations Management and Strategic Management)

Marketing

Statistics

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

Degree Requirements

Doctoral students must file a program of study that has been approved by their doctoral committee within one year of completing their first year of doctoral studies. This committee is nominated by the department chairperson in a student's intended area of concentration, subject to the Graduate Council's policies and procedures. Following are specific degree requirements:

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

2. Students are required to have a sound and broad base on which to build their Ph.D. coursework. The departmental doctoral advisor will work with the student to determine what, if any, courses need to be completed. All such work is subject to approval by the temporary doctoral advisory committee and the Director of Graduate Business Programs. Specific concentrations may have prerequisites.

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

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

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

Comprehensive Examinations

Comprehensive written examinations over the concentration area are required of each person seeking candidacy for the Ph.D. degree. This examination is administered in two sessions of approximately four hours each. Students quality in the cognate area by completing a one-session, four-hour examination or an equivalent jointly approved by the student's major professor and the student's advisor in the cognate area. Comprehensive examinations are generally offered during the fall and spring terms. Comprehensive examinations must be taken within five years of matriculation.

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

Doctoral Committee

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

Admission to Candidacy

Students may apply for admission to candidacy for the Ph.D. after maintaining at least a "B" average in coursework, successful completion of comprehensive examinations, and acceptance of a research proposal for the dissertation by the student's doctoral committee.

Admission to candidacy must be approved at least one full semester prior to the date the degree is conferred. (Admission in the fall permits graduation in the following spring semester.)

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

502-03 Business Core for Master of Accountancy I, II (3) Development of role and responsibility of account-ant as business advisor. Assessment and delivery of customer value, continuous system improvement, sta-tistical process control, human resource management, role of quality in competitive organizations, performance measurement, financing, and overall corporate strategy. Prereq: Admission to M.Acc. program.

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

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

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

510 Management of Responsible Service Organizations (3) Management of non-profit organizations or public accountable functional methods built on analyzing, empowering, monitoring and mentoring employees as they diagnose and respond to individual customer needs.


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


593 Directed Independent Study (3) Cross-disciplinary topic of mutual interest to student and faculty. Available only by permission of faculty member. May require approval of Director of Graduate Business Programs. May be repeated. Maximum 6 hrs. S/NC or lettergrade.
Chemical Engineering

(Chair of Engineering)

MAJOR DEGREES

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

Charles F. Moore, Head

Professors:

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

Courcoul, Robert M., Ph.D ................. Tennessee

Cubison, David L. (Emeritus), Ph.D .... Texas

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

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

Johns Hopkins

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

Hu, Sen-Wen (Emeritus), Ph.D .............. Wisconsin

Moore, Charles F. (Alumni Prof.) (Lisbon), Ph.D ............. Louisiana State

Perona, Joseph J. (Emeritus), PE, Ph.D

Northwestern

Prados, John W. (University Prof.) (LE), Ph.D ............ Minnesota

Sheth, Atul C. (UTSI), Ph.D ............... Northwestern

Thomas, Carl O. (Emeritus), Ph.D ....... Pennsylvania

Associate Professors:

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

Wang, Tse-Wei, Ph.D, Ph.D .............. MT

Weber, Frederick E., Ph.D ............... Minnesota

Frymier, Paul D., Ph.D ............... Virginia

Kaffer, David J., Ph.D, 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, 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 the thesis. The minimum requirements are 15 hours in chemical engineering; 3 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 3 hours chosen from either of these two categories.


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

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

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

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

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

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

THE DOCTORAL PROGRAM

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

Department requirements consist of the satisfactory completion of:

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

2. Supporting courses in related scientific and engineering fields amounting to approximately 24 semester hours, subject to approval by the student's faculty committee. These related fields will normally include mathematics, chemistry, 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 processes and related problems, optimizing linear and dynamic programming; Prereq: Mathematics 245.


477 Honors: Engineering Internship in Process Control (4) Selected students work in small groups on industrial problems in process dynamics and control. Directed by faculty and engineers from host company. Prereq: Process Dynamics and Control and consent of instructor.

478 Honors: Professional Experience in Process Control (4) Selected students work in small groups on industrial problems in process dynamics and control. Directed by faculty and engineers from host company. Prereq: Process Dynamics and Control and consent of instructor.

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


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

500 Thesis (1-15) PrN only, E

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

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

505 Engineering Analysis (3) Solution of problems in chemical engineering and materials areas, 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 to problems in systems and control areas. Geometric and physical interpretation of matrix 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 studies. Introduction to linear programming. Computer projects. Prereq: Graduate standing or consent of instructor. (Same as Electrical Engineering 507 and Mechanical Engineering 507.)

531 Advanced Chemical Engineering Thermodynamics (3) Principle of thermodynamics, chemical equilibrium, and non-ideal 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, fluid flow stage pond to mass transfer operation, emphasizing nonisothermal and multicomponent systems.

547 Introduction to Transport Phenomena (3) Unified treatment of mass, momentum, and heat transfer. Differential and integral balances in deriving governing equations. Analogies between processes. Use of dimensionless approach in scaling systems up or down. Applications involving transfer and simultaneous chemical reactions.

551 Chemical Reactor Analysis (3) Rate models for heterogeneous reactions, properties of porous catalytic catalysts, deadend, local, and stirred vessels. Fluid-solid reactions. Prereq: Mass Transfer and Separation Processes.

575 Applied Microbiology and Bioengineering (3) Crossdisciplinary course combining basic concepts in microbiology, biochemistry, reaction kinetics, and biochemical and environmental engineering. Commercial processes, biodegradation, wastewater treatment, analysis of basic bioreactor systems, biosensors, and immobilization methods. Fundamental laboratory techniques during 5-week laboratory sections. Prerequisite: Environmental Engineering 575, Agricultural Engineering 575 and Microbiology 575.

580 Technical Review and Assessment (3) Preparation of critical review of literature in area related to chemical engineering. Limited to candidates in non-thesis option. Prerequisite: Consent of advisor.

581 Industrial Pollution Prevention (3) Principles and practical aspects of industrial waste minimization. Regulatorv protocols, waste minimization strategies, economic analysis, process safety, case study: analysis of alternative waste minimization/management technologies. Prerequisite: 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) P/NP only.

631 Advanced Topics in Statistical Thermodynamics and Molecular Dynamics (3) Statistical thermodynamics, molecular-based model formulations, Monte Carlo and molecular dynamic calculations; applications to supramolecular fluids, macromolecules and biological systems. Prerequisite: 535.

641 Advanced Diffusional Operations (3) Fixed and fluidized bed operations, recent developments in separation processes. Prerequisite: 542.

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

647 Advanced Transport Phenomena (3) Theory of mass, momentum, and energy transport in reactive and non-reactive systems. Formulation of transport models useful for application to analysis and design of separation processes, and chemical and biochemical reactors. Prerequisites: 505, 547.

651 Advanced Reactor Analysis (3) New reactor systems, reactor stability, recent developments in reactor analysis. Prerequisite: 551.

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 mechanistic processes, interactions, and regulation at several systems levels (reactor or macro, ecological, cellular, physiological and molecular). Experimental methods for data gathering, signal resolution and processing, mathematical signal analysis, model development (deterministic, stochastic, phenomenological), and utility and limitations of approach. Prerequisite: 575 or consent of instructor.

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

Chemistry

(College of Arts and Sciences)

MAJOR

DEGREES

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

Michael Sepaniak, Head

Professors:

Adcock, J. L., Ph.D. .......... Texas
Alexandritis, S. D. (Hoechst-Celanese) Prof. of Polymer Science), Ph.D... California
Baker, D. C. (Paul and Wilma Ziegler Prof.), Ph.D... Ohio State
Bartmess, J. E., Ph.D...... Northwestern
Bloor, J. E. (Emeritus), Ph.D...... Manchester
Bull, W. E. (Emeritus), Ph.D...... Illinois
Chambers, J. Q., Ph.D...... Tennessee
Cook, K. D., Ph.D...... Wisconsin
Dean, J. A. (Emeritus), Ph.D...... Michigan
Eastham, J. F. (Emeritus), Ph.D...... California
Fletcher, W. H. (Emeritus), Ph.D...... Minnesota
Grimm, F. A., Ph.D...... Cornell
Guiochon, G. (Distinguished Scientist), Ph.D...... Ecolle Polytchnique and Paris VI
Kabalka, G. W. (Robert H. Cole Prof., Distigluex Prof.), Ph.D...... Purdue
Kleinfler, D. C., Ph.D...... Princeton
Kovac, J. D., Ph.D...... Yale
Lietzke, M. H. (Emeritus), Ph.D...... Wiscosin
Magid, L. J., Ph.D...... Tennessee
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...... Johns Hopkins
Wehry, E. L. (Emeritus), Ph.D...... Purdue
Williams, T. F. (Distinguished Prof.), Ph.D...... London
Wunderlich, B. (Distinguished Scientist), Ph.D...... Northwestern

Associate Professors:

Barnes, C. E., Ph.D...... Stanford
Feiglirte, C. S., Ph.D...... Colorado
Schell, F. M., Ph.D...... Indiana
Xue, Z. B., Ph.D...... California

Assistant Professor:

Dadamun, M. D., Ph.D...... Massachusetts
Gilman, S. C., Ph.D...... Penn State
Hinde, Robert J., Ph.D...... Chicago
Young, D. G., Ph.D...... Ohio State

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

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

THE MASTER'S PROGRAM

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

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

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

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

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

4. Sufficient graduate coursework in chemistry (at the 400 level or above) and/or related field to make an overall total of 30 hours, including one of the following sequences: 530-31, 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.

THE DOCTORAL PROGRAM

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

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

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

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

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

4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 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: 510-11-12, 530-51-52, 550-51-52, 570-72-73, 590-94-95.

6. A final oral examination.

The Ph.D. program with concentration in chemical physics is conducted jointly with the Department of Physics. Requirements depend on the choice of the major department. Chemistry/departmental requirements include passing the above degree requirements in chemistry with concentration in physical chemistry plus 6 additional hours in physics at the 500 level or above. Three of the additional physics 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 modern techniques for characterization, coordination and organometallic chemistry. Prerequisite: 330. Prerequisite: 330 or 381. Sp

450 Advanced Organic Chemistry (3) Modern organic reactions of mechanistic, synthetic, and theoretical interest. Current trends. Prerequisite: 360. Fall

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 473 nor for both 481 and 483. 473-83 Properties of gases; first, second, and third laws of thermodynamics; chemical equilibria; simple phase-equilibrium; properties of solutions; introduction to statistical thermodynamics. 483-Kinetics of chemical reaction; introduction to quantum mechanics and applications to electronic structure of atoms and molecules;
molecular spectroscopy. Prereq: General Chemistry, Elements of Physics or Fundamentals of Physics: Electricity and Magnetism, and Calculus III. F, SP

479-89 Physical Chemistry Laboratory (2, 2) 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. Lab 479-E, 489-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 (1-16) Pr/NP only. E

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

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

510 Analytical Spectrometry (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 electrochemical phenomena. Prereq: 1 yr of physical chemistry.

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

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

530 Chemical Bonding (3) Wave mechanical atom, group theory, quantum approach to molecular orbital theory, covalent, ionic, and metallic bonding, ligand field theories, solid state. Prereq: 1 yr of physical chemistry.

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

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

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

550 Structure and Reactivity in Organic Chemistry (3) Structure and bonding in organic compounds; molecular orbital theory, quantum chemistry, 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, radical, and pericyclic reactions; reactive intermediates. Prereq: 550. Sp

553 Spectroscopic Characterization of Organic Compounds (3) Organic structure elucidation using spectroscopic methods: nuclear magnetic resonance, ultraviolet and mass spectrometry. Prereq: 360 or equivalent. F

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

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

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.

573 Chemical Kinetics and Transport (3) Time-dependent chemical kinetics; chemical kinetic rates, reaction and transport theory. Prereq: 1 yr of physical chemistry.

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


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

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

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

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: Consent of instructor. May be repeated. Maximum 12 hrs.

## Child and Family Studies

### Majors

**Child and Family Studies**

**Majors**

**Child and Family Studies**

**M.S. Human Ecology**

**Ph.D.**

**Connie Steele, Head**

**Professors:**

- Blanton, Priscilla, Ed.D. .................................. Tennessee
- Buehler, Cheryl, Ph.D. .................................... Minnesota
- Cunningham, Jo Lynn, Ph.D. ............................. Michigan State
- Fox, Greer Lilton, Ph.D. ................................. Michigan
- Moran, James D., Ph.D. .................................. Oklahoma State
- Nordquist, V. Mick, Ph.D. ............................... Tennessee
- Steele, Connie, Ed.D. .................................... Texas Tech
- Twardosz, Sandra, Ph.D. ................................. Kansas

**Associate Professors:**

- Allen, Jan, Ph.D. ........................................... Purdue
- Maia, Julia, Ph.D. ......................................... Iowa State
- Smith, Delores, Ph.D. .................................... Oklahoma State
- Tegano, Deborah, Ph.D. ................................... Virginia Tech

**Assistant Professors:**

- Groves, Melissa, Ph.D. ................................. Virginia Tech
- 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 12 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 Track 1 consist of early childhood education, early childhood special education, early childhood administration and child 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 is based on an undergraduate degree in child development or equivalent coursework. A non-thesis option only is available in Track 2.
Theo Thesis students are required to take: 3 hours of 500-level research methods; 3 hours of 500-level statistics; 9 hours of CFS courses in the area of concentration; 6 hours of thesis credit; and an oral comprehensive examination. Non-thesis students are required to take 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 564, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

Track 2 - All students in the early childhood education licensure program must enroll in Human Ecology 574, 575, 591, and Holistic Teaching (or equivalent CFS courses). Students select 3 hours from CFS 510, 511 or 512; three courses from CFS 511, 520, 521, 522, 530, 540, 525, 590; 3 hours of 500-level statistical methods or interpretation of statistics or research methods (requirement may be met with CFS 570); and written comprehension examination (36 hours).

The family studies concentration consists of specializations in family life intervention and family science. Thesis and non-thesis options are available. Students should also consider an interdisciplinary minor in gerontology to provide a life span perspective to human development or family studies.

Students in the family studies concentration must enroll in CFS 550, 571, and 540 or 560. At least 6 hours in a cognate area outside the department are required. Thesis students are required to take: 3 hours of 500-level research methods; 3 hours of 500-level statistics; 6 hours of CFS courses in an area of concentration; 6 hours of thesis credit; and an oral comprehensive examination. Non-thesis students are required to take: 3 hours of 500-level research methods, statistical methods, or interpretation of methods and statistics; CFS 564, 565; 9 hours of CFS courses in the area of concentration; and a written comprehensive examination.

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

THEP.D. CONCENTRATION

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

Requirements include:
1. Minimum 13-16 hours in child and family studies required foundation courses: 510, 550, 570, 571; 511 and 630 (child development area); or 634 (family studies area).
2. Minimum 12 hours in 500- and 600-level courses in child development or family studies, with at least 3 hours in 600-level courses (in addition to the required courses described in #1);
3. Minimum 6 hours in a cognate area;
4. Minimum 9 hours in graduate-level statistics; with at least 3 of these hours in a more specialized area than a sequence of course surveys;
5. Minimum 3 hours of specialized research methods;
6. Pre-doctoral research project approved by student's committee;
7. Minimum 8 hours of electives;

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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

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

505 Development of Interpersonal and Supervision Skills (2) Refinement of interpersonal skills needed to work with families and other professionals. Supervisory training in others' skill development, active listening, self-disclosure, relationship building, and negotiation. F

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

511 Survey of Research in Child Development (3) Classic and contemporary research literature in child development from conception through adolescence. Prereq: 510 or equivalent or consent of instructor. Sp

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

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) Current 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 with 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 educational 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. 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 child's growth; parent's role in development and socialization of system 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 Advanced Family Diversity (3) Diversity in family configurations in contemporary U.S. society. Variations of family patterns by race, ethnicity, religion, and social class; societal dynamics of family formation, composition, and paternity. Prereq: 550. F

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.

562 Families in Crisis (3) Family processes during times of stress, vulnerabilities, and coping mechanisms of families. Prereq: 550 or equivalent.

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

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

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

566 Approaches to Family Intervention and Counseling (3) Various theoretical approaches for family intervention and counseling. Structural, strategic, experimental, and social learning schools of practice. Effects of intervention from perspective of their impact on family functioning and family environment. Prereq: 562. (Same as Counselling Education and Counseling Psychology 566.)

567 Family Violence (3) Theory and research on initiation, maintenance and cessation of violent behaviors in intimate family contexts; and assessment of responses to violent family behaviors, perpetrators, victims, and family systems. Prereq: 550. F/A


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

580 Special Topics in Human Development or Family Studies (1-3) Research, theory and current issues in child development or family studies; divorce, handicapped children, sibling interactions, work and family, Plagist, mainstreaming children, theory and research in human sexuality, cognition. Prereq: 6 graduate hrs in major, or consent of instructor. May be repeated with different topics. Maximum 9 hrs. E

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

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

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

(College of Engineering)

MAJORS

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

Gregory D. Reed, Head

Professors:
Bennett, R. M., PE, Ph.D. ..................................... Illinois
Burdette, E. G. (Fred N. Peebles Prof.), PE, Ph.D. ............... Illinois
Chatterjee, A., PE, Ph.D. ....................................... NC State
Davis, W. T., Ph.D. .................................................. Tennessee
Deatherage, U. H., PE, Ph.D. .................................... Tennessee
Drumm, E.C., PE, Ph.D. ........................................... Arizona
Ghosh, M. (Goodrich Chair of Excellence). Ph.D. .............. Illinois
Goodpasture, D. W., PE, Ph.D. ................................... Illinois
Grecco, W. L. (Emeritus), Ph.D., Michigan State
Heathington, K. W. (Emeritus), Ph.D. ............................. North Carolina
Humphrey, B. (Emeritus), Ph.D., Texas A&M
Johnson, H. L. (Emeritus), M.S. ................................. Tennessee

Miller, W. A. (Granger Prof.), PE, Ph.D. ......................... Georgia Tech
Reed, G. D. (Laison), PE, Ph.D. ................................. Arkansas
Robinson, B. R. (Fisher Prof.), PE, Ph.D. ......................... Iowa State
Smoot, J. L., PE, Ph.D. ........................................... Virginia Polytechnic Institute and State University
Tachritz, B. A. (Condra Prof.), PE, Ph.D. ......................... Missouri State
Walker, C. R. (Emeritus), M.S. .................................... Michigan State
Wegmann, F. J., Ph.D. .............................................. Northwestern

Associate Professors:
Chou, K. G., Ph.D. .................................................. Northwestern
Cox, C. D., Ph.D. .................................................... Penn State
Han, L. D., Ph.D. .................................................... California
Hansen, J. H. (UTSI), Ph.D. ........................................ Missouri
Mauldin, M., Ph.D. ................................................... California
Miller, T. L., PE, Ph.D. ............................................ Tennessee
Richards, S. H., PE, Ph.D. .......................................... Tennessee
Robinson, K. G., Ph.D. ............................................. Virginia Polytechnic Institute and State University

Assistant Professor:
Jackson, N. M., PE, Ph.D. ......................................... Oregon State

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, 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 programs.

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 33 semester hours is required. Special problems culminate in a written report which must be approved by the student's major professor.

Environmental Engineering

For a Master of Science with a major in Environmental Engineering, normally a Bachelor's degree in a field of engineering is required. For a student who does not have an engineering background, the following minimum prerequisite courses will be required: Basic Engineering or Computer Science 101; Basic Science 121, 131; Engineering Science and Mechanics 231; Statistics 251; Civil Engineering 390, 395, 380; Mathematics 141, 142, 231, 241; Chemistry 120, 130. In general, these must be completed with a B average before courses for graduate credit can be taken.

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

Non-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.

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

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

THE DOCTORAL PROGRAM

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

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

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 24 semester hours in 600 Doctoral Research courses is 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 reading knowledge of a foreign language is crucial to the student's research efforts.

5. and 6. For completion of the dissertation, prior to graduation, each student must pass a comprehensive examination.

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

Civil Engineering

GRADUATE COURSES

421 Portland Cement and Asphalitic Concrete (3) Aggregate characteristics, properties of Portland cement concrete, mix design methods for concrete, asphalt and asphalitic 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; basic principles of geometric and pavement design. Prereq: 210, 251, 352.

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

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

461 Analysis of Framed Structures (3) Maximum stress due to moving loads; use of influence lines; lateral forces due to earthquake and wind, analysis of portals, building frames, and space frames; matrix methods; use of computer in structural analysis. Prereq: Structural Analysis II.

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

474 Reinforced Concrete Design (3) Reinforced concrete continuous beams and floor slabs, columns with combined axial loads and bending, footings and retaining walls. Prereq: 471.

485 Principles of Hydrogeology (3) (Same as Geology 485). Principles of groundwater occurrence, movement and storage; geologic controls. Prereq: Geology 100.

490 Water Resources Project Design (3) Coherent development of multipurpose reservoir and dam project; data acquisition; spillway and outlet works design; earthen and gravity dam stability analyses; drains and filters; maintenance and operation principles; and dam safety concepts, dam break analyses. Prereq: 390, 395.

494 Urban Drainage Engineering (3) Design and management of stormwater conveyance and control structures. Application of hydraulic and hydraulic principles to design of drainage systems for urban, suburban, and highway development; design of inlet structures, ditches, culverts, and detention/retention basins; application of computer-aided design and computer-aided 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; instruction in 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 faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

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

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


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


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


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

538 Finite Element Applications in Geotechnical Engineering (3) Applications of finite element method to typical problems in geotechnical engineering. Confining and unconfined flow through porous media, stresses and strains in elastic halfspace; representation of nonlinear soil behavior with elastic and elastoplastic models; soil structure interaction effects. Prereq: Introduction to Soil Behavior and 551.

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

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

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

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

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

552 Traffic Engineering-Operations (3) Signs, signals and traffic control; signal operation; signal timing/timphasing; one-way reversible flow; system operation; identification and correction of high-accident locations and system deficiencies. Prereq: 551 or 452.

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

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

555 Public Transit Planning (3) Characteristics of transit modes—conventional and paratransit; operational design of transit services; route planning and scheduling; 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; roadside hardware design and crash testing. Prereq: 452 or graduate standing.

557 Transportation Planning and Operations with Micro-Computer Applications (3) Transportation system management techniques and application of micro-computers to analysis of transportation actions. Prereq: 551 and 556.

558 Planning and Transportation (3) Preparation of transportation as elements of comprehensive development. Analysis of relationships between various transportation modes and between transportation and other community features. Use of planning process to evaluate existing travel patterns, modeling of demand, proposing alternatives and evaluations. Prereq: Graduate standing. (Same as Planning 537.)

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

563 Statically Indeterminate Structures (3) Deflections of beams and trusses; force methods; moment distribution and other displacement methods; secondary stresses. Prereq: 361.

565 Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; eigenvalue and eigenvector behavior considered for structural systems; earthquake design and response of structures. Prereq: 551.

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

571 Behavior of Steel Structures (3) Behavior of structural steel members due to static and fatigue loading; relation between research results and current specifications for design. Prereq: 471.

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

574 Behavior of Reinforced Concrete Members (3) Moment-curvature and load-deflection relationships for reinforced concrete beams; combined bending and axial load; shear and moment in reinforced concrete members. Prereq: Introduction to Structural Design.

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

576 Masonry Design (3) Clay and concrete masonry materials; unreinforced masonry design; reinforced masonry design; seismic behavior of masonry structures. Prereq: Introduction to Structural Design.

580 Risk Analysis in Civil and Environmental Engineering (3) Applications of probability theory and statistics in civil engineering disciplines: structures, geotechnology, water resources, transportation, and
Environmental Engineering

GRADUATE COURSES

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

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

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

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

520 Open Channel Hydraulics (3) Open channel flow principles, properties, and classifications; uniform and gradually varied flow theory and applications; open channel design; unsteady flow theory and analysis; dynamic routing; spatially varied flow; nonlinear flow; meanderment; microcomputer applications, featuring HEC-2 model. Prereq. Civil Engineering 300.

522 Floodplain and Urban Flood Management (3) Review of national, regional, and local flood problems and state of the art flood damage reduction alternatives: structural and non-structural, institutional responses; policies, programs, organizations, regulations, and legal aspects; floodplain hydrology and hydraulic, HEC-1-HEC-2; floodway encroachment, flood hazard zone and damage potential determinations; case studies. Prereq. Civil Engineering 300 or consent of instructor for non-majors.

524 Sediment Transport (3) Sediment properties and measurements; principles of dynamics of suspended and bed sediment transport in erodible channels; erosion, transportation, and deposition of sediment by flowing water; erodible channel design; channel regime theory; common computer models. Prereq. Civil 300.


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

535 Ground Water Hydrology (3) Dynamics of flow and contaminant transport in porous and non-porous aquifers; chemical, physical, and biological processes affecting the transport of environmental contaminants. Prereq. Consent of instructor. Prereq: Hydraulics and Hydrology or Civil Engineering 485 for geology majors. (Same as Geological Sciences 556).

540 Remote Sensing for Transportation and Facilities (3) Principles of remote sensing; sources of data and data acquisition systems; imaging; spatial analysis and digital techniques for analysis of aerial and terrestrial remote sensing data. Remote sensing imagery and application to transportation and facilities planning and design. Prereq. Consent of instructor.

541 Remote Sensing Data Acquisition and Analysis (3) Active and passive sensors; automated data acquisition and digital image analysis; image enhancement; and classification techniques for color and infrared remote sensing imagery. Prereq. Consent of instructor.

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

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

551 Physicochemical Unit Processes (3) Theory and design application in water and wastewater treatment. Prereq. Civil Engineering 360, and Civil Engineering 390.

552 Biological Treatment Theory (3) Theory and design application of biological processes to treatment of wastewater and solid wastes. Prereq. Civil Engineering 360, 2 hrs and 1 lab. (Same as Agricultural Engineering 552).

553 Aquatic Chemistry (3) Theoretical, applied, and analytical chemistry of aquatic systems: water chemistry, chemical interactions in aquatic systems, aquatic systems chemistry, and aquatic systems analysis. Prereq. Chemistry 100 and 1 lab.

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

555 Solid Waste Management (3) Characterization and management 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.

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

570 Air Quality Management/Pollution Control (3) An introduction to the concepts of air pollution and its control; sources, meteorology, effects; stack emission control systems. Prereq. Consent of instructor.

571 Design of Air Pollution Control Systems (3) Design and evaluation of systems used to control emission of gaseous and particle air pollutants. Prereq. Consent of instructor.
GRADUATE COURSES


405-06 Selected Readings from Greek Literature (3.3) For advanced students in Greek, plays, historical writings, poetry of ancient Greece in original Greek. Prereqs: 401-402 or consent of instructor. May be repeated. Maximum 9 hrs.

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

431-32 Selected Readings from Latin Literature (3.3) For advanced students in Latin, oratory, historical writings, poetry of ancient Rome in original Latin. Prereqs: 351-352 or consent of instructor. May be repeated. Maximum 9 hrs.

435 Medieval Latin (3) Selected readings from Latin prose and poetry of medieval Europe. Prereq: Consent of instructor.

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

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

462 Roman Law (3) Development of Roman law through examination of cases from writing of Roman jurists, world's first legal professionals. Understanding legal institutions in relationship to Roman society. Roman property and contract law. This may be repeated with written approval of the Associate Dean for Graduate Communications. May be repeated with written approval of the Associate Dean for Graduate Communications. May be repeated with written approval of the Associate Dean for Graduate Communications. May be repeated with written approval of the Associate Dean for Graduate Communications. May be repeated with written approval of the Associate Dean for Graduate Communications. May be repeated with written approval of the Associate Dean for Graduate Communications.

500 Communications (College of Communications)

MAJOR DEGREES

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

The College of Communications offers the Master of Science and the Doctor of Philosophy degrees with a major in Communications. 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, and at Martin on the University of Tennessee at Martin 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, they must complete the Graduate Record Examination, rating forms, and application forms as required by the College of Communications. Minimum requirements for admission to full potential candidate status normally include a 3.0 (4.0 system) grade-point average in undergraduate studies and scores at or above the fiftieth percentile in verbal, quantitative and analytical aptitude on the Graduate Record Examination. All application materials are screened by an admissions committee authorized by the faculty of the College of Communications.

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

A baccalaureate degree in communications or a related field is recommended. Admission is possible with other baccalaureate degrees. However, all applicants must have the appropriate background are required to take up to 18 semester hours of prerequisite and corequisite courses as determined by the department in which the student is enrolled. Students must take a proficiency test on any prerequisite course, subject to review by the master's or doctoral committee of the College of Communications.

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

THE MASTER'S PROGRAM

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

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

Students planning to pursue a doctoral degree with a major in Communications may be accommodated in the M.S. program through special academic advising.

Degree Requirements

The M.S. program emphasizes communications management in the areas of advertising, broadcasting, journalism (publications), and public relations. For the thesis option, a minimum of 36 hours of approved graduate work is required. The non-thesis option requires 38 hours.

1. Ten hours of core courses—Communications 510, 512, 540, and 560 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 500), including a thesis seminar, or a 3-hour project (Communications 590).

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

A student's internship experience requires approval by his/her advisor. Credit will be given through Advertising 596, Broadcasting 596, Journalism 596, or Public Relations 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 required hours for the M.S. program. Previous professional experience will be evaluated by the student's committee.

A student's work in the required courses is evaluated for credit by his/her advisor. A grade below B will be reported to the College of Communications.

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

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

THE DOCTORAL PROGRAM

The Ph.D. with a major in Communications is intended to prepare scholars for teaching, research, administration, and service in the field of mass communications. The program is interdisciplinary, consisting of a required core curriculum and recommended courses outside the College in the related social and behavioral sciences. The program is flexible and will accommodate a wide variety of career goals in communications. New students may be admitted to the program at any time; however, core courses begin only in the fall semester.

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

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

1. A 3.0 (4.0 system) grade-point average in undergraduate studies, and 3.5 for graduate work in a master's degree; 2. at or above the fiftieth percentile in verbal, quantitative and analytical aptitude on the Graduate Record Examination; 3. endorsement by at least three former teachers or professional colleagues; and 4. a statement of the applicant's goals and reasons for pursuing the doctorate. Personal interviews with members of the Ph.D. Admissions Committee are recommended and may be required. Professional experience in some field of communications is a highly desirable criterion for admission.

A minimum of 88 hours of approved graduate work is required by the Ph.D. in:

1. Twenty-eight hours of core courses—Communications 610, 612, 620, 640, 641; 6 hours of statistics; and three of the following courses: Communications 622, 632, 642, and 652.

2. Fifteen hours in a primary concentration (advertising, broadcasting, information...
courses to be counted as elective courses in students. During summers such students may but will be enrolled officially as veterinary and experimental medicine graduate program.

Knoxville may be admitted to the Comparative Record Examination. Exceptional performance on the Graduate physical and biological sciences may be degree with a strong background in 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 electives, 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 to direct doctoral research. At least one member must be from the College of Veterinary Medicine and at least one member from the Graduate School of Medicine.

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

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, Medicine, Medical Biology, Obstetrics and Gynecology, Pathology, Pediatrics, Radiology, and Surgery.

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

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

506 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. May be repeated. Maximum 9 hrs. S/N C 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 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 410-419 or equivalent. F, A

545 Clinical Genetics (3) Human genetic disorders: new developments in cytogenetics, molecular genetics, clinical diagnosis 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/N C only. F, S, 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 instructor. May be repeated. Maximum 6 hrs. Same as Biochemistry and Cellular and Molecular Biology 611. F, Sp

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

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 toxicity, 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 concluding research on animal subjects. Compliance issues and techniques. F

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

530 Wildlife Diseases (2) (Same as Wildlife and Fisheries 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

551 Mammalian Organography (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 pharmacokinetics and pharmacodynamics of agents in disease states. Pharmacological effects, chemical and physical properties, metabolism, toxicology, important idiosyncrasies, and clinical applications. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. E

600 Doctoral Research and Dissertation (3-15) S/N 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 pathobiological and nutritional diseases and lesions. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

604 Veterinary Pathology Seminar (1) Subjects of current interest in veterinary medicine. Students present one seminar per term enrolled. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. E

605 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar per term enrolled. 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 biostatistical literature and design proposal for clinical research project. Prereq: Consent of instructor. Sp

607 Diagnosis and Pathogenesis of Viral 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 historical and modern application to diseases of animals. Host-agent relationships, measurement of disease frequency, animal production and disease monitoring and control, field investigations, animal 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, hemostasis. Principal biochemical and morphologic responses of various cells, tissues and organs to injury and other metabolic derangements. Selected contemporary topics from current literature and textbooks. Prereq: Consent of instructor. Sp, A

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

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

652 Disorders of the Endocrine System (2) (Same as Animal Science 662.) Sp, A

Comparative Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Computer Science

(College of Arts and Sciences)

DEGREES

MAJOR

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

Robert C. Ward, Head

Professors:

Dongarra, Jack, Ph.D......................New Mexico

Langston, Michael A., Ph.D..............Texas A&M

Pooe, J. H., Ph.D.........................Georgia Tech

Sherman, Gordon R. (Emeritus), Ph.D....Purdue

Thomason, Michael G., Ph.D.............Duke

Ward, Robert C., Ph.D....................Virginia

Associate Professors:

Berry, Michael W., Ph.D..................Illinois

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

Vander Zanden, Bradley, Ph.D...........Cornell

Vose, Michael D., Ph.D..................Texas

Assistant Professors:

Gregor, Jens, Ph.D........................Aalborg (Denmark)

Plank, James S., Ph.D....................Princeton

Raghavan, Padma, Ph.D..................Penn State

Straight, David W., Ph.D..................Texas

Instructor:

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

THE MASTER'S PROGRAM

Two semesters of calculus plus two additional semesters of college mathematics (e.g., linear algebra, differential equations, probability) and a course in discrete structures and in systems programming are required for admission. For the master's degree, 30 semester hours of graduate credit are required, of which must be 500 level or above. Computer Science 530, 550 and 560 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 coursework 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, 560 and 580 are required for the degree. At least six hours of 600-level graded courses must be taken in computer science at UTK. The student's advisor and committee will establish the specific course requirements. The comprehensive examination consists of a departmental written examination and a subsequent oral examination conducted by the student's committee.

GRADUATE COURSES

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

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

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

471 Numerical Analysis (3) (Same as Mathematics 471.)

472 Numerical Algebra (3) (Same as Mathematics 472.)

480 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.

494 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 (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Maximum 9 hrs.

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.

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


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; symbolic and semantic methods, relational models. Prereq: Discrete Structures and probability or statistics.

552 Image Analysis (3) Enhancement and restoration of digital images. 2D transforms. Segmentation and description. Computation and procedures for image reconstruction. Prereq: One yr calculus and discrete structures.

560 Language Design and Implementation (3) Complex; lexical analysis, parsing, code generation and optimization, and run-time storage administration. Language design issues: description, 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. Prereq: Numerical linear algebra.

580 Foundations (3) Finite automata and regular sets, push-down automata and context-free languages, Turing machines, recursively enumerable sets, decidability, 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.


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

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

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

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

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

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

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

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

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

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

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**Consumer and Industry Services Management (College of Human Ecology)**

**MAJORS**

**DEGREES**

- Human Ecology ................................... Ph.D.
- Recreation, Tourism and Hospitality Management .............................. M.S.
- Textiles, Retailing and Consumer Sciences ................................. M.S.
- Therapeutic Recreation and Hospitality Management ............................ M.S.

**Nancy B. Fair, Head**

**Professors:**

- Bressee, Randall R. (Liaison), Ph.D. Florida State
- Buckett, Kermil E., Ph.D. ................. Tennessee
- Dyer, C. L., Ph.D. ......................... North Carolina
- Hayes, Gene A. (Liaison), Ph.D. ............ North Texas State

**Wadsworth, Larry C., Ph.D. .......... NC State**

**Associate Professors:**

- Allam, Youssef, Ph.D. ................. Tennessee
- Bhat, Gajanm, Ph.D. ....................... Georgia Tech
- Bressee, Randall R. (Liaison), Ph.D. Florida State
- Costello, Carol, Ph.D. ................. Tennessee
- Krick, Ken L., Re.D. ......... Indiana
- Fair, Nancy B., Ph.D. ................. NC State
- Huil, Ann E. (Liaison), Ph.D. ........ Western Oregon State

**Assistant Professors:**

- Hendrick, Francis T., Ph.D. .......... Oregon
- Lee, Jinkock, Ph.D. ....................... Ohio State
- McGrath, M., Ed.D. ...................... Tennessee
- Young, Katherine A., J.D. ......... California Western School of Law

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The Department of Consumer and Industry Services Management offers the master's degree with majors in Textiles, Retailing and Consumer Sciences, concentrations in textile science and in retail and consumer sciences, and in Recreation, Tourism and Hospitality Management. Concentrations in therapeutic recreation, recreation administration, tourism, and hospitality management. An interdepartmental interdisciplinary minor in gerontology gives the graduate student an opportunity for combining knowledge and experience about aging in American society with his/her own major concentration.

The programs in Consumer and Industry Services Management prepare students for careers in industry, business, public and private agencies, and educational institutions. The research and graduate assistantship opportunities offer master's level work enables students to conduct research in retail management and merchandising and in the consumer areas related to retail decision making. Students in textile science are expected to have a solid foundation in mathematics, as well as a formal background in a physical science or engineering.

Interested students should contact the Department head for more information.

**ADMISSION REQUIREMENTS**

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

In addition to specified entrance requirements stipulated by the Graduate School, admission to the master's degree program with a major in Textiles, Retailing and Consumer Sciences is dependent on completion of undergraduate courses that give the necessary background for success in the graduate program. For the concentration in retail and consumer science, students should have an adequate background in retailing and/or consumer science supported by coursework in economics, marketing, mathematics, and statistics. For the concentration in textile science, students should have a basic technical background in textile science or materials science supported by mathematics.
through differential equations, organic chemistry, and general physics.

Superior students deficient in one or more of the above requirements, may be admitted at the discretion of the department's graduate faculty.

THE MASTER'S PROGRAM

The requirements for the major in Textiles, Retailing and Consumer Sciences are listed below.

Retail and Consumer Sciences (Thesis)

| Major (Required RCS courses): 510, 511, 541, 550, 562, 590 | 16 |
| Cognate Area | 6 |
| Statistics | 6 |
| Thesis | 6 |
| Total | 34 |

Retail and Consumer Sciences (Non-Thesis)

| Major (Required RCS courses): 510, 511, 541, 550, 562 | 15 |
| Cognate Area | 6 |
| Statistics | 3 |
| 501 (Professional Paper/Project) | 3 |
| Electives | 9 |
| Total | 36 |

Textile Science (Thesis Option)

| RCS 552 | Research Methods* | 3 |
| TS 590 | Textile Science courses | 12 |
| Cognate Area | 6 |
| Statistics | 3 |
| Thesis | 6 |
| TOTAL | 34 |

*Must include RCS 562 or equivalent; or 3 hours of laboratory techniques in materials analysis and characterization.

Textile Science (Non-Thesis Option)

| Nonwovens Core (Required TS courses: 510, 521, 526, 528, 585) | 15 |
| Related Courses | 9 |
| Statistics | 3 |
| Professional Project, TS 501 | 3-6 |
| Total | 30-33 |

The major in Recreation, Tourism and Hospitality Management requires 33-36 hours for the thesis option and 36-39 hours for the non-thesis option depending upon the specific concentration. For all thesis concentrations, individuals not possessing an undergraduate degree in the discipline or having appropriate full-time work experience will be required to take 590 (graduate internship).

Requirements for each concentration are:

**Hospitality Management**

All students (28 hours): Hotel and Restaurant Administration 530, 537, 542; Nutrition 541; Hotel and Restaurant Administration/Nutrition electives (12 hours); related area (6 hours); statistics (3 hours);

Thesis Option (6 hours): 500;
Non-Thesis Option (9 hours): 535; Hotel and Restaurant Administration/Nutrition elective (3 hours); elective (3 hours).

For a description of courses in the hospitality management concentration, see Nutrition.

**Recreation Administration**

All students (27 hours): 415 or 440, 510, 515, 540, 541; Safety Education 443; Sport Management 512; statistics (3 hours); research methods (3 hours);

Thesis Option (6 hours): 500;
Non-Thesis Option (9 hours): 590 (6 hours); elective (3 hours).

**The Therapeutic Recreation**

All students (24 hours): 420 or 425, 510, 515, 520, 521, 522; statistics (3 hours); research methods (3 hours);

Thesis Option (9 hours): 500; elective (3 hours);
Non-Thesis Option (12 hours): elective (6 hours); 590 (3-6 hours).

**Tourism**

All students (30 hours): 470, 510, 515; Hotel and Restaurant Administration 532, 542; Marketing 510; Hotel and Restaurant Administration 555 or Planning 540; Planning 548 or 550; statistics (3 hours); research methods (3 hours);

Thesis Option (6 hours): RTM or HRA 500;
Non-Thesis Option (9 hours): 590 (3-6 hours); elective (3-6 hours).

**THE PH.D. CONCENTRATIONS**

**Retail and Consumer Sciences**

Students enrolled in the Ph.D. program with a concentration in retail and consumer sciences are provided with a foundation in management and retail and consumer sciences to further theory and application in advanced study and research. Requirements are either 81 or 90 hours, depending upon whether students select a minor in statistics. Requirements include:

| Major (RCS Required Courses): 614, 615, 625, 641, 651 | 15 |
| Research Methods: 590, 616 | 5 |
| Statistics | 12-15 |
| Cognate Area | 9 |
| Human Ecology 630 | 3 |
| Electives | 21-24 |
| Dissertation | 83-89 |

Note: (1) Statistics hours must include Statistics 537, 538, 579. (2) Cognate hours must include at least 3 hours at the 600 level. (3) Students choosing to take a minor in statistics will take a minimum of 15 hours of prescribed statistics courses and are not required to take a cognate area.

**Textile Science**

Students enrolled in the Ph.D. program in Human Ecology with a concentration in textile science take one common course which provides a foundation for the integration of textiles and apparel in the context of the natural environment. A required departmental research seminar exposes students to research being conducted in all areas of study in the department.

1. RCS 552 (3 hours);
2. Research Methods which must include 6 hours of laboratory techniques in materials analysis and characterization;
3. TS 590 (2 hours). Attendance at seminar is required for all full-time students;
4. Six hours in statistics at the 500-600 level;
5. Eighteen hours in textile science courses;
6. Nine hours in a cognate area;
7. Fourteen hours of other courses which may include up to 6 hours of dissertation; and

Note: Students must take a minimum of 9 hours at the 600-level in the College of Human Ecology, exclusive of dissertation. Transfer students with a master's degree from another institution are required to complete at least 42 hours (including dissertation hours) from UTK.

**ACADEMIC STANDARDS**

1. Evaluation of student progress will normally occur prior to enrollment for thesis hours (or the non-thesis option) and during the second semester of full time enrollment in the program. The review of the student will be undertaken by the faculty with consideration given to factors such as: GPA (minimum 3.0), portfolio evaluation, and demonstrated research capability.
2. If progress or performance is deemed insufficient, the faculty may recommend probation with specific goals set for a specified time or termination.

**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 Textiles, Retailing and Consumer Sciences is available to residents of the state of Mississippi. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

**Hotel and Restaurant Administration**

**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 if the student is a non-resident. May be repeated. S/N Con only.

530 Computer-aided Foodservice and Lodging Management (3) Application of computer technology to foodservice and lodging industry: inventory, cost accounting, production, nutrition analysis, revenue management, and sales planning and analysis. Prereq: Quantity Food Procurement, Production and Service, Microcomputer Applications or consent of instructor. F/A

531 Advanced Financial Management (3) Financial planning, operations and evaluation techniques used in foodservice and lodging management; developing budgets, accounting systems and financial reports. Prereq: Food and Lodging Cost Control or consent of instructor. F/A

532 Advanced Human Resource Management (3) Identifying labor needs: development and maintenance of work force. Prereq: Food and Lodging Personnel Development or consent of instructor. F/A

533 Advanced Food Production and Delivery System Management (3) Analysis of food production and delivery systems; application of quantitative methods and models to optimize decisions. Prereq: Quantity Food Procurement, Production and Service or consent of instructor. F/A

534 Special Topics in Foodservice and Lodging Administration (1-3) Problems selected for study by student with guidance of faculty member. Prereq: Consent of instructor. May be repeated. E

536 Directed Study in Foodservice and Lodging Administration (1-3) Problems selected for study by student with guidance of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
510 Perspectives and Trends in Leisure Services (3) Basic role of leisure delivery systems in today's society, scope of leisure services, determinants of leisure behavior, developmental features of leisure and recreation. Current trends, problems, laws, and issues affected by and/or affecting delivery of leisure services. Sp

515 Philosophical and Conceptual Foundations of Leisure (3) Philosophy, nature of philosophy, concepts of leisure, recreation, play, work, and other factors, history of field, and relationship of ideas to contemporary society and to professional practice. F

520 Program Design and Evaluation in Therapeutic Recreation (3) History, philosophy, nature, purpose, special populations served, programming process, professional aspects of therapeutic recreation. Basic overview of aspects of leisure delivery systems. Prereq: Consent of instructor. F

521 Facilitation Techniques in Therapeutic Recreation (3) Role of therapeutic recreation in clinical and non-clinical settings; application of life-style planning, self-awareness, values clarification and assertiveness training in therapeutic recreation, relationship of leisure education to therapeutic recreation. Prereq: Consent of instructor. Su

522 Clinical Aspects in Therapeutic Recreation (3) Concepts and techniques utilized by experienced and advanced therapeutic recreation specialist: clinical issues; comprehensive program concerns, administrative funding and trends in operation of therapeutic recreation services. Prereq: 220. Sp

540 Fiscal Policies for Recreation and Sports Related Organizations and Facilities (3) Application of fiscal policies and procedures to operation of recreation and sports related organizations and facilities. Finance, revenue generating strategies, cash and inventory control, commercial/public cooperative ventures and microcomputer applications. Prereq: 430 or consent of instructor. Sp

541 Management and Operation of Recreation and Sport Related Facilities (3) Research for making program and management decisions, process of cost analysis, and basic design of recreation and sport related facilities. Prereq: Consent of instructor. Su

590 Graduates Internship (1-6) Required of all graduate students. Minimum 50 clock hours for each hour credit. Work experience, evaluation by agency and university and written paper required. E

591 Directed Study in Leisure & Recreation (1-6) Individual study and group discussion of topics related to current problems. Prereq: 533 or consent of instructor. F,A

592 Special Topics in Recreation & Leisure Studies (1-6) May be repeated. Maximum 6 hrs. E

595 Special Topics in Retail and Consumer Sciences (1-3) Lecture, group discussion on specialized topics: retail industry structure, international trade, international retailing, consumer affairs, entrepreneurship, small business management, issues in retail management, issues in retailing, quality perception by consumers, product and service value, retailing to children, retailing and special populations, special research methods. Prereq: 9 hrs graduate coursework. May be repeated. Maximum 9 hrs.

596 Directed Study (1-3) Individual study and group discussion of topics related to current problems. May be repeated. S/NC only. E

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

641 Retail Consumer Behavior (3) Theories and concepts from social science in relation to retail consumer behavior. Prereq: 6 hrs of sociology and/or psychology. F,A

651 The Consumer and Public Policy (3) Public policy issues within consumer environments. Analysis of past and present policies within economic, social, legal and business frameworks. Implications of consumer issues and public policy alternatives. Literature and research focus. Prereq: 550 or consent of instructor.

695 Advanced Topics in Retail and Consumer Sciences (3) Lecture, group discussion, individual research on advanced topics and research areas of current significance to retail and consumer sciences. Prereq: 9 graduate hours in consumer sciences. May be repeated. Maximum 9 hrs.
Textile Science

GRADUATE COURSES

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

501 Professional Project (3-6) Application-oriented, capstone project to show competence in major academic area. Enrollment limited to textile science students in non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC only.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. Maximum 9 hrs. S/NC only.

510 Fiber Science (3) Physical properties, mechanical properties and microstructure of polymeric fibers; relation to end-use properties. Prereq: Organic Chemistry and Thermal Physics or equivalent.


521 Nonwovens Science and Technology I (3) Non-woven fabric technology, different web forming processes, and relationships among the chemical, morphological and mechanical properties of fibers and orientation in webs to final performance properties of bonded structures. Prereq: Organic chemistry or consent of instructor.

526 Nonwovens Science and Technology II (3) Interactions between chemical, production and mechanical properties of nonwoven fabrics; characterization of fiber morphology and web structure; chemistry of nonwoven binders and finishes; and engineering of specific fabric properties. Prereq: 521 or equivalent.

528 Laboratory Methods in Nonwovens Processing and Characterization (3) Laboratory experience in nonwoven fabrication processes and characterization techniques. Effect of processing conditions on structure development and properties of different types of webs. Prereq: 510 and 521.


590 Research Seminar (1) Research topics in textile science. May be repeated. S/NC only. F,Sp

593 Directed Study (1-3) Individual problems in textile science. Prereq: 9 hrs textiles graduate coursework. May be repeated. Maximum 9 hrs.

595 Advanced Topics in Textile Science (1-3) Lecture, group discussion, individual research on advanced topics and research areas of current significance: future direction, professional issues, theoretical approaches. Prereq: Doctoral student and 9 hrs textiles graduate coursework. May be repeated. Maximum 9 hrs.

625 Physical Chemistry of Fibers (3) Physical chemistry of fibers and fiber forming polymers: surface chemistry and thermal properties. Prereq: 510.


695 Advanced Topics in Textile Science (3) Lecture, group discussion, individual research on advanced topics and research areas of current significance: future direction, professional issues, theoretical approaches. Prereq: Doctoral student and 9 hrs textiles graduate coursework. May be repeated. Maximum 9 hrs.

Counselor Education and Counseling Psychology

(Majors in Education)

MAJORS DEGREES

Counseling Counseling Education (M.S.) Counseling Education (Ed.S., Ph.D.)

M. A. Hector, Leader

Professors:


Hector, Mark A., Ph.D., M.D. .........., Arizona State

Huck, Schuyler W., Ph.D. ................., Northwestern

McCain, Ed W. (Emeritus), Ph.D. ........., Texas

Peterson, Marla P., Ph.D. ................., Ohio State

Poppin, William A., Ph.D. ............... , Ohio State

Thompson, Charles L., Ph.D. ............, Ohio State

Associate Professor:

Hutchens, Teresa A., Ph.D. ............... , Georgia

The Counselor Education and Counseling Psychology unit participates in graduate programs leading to degrees, majors, and concentrations in:

- Master of Science

Counseling

Community counseling

School counseling

Educational Specialist

Education

School counseling

Doctor of Philosophy

Education Counseling psychology

See Education Under Fields of Instruction for full description of all degree requirements.

The M.S. and Ed.S. degree programs with their respective concentrations are accredited by the Council for Accreditation of Counseling and Related Educational Programs. In addition, the counseling psychology concentration under the college-wide Ph.D. program is accredited by the American Psychological Association, and the specialization in counselor education within the counseling psychology concentration is accredited by the Council for Accreditation of Counseling and Related Educational Programs.

The Counselor Education and Counseling Psychology unit emphasizes research-based practices that address the growth and development of the whole person throughout the lifespan. In its counseling programs, the unit concentrates on maximizing development and adjustment of individuals through prevention and 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; and 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 personal self-concept and its relevance in educational and counseling settings. 3 hrs and 2 labs.

431 Personality and Mental Health (3) Various perspectives of mental health with application to education and other social institutions. 3 hrs and 2 labs.

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. Maximum 9 hrs. S/NC only.


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.

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 qualitative basis of testing. 3 hrs and 2 labs.

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. 3 hrs and 2 labs.

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.

550 Introduction to Pupil Personnel Programs (3) Philosophy, process, professional standards, counselor role in relation to school staff and mental health professionals, and ethics of profession. 3 hrs and 2 labs.

551 Theory and Practice of Counseling (3) Introduction to conceptual frameworks and their relation to practice in counseling. Prereq: Consent of instructor. 3 hrs and 2 labs.

552 Career Development: Vocational Theory, Research and Practice (3) Relationship of vocational theory, career development research and societal factors to career counseling. 3 hrs and 2 labs.

553 Career and Educational Information Systems and Resources (3) Use of computerized information systems and resources for career and educational planning. Prereq: 550 or consent of instructor and Internet access account.

554 Group Dynamics and Methods (3) Theory and types of groups, descriptions of group practices, methods, dynamics, and facilitative skills, supervision of leadership skills. 3 hrs and 2 labs.

555 Practicum in Counseling (3) Supervised practice and counseling in counseling skills with individual clients. Prereq: Admission to program. 3 hrs and 2 labs.

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 9 hrs. S/NC or letter grade.

558 Internship in School Counseling (1-8) Supervised practical experience at academic unit approved site. Prereq: 550 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only.
Ecology and Evolutionary Biology

(College of Arts and Sciences)

MAJOR

DEGREES

Ecology and Evolutionary Biology ... 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
Delcourt, P. A., Ph.D. .......... Minnesota
Echternacht, A. C., Ph.D. .......... Kansas
Ettlin, D. A., Ph.D. .......... Minnesota
Gavrilits, S., Ph.D. .......... Moscow State
Greenberg, N. B., Ph.D. .......... Rutgers
Gross, J. L., Ph.D. .......... Cornell
Hálim, T. G., Ph.D. .......... Missouri
Harris, W. F., Ph.D. .......... Tennessee
Kot, M., Ph.D. .......... Arizona
McCormick, J. F., Ph.D. .......... Emory
McCauley, G. F., Ph.D. .......... Cornell
Pan, M. L., Ph.D. .......... Pennsylvania
Pimm, S. L., Ph.D. .......... New Mexico State
Riechert, S. E., Ph.D. .......... Wisconsin
Sayerl, 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. (Emeritus), Ph.D. .......... Duke

Associate Professors:
Amundsen, C. C., Ph.D. .......... Colorado
Boake, C. R. B., Ph.D. .......... Cornell
Delcourt, H. Ph.D. .......... Minnesota
Drake, J. A., Ph.D. .......... Purdue
Fox, D. J., Ph.D. .......... Johns Hopkins
Gitterson, 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:
Greene, 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 administers an interdisciplinary graduate program which offers both the Master of Science and Doctor of Philosophy degrees with a major in Ecology and Evolutionary Biology and concentrations in behavior, ecology (including mathematical ecology) and evolutionary biology.

REQUIREMENTS FOR ADMISSION

Applications are accepted once a year. The deadline for receipt of all application materials is 15 January for those applicants wishing to enroll in the following Fall or Spring semesters. Applications incomplete as of that date, or received after that date, will not be considered. Applicants are expected to have 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. Applicants are required to submit scores from the general Graduate Record Examination (GRE) and successful applicants will usually have a composite score on the general section of at least 1650. 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 averages well above these minimums).

Application must be made to both The Graduate School and the department. The departmental application requires 3 letters of recommendation from persons capable of assessing 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, 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) during 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 thesis research committee; (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 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; (3) pass a written and comprehensive examination designed to test for adequate knowledge in those areas essential to the student's research program; and (4) satisfactorily complete and defend a dissertation. The department does not require a reading knowledge of a foreign language, but this may be imposed by the student's faculty dissertation research committee. If so, the student has the option of demonstrating reading knowledge of the prescribed language by either (a) passing the official reading examination given by the language department or (b) earning a grade of at least a B in the second semester of a special language reading course for graduate students.

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

403 Plant Evolution (3) (Same as Botany 403.)

411-412 Minicourse in Ecology and Evolutionary Biology (2) Selected advanced topics in ecology, behavior, and evolutionary biology, concentrated in time and subject matter. Consult department listing for topics offered. Prereq: As announced. May be repeated. Maximum 4 hrs may apply toward departmental major.

431 Plant Ecology (4) (Same as Botany 431.)

446 Introduction to Oceanography (4) Basic oceanography: physical, chemical, geological and biological processes and patterns. Oceanic systems: upwellings, polar oceans, hydrothermal vents, gyres, coral reefs, estuaries, and coastal regions. Field trip to coastal area. Prereq: General Biology and General Chemistry. General Ecology recommended.

450 Comparative Animal Behavior (3) Principles and methods of ethology, ecological, developmental, physiological and evolutionary aspects. (Same as Psychology 450.)

459 Comparative Animal Behavior Laboratory (3) Introduction to observational and experimental research in ethology. Coreq: 450. (Same as Psychology 459.)


461 Special Topics in Organismal Biology (3) Evolution, ecology, biogeography, classification, and anatomy of selected animal and plant taxa. Prereq: General Ecology or consent of instructor.

470 Aquatic Ecology (3) Introduction to the physical-chemical nature of inland waters with description of biotic communities and their interrelationships. Prereq: General Chemistry and General Biology 2 hrs and 1 lab.

474 Ichthyology (4) Evolution, classification, collection and identification, distribution and biology of fishes; freshwater fauna of Eastern North America. Prereq: General Ecology or consent of Instructor. 2 hrs and 2 labs.

484 Conservation Biology (3) Application of principles and techniques of ecological research to conservation of biodiversity at genetic, population, community, and ecosystem levels. Prereq: General Genetics and General Ecology.

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

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

503 Ecology and Evolutionary Biology Seminar (1) Advanced topics in ecology, behavior, and evolutionary biology. Semester departmental majors encouraged. Required of all first- and second-year graduate students. May be repeated. Maximum 4 hrs. S/NC only.

504 Special Topics (1-3) Selected directed readings or special course in topics of current interest. Consult department listing for offerings. May be repeated with consent of instructor. Maximum 9 hrs. S/NC only.


507 Basic Concepts in Ecology (3) Contemporary issues in ecology. Prereq: Admission to program in Ecology and Evolutionary Biology. Required of all first-year students. Sp

508 Introduction to Faculty Research (1) Orientation of new graduate students to current research of departmental graduate faculty. Prereq: Admission to program in Ecology and Evolutionary Biology. Required of all first-year students. S/NC only.

509 Foundations: Readings in Ecology (1-2) Readings and discussion of classic papers in field. Prereq: Ecology for Planners and Engineers (3) (Same as Psychology 516.)


516 Colloquium in Ethology (1) (Same as Psychology 516.)

520 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. Appropriate for students in Planning and Environmental Engineering. Not bounded for graduate students in Ecology and Evolutionary Biology.

524 Physiological Ecology of Animals (3) Adaptive physiological response of animals to natural changes in or extremes of physical and biotic environment. Terrestrial vertebrates. Prereq: Undergraduate courses in animal physiology and ecology, Biochemistry and Cellular and Molecular Biology 440 and General Ecology or equivalent.

535 Ecology and Development in the Amazon (3) Natural history, ecosystem diversity and function, and opportunities for sustainable economic development in the Amazon Basin. Includes field trip of 7-10 days to Manaus, Brazil.

540 Insect Taxonomy I: Major Orders (3) Survey of classification of major orders of insects, with practical experience in identification of insects at family level. Prereq: Consent of instructor, 4 hrs combined lecture and lab.

541 Insect Taxonomy II: Minor Orders (3) Survey of classification of minor orders of insects, with practical experience in identification of insects at family level. Prereq: 540 or consent of instructor, 4 hrs combined lecture and lab.

542 Insect Structure and Function (3) Integrated study of morphology, behavior, development, and physiological adaptations of insects. Insects included are representative of each major order. Prereq: Consent of instructor.

543 Aquatic Insects (3) Taxonomy and biology of aquatic insects; immature forms. Prereq: Consent of instructor. 2 hrs and 1 lab.

544 Fresh Water Invertebrate Zoology (3) Ecology and taxonomy of freshwater invertebrates exclusive of insects. Prereq: Comparative Invertebrate Ecology or equivalent and consent of instructor. 3 hrs lab and field study.

545 Advanced Animal Behavior (3) Second-level course in ethology, stressing evolution, genetics, physiology, ecology and human behavior. Prereq: 450 or equivalent. (Same as Psychology 545.)

547 Conceptual Foundations of Evolution and Behavior (3) (Same as Psychology 547.)

552 Development Planning in the Third World (3) (Same as Planning 552.)
THE MASTER'S PROGRAM

STUDENT'S RIGHT TO PETITION

ACADEMIC STANDARDS

STUDENT'S RIGHT TO PETITION

THE MASTER'S PROGRAM

MINOR IN ENVIRONMENTAL POLICY

MINOR IN ENVIRONMENTAL POLICY

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; Forestry, Wildlife and Fisheries; Geography; Management; Planning; Political Science; and Sociology.

Students may request admission to the minor following admission to a graduate program in one of the participating departments. Students in good standing in one of these programs may apply for admission to the minor in environmental policy. The coordinating committee will consider the admission of interested students. Applicants should have a background in both natural and social sciences evidenced by prior coursework or experience. One course in environmental studies from the student's major discipline and one course in quantitative methods are required. These requirements may be fulfilled before or after admission to the minor. 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 Sciences 414 or Geography 433 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

GRADUATE COURSES

400 Special Topics (3) Topics vary. Prereq: Determined by department. May be repeated.
413 Macroeconomic Fluctuations (3) Analysis of historical data, methods of analyzing macro-economic fluctuations, theoretical explanations of cycles, and role of monetary and fiscal policies in aggregate economy. Major writing requirement. Prereq: Intermediate Macroeconomics or consent of instructor.
415 History of Economics (3) Same as History 415.
424 Political Economy of World Development (3) Topics vary: Latin America, Asia, Soviet Union and Eastern Europe. Analysis of major economic strategies, policies, and problems. Prereq: 201. This course includes a major writing requirement. May be repeated when topic varies. Maximum 9 hrs.
462 Economics of Resources and Environmental Policy (3) Economic analysis of environmental policy and allocation of resources. Benefits and costs of development of natural resources and impacts of growth on environment. Major writing requirement. Prereq: 201.
471 Public Finance: Optimal Government Functions and Expenditure Analysis (3) Problems of collective
consumption, external effects, public investment, social decision making. Major writing requirement. Prereq: 501.

472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual taxes and of tax systems, non-tax sources of revenue, fiscal federalism. Major writing requirement. Prereq: 501.

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

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

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

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

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


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

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

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

577 Environmental Economics and Policy Management (3) Interdisciplinary perspective on goals of sustainable economic balance and environmental quality. Development of decision-making skills in area of governmental-business relations.


583 Econometric Techniques (3) Multivariate time series, panel data and limited dependent variable analysis applied to economic problems. Prereq: 582.

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

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


Welfare, and principal developments in macroeconomics after 1800. Background for and origins, concerns, methods, and conclusions of economic theory. Prereq: Intermediate Microeconomics with B or better and Calculus.

621 International Economics (3) Comparative advantage, trade protection, commodity composition of trade, protectionism, trade restrictions, trade liberalization, U.S. trade policy, exchange rate determination, balance of payments adjustment, multinational corporations, and international capital flows. Prereq: 512 and 514.

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

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


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

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

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

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

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


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

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

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

682 Econometric Methods (3) Advanced topics in econometrics. Prereq: 583 or equivalent.

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

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: Counseling 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 Childhood Education (ICEE), Language, Communication, and Humanities Education (LCH), Leadership Studies in Education (LSE), Psychosocial Education (PSE), Rehabilitation, Deafness, and Human Services (RDHS), Sport and Physical Activity (SPA). The College also offers an initial teacher licensure program at the undergraduate 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: Counseling (CECP), Rehabilitation counseling (RDHS), School counseling (CECP).

The program includes thesis and non-thesis options. The concentration in community counseling is fully accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP) and requires completion of 60 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 is fully accredited by the Council for...
Accreditation of Counseling and Related Educational Programs and 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, assessment, and instruction (ESMRT)
- Education of the deaf and hard of hearing (RDHS)
- Elementary education (HTL and IECE)
- English education (LCHE)
- Foreign language/ESL education (LCHE)
- Instructional technology (ESMRT)
- Mathematics education (ESMRT)
- Modified and comprehensive special education (HTL)
- Reading education (HTL)
- Science education (ESMRT)
- Social foundations (CSE)
- Social science education (HTL)
- Special education: early childhood (IECE)
- The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. The non-thesis option requires the completion of 33 hours of coursework (36 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)
- Education for the deaf and hard of hearing (RDHS)
- Elementary teaching (HTL and IECE)
- Modified and comprehensive special education (HTL)
- Secondary teaching (ESMRT, HTL, and LCHE)
- Special education: early childhood (IECE)
- 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)
- Sport studies (CSE)
- Sport management (SPA)
- Applicants must submit a unit admission application and 3 letters of recommendation. Both thesis and non-thesis options are available. The non-thesis option requires 32 hours, including a project, and a course in research design or an approved specialized research class. The thesis option requires the completion of 30 hours, including 6 hours of Thesis 500. Both options require a minimum of 12 hours of sport studies, exercise science, or sport management courses.

Leadership Studies in Education
The master's degree program 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 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, assessment, and instruction (ESMRT)
- Educational administration & supervision (LSE)
- Elementary education (HTL)
- English education (LCHE)
- Foreign language/ESL education (LCHE)
- Instructional technology (ESMRT)
- Mathematics education (ESMRT)
- School counseling (CECP)
- School psychology (PES)
- Science education (ESMRT)
- Social science education (HTL)

The instructional and curricular concentrations require completion of a minimum of 30 hours of coursework beyond the master's degree, including 6 hours in core courses, 18 hours in specialized courses, and 6 hours to be determined by the student's committee.

The concentration in educational psychology: collaborative learning requires the completion of a minimum of 90 hours beyond the baccalaureate degree. Coursework is required in statistics and research design. Comprehensive examination in the concentration, supporting specialization, and cognate area(s), as well as an oral examination on the dissertation, are also required.

THE DOCTOR OF EDUCATION PROGRAM
The Ed.D. program with a major in Education is available in the following concentrations (with abbreviated unit designations):
- Curriculum, assessment, and instruction (ESMRT)
- Educational psychology: collaborative learning (PES)
- Elementary education (HTL)
- English/foreign language/ESL education (LCHE)
- Instructional technology (ESMRT)
- Leadership for teaching and learning Leadership studies (educational administration & supervision; higher education) (LSE)
- 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 concentration in adult education requires the completion of a minimum of 90 hours beyond the baccalaureate degree. Coursework is required in statistics and research design. Additional coursework includes completion of two consecutive semesters of Educational Adminis-
tion and Supervision 604 during residence. Though an internship is highly recommended, it is not required. A foreign language requirement is at the discretion of the committee. A written comprehensive examination, as well as an oral examination on the dissertation, is required. 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; Psychoeducational Studies; and Rehabilitation; Deafness, and Human Services. The program requirements are:

**Requirements**

**Minimum Hours**

<table>
<thead>
<tr>
<th>Research Area</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign or Computer Language (demonstrate proficiency)</td>
<td>6</td>
</tr>
</tbody>
</table>

**General Core Requirements**

**Option A**

- History and philosophy of education, (both areas must be represented) 4
- Learning theory and curriculum (both areas must be represented) 4
- Administrative/Leadership theory 2
- Trans-college seminar: two consecutive semesters 2

**Option B**

- Philosophy of education 3
- History of education 3
- Administrative theory 3
- Learning theory 3
- Curriculum theory 3
- Trans-college seminar: two consecutive semesters 2

**Option C**

- Philosophy of science 3
- Trans-college seminar: two consecutive semesters 2
- Seminar(s) in primary concentration 3
- Learning theory/group dynamics or independent study in this area 3

**Concentrations**

- Primary Concentration: A minimum of hours normally selected from one or two specializations within the primary concentration 15
- Supporting Concentration: A minimum of 9 hours selected from a concentration other than the primary concentration 9

**Cognate**

- A minimum of 6 hours selected from outside the college in addition to the designated research courses 6

**Dissertation**

24

The concentrations are:

- Adult education
- Counseling psychology (counseling psychology; counselor education)
- Cultural studies in education (cultural studies; sport history; sport philosophy; sport sociology)

Early childhood special education

Elementary education

English, foreign language, ESL education

Exercise science

Instructional technology/curriculum

Leadership studies (educational administration and supervision; higher education)

Literacy studies (reading/language arts)

Mathematics, science, and social science education

Rehabilitation and special education

Research/assessment/evaluation

School psychology

Residence is three consecutive semesters of full-time coursework. The program requires coursework in both a supporting concentration and a cognate area, as well as either foreign language or computer proficiency. Coursework in statistics and research design is required in all specializations. Pre-dissertation research participation is also a requirement.

For the Ph.D. with a major in Education under Counselor Education and Counseling Psychology and under Psychoeducational Studies units, two applications are required: one for the Ph.D. in Education program and one for the unit that specifies which specialization is desired, in addition to the application for admission to The Graduate School.

Under Counselor Education and Counseling Psychology, the following minimum number of hours is required, according to which field the student follows: counseling psychology, 96; counselor education, 98. The concentration in counseling psychology requires a year-long practicum sequence and the equivalent of a year’s full-time work as an intern in an appropriate counseling setting.

Under Psychoeducational Studies, the following minimum number of hours is required in each program: educational psychology, 92; school psychology, 97. The concentration in educational psychology also requires a supervised practicum experience in classroom teaching.

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:

**Full Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>575</td>
<td>Internship</td>
<td>4 hrs</td>
</tr>
<tr>
<td>574</td>
<td>Analysis of Teaching for Professional Development</td>
<td>2 hrs</td>
</tr>
<tr>
<td>591</td>
<td>Clinical Studies</td>
<td>4 hrs</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>24 hrs</td>
</tr>
</tbody>
</table>

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, or Psychoeducational Studies, may pursue a minor in gerontology. This interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

**ACADEMIC COMMON MARKET**

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in 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 hearing impaired or elementary education), Louisiana (concentration in foreign language/ESL education-Track 1 only), or Maryland, South Carolina, Virginia, West Virginia (concentration in education of the deaf and hard of hearing). The M.S. program in Performance and Sport Studies is available to residents of Arkansas and Alabama, South Carolina, Virginia (concentration in sport management only). The Ph.D. program in Education is available to residents of the states of Arkansas (concentration in educational psychology, educational administration and supervision/higher education, educational psychology, 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. Maximum 6 hrs.

517 Seminar (1-3) Historical development, current trends, and techniques in teaching and counseling; research on contemporary issues in education. 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 problems, research, models, and techniques in teaching. May be repeated. Maximum 6 hrs. S/NC only. E

562 Direction and Supervision of Student Teaching (3) Techniques for the supervision of student teaching. Prereq: Consent of instructor. Sp, Su

588 Teacher-Parent-Community Relations (3) Techniques for effective relations between parents and teachers. Prereq: Consent of instructor. Sp, Su

574 Analysis of Teaching for Professional Development (1) Strategies to document and analyze effectiveness of teaching and of professional development. Study and application of various approaches. Coreq: 575. F

575 Professional Internship in Teaching (1-8) Intensive teaching and teaching-related experiences in professional settings in public schools. Enrollment limited to...
postbaccaulareate students in professional year program. Prereq: Admission to Teacher Education Program. May be repeated. Maximum 12 hrs. S/N only. F,Sp

579 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 for probationary licensure year. May not be used toward degree requirements. May be repeated. Maximum 12 hrs. S/N 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 8 hrs. S/N 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: 251.

601 Trans-College Seminar (1) Introduction to Ph.D. program in Education: research requirements, meaning of scholarship in academic and issues/problems in education. Minimum of two consecutive semesters preceded 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 toward 500 requirement. S/N only. E

618 Interpretation and Application Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction, new methodologies and strategies. Utilization of research to improve curriculum and instruction practice, application of research principles in context of specific professional assignments. Prereq: Consent of instructor. Sp

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

(College of Education)

MAJOR DEGREES

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

M. Everett Myer, Leader

Professors:

Dessart, Donald J., Ph.D. ............... Maryland
Doak, E. Dale, Ed.D. ...................... Colorado
Frandsen, Henny, Ph.D. ................... Illinois
French, Russell, Ph.D. .................... Ohio State
Hipple, Theodore W., Ph.D. .......... Illinois
Mcmurty, Lonnie D., Ed.D. .............. Indiana
Myer, M. E. (Lission), Ph.D. ............ Florida
Ray, John R., Ed.D. ....................... Tennessee
Roeske, C. E., Ph.D. ....................... Ohio State

Associate Professor:

Connelly, Mary Jane, Ed.D. ............. VPI
Grant, A. D., Ph.D. ....................... Wisconsin
Melear, C. T., Ph.D. ...................... Ohio

Assistant Professor:

Robinson, Stephanie O., Ph.D. ........... Florida

The Education in the Sciences, Mathematics, Research, and Technology unit participates in graduate programs leading to degrees, majors, and concentrations in:

Master of Science

Education

Track 1-curriculum, assessment, and instruction

Track 1 - instructional technology

Track 1 - science education

Track 2-secondary teaching

Educational Specialist

Education

Curriculum, assessment, and instruction

Instructional technology

Mathematics education

Science education

Doctor of Education

Education

Curriculum, assessment, and instruction

Instructional technology

Mathematics education

Science education

Doctor of Philosophy

Education

Instructional technology/curriculum

Mathematics/science/social science education

Research/assessmen evaluation

See Education under Fields of Instruction for full description of all degree requirements.

The unit is composed of four areas: science and mathematics education, educational research and statistics, instructional media and technology, and curriculum studies. The mission of all areas focuses on the preparation of teachers and instructors in curriculum and integrative mathematics and sciences and in the preparation of various other professionals who desire to utilize educational research and instructional technology.

GRADUATE COURSES

475 Utilization of Instructional Media (3) Basic concepts of communication and instructional development for improving instruction through use of media. (See as Information Sciences 475.) E

485 Teaching Mathematics, Grades 7-12 (3) Preparation of teaching plans, evaluation of 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, 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 enrolled in residence 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


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

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

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

522 Programs and Materials in Elementary School Mathematics (3) Examination, development and use of materials for creating an active learning environment for learning mathematics in elementary and middle schools. Prereq: 530, 543, or equivalent.

530 Teaching Mathematics to Young Children: K-4 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. For those with little preparation in teaching elementary school mathematics.

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

535 Program Evaluation in Education (3) Issues and practices in planning and conducting program and curriculum evaluation in variety of settings. Fundamentals of design, measurement, philosophy, ethics, and underlying values; proper role and use of evaluation in educational organizations. Prereq: Consent of instructor. (Same as Higher Education 534.)


543 Teaching Mathematics in Middle Schools: 5-8 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. For those with little preparation in teaching middle school mathematics.

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

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

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

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

565 Instructional Trends and Issues in Science Education (3) Analysis of current trends and issues in instruction, instructional issues facing elementary, secondary, and community college science teachers, and application of educational theory to teaching biological, physical, and environmental sciences. Prereq: 496, Holistic Teaching/Learning 422, or equivalent.

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

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

572 Nature of Mathematics and Science Education (3) Teaching and assessment of mathematics and science based upon student conceptions of nature of mathematics and science.

573 Instructional Design and Interactive Multimedia (3) Basic instructional design and development of interactive multimedia programs. Use of appropriate authoring program for writing instructional program; Macintosh as computer platform.

577 Introduction To Data Processing in Curriculum and Instruction (3) Analysis of current activities in educational computing and data processing. Curriculum, instructional research, and classroom management applications from microcomputers to super computers. Prereq: Consent of instructor. E
580 Techniques for Research in Curriculum and Instruction (3) Fundamentals of research methodology applicable to curriculum, instruction, and other areas of educational inquiry. Critical reading of research and development of skills needed for proposal development. Prereq: Consent of instructor. E

581 Seminar in Mathematics Education (3) Current issues influencing instruction in mathematics in schools, elementary through college. Related teaching methodologies. Opportunities for special work on problems. Prereq: 485 or equivalent.

582 Teaching Enrichment Mathematics in Middle and Junior High Schools (3) Topics to enrich middle and/or junior high mathematics. Geometrical, laboratory, and problem-solving activities. Special attention to microcomputer system. Opportunities for individuals to work on projects. Prereq: 485 or equivalent.

583 Teaching Mathematics in Senior High Schools and Community Colleges (3) Topics appropriate for high school and community/junior college mathematics curriculum. Special problems related to enrichment, problem solving, and use of microcomputers. Opportunities for special projects. Prereq: 485 or equivalent.

586 Teaching Probability & Statistics (3) Teaching of probability and statistics in schools, elementary through college. Probabilistic and statistical experiments, demonstrations, and applications. Prereq: 485 or equivalent.

588 Instructional Theory and Design (3) Relationship of curriculum to instruction; examination of instructional and related learning theories; instructional models and teaching styles.

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

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

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

596 Curricular Trends and Issues in Science Education (3) Analysis of elementary and secondary curriculum projects for biological, physical, and environmental sciences. Impact of current learning theories on future curriculum development projects. Prereq: 496, Holistic/Teaching/Learning, or equivalent. Prereq or coreq: 565 or consent of instructor.

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

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

623 Using Research for Curriculum Improvement (3) Research methodology; application to descriptive/survey analysis of curriculum materials. Critical reading of research, methodology in research, analysis of research such as trend and relationship of such trends with broader educational issues. Prereq: Consent of instructor. E


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

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

672 Interpretation and Application of Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction, new methodology and strategies. Utilization of research to improve curriculum and instruction practice, application of research principles in context of specific professional assignments. Prereq: Consent of instructor. E

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

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

683 Advanced Studies in Mathematics Education (3) Analysis of current research in mathematics education and/or implications of research for classroom practice. Prereq: Two graduate courses in mathematics education.

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

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

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

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

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

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### Electrical Engineering

(University of Tennessee)

**DEGREES**

- **MAJOR**
  - Electrical Engineering
  - M.S., Ph.D.
  - T. V. Blatock, Acting Head

**Professors:**
- Alexeif, Igor (Emeritus), Ph.D., PE, Ph.D., Pennsylvania
- Bailey, Milton (Emeritus), Ph.D., Georgia Tech
- Birdwell, J. Douglas, Ph.D., MIT
- Bishop, Asa O., Jr., Ph.D., Pennsylvania
- Blatock, T. Vaughn, Ph.D., Tennessee
- Bodenheimer, Robert E., Ph.D., Northwestern
- Bose, Bimal K. (Condra Chair of Excellence), Ph.D.
- Bouldin, Donald W., Ph.D., Vanderbilt
- Gonzalez, R. C. (Distinguished Prof.), Florida
- Green, Walter L., Ph.D., New York
- Kennedy, Eldredge J., Ph.D., Tennessee
- Lawler, J. S. (Liaison), Ph.D., Michigan State
- Neff, Herbert P. (Emeritus), Ph.D., Auburn
- Pace, Marshall O., Ph.D., Georgia Tech
- Pierce, J. Frank (Distinguished Prof.)
- Emeritus, Ph.D., Pittsburgh
- Pujo, Alfonso Jr. (UTSI), Vanderbilt
- Roberts, M. J., Ph.D., Tennessee
- Rochelle, Robert W. (Emeritus), Ph.D.
- Roth, J. John, Ph.D., Cornell
- Symonds, Frederick W., Ph.D., Nottingham
- Tillman, James D. (Emeritus), Ph.D., Auburn

**Associate Professors:**
- Abidi, M. A., Ph.D., Tennessee
- Bomer, Bruce W. (UTSI), Ph.D., Tennessee
- Crilly, Paul B., Ph.D., New Mexico State
- Johnson, Roy D., Ph.D., Case Western
- Koch, Daniel, Ph.D., Missouri (Rolla)
- Rochelle, James M., Ph.D., Tennessee
- Weller, J. Wayne, Ph.D., Tennessee

**Assistant Professors:**
- Smith, L. Montgomery (UTSI), Ph.D.
- Whitaker, Ross T., Ph.D., North Carolina
- Virginia

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The Electrical Engineering Department has a graduate committee to administer, promote and advance the general well-being of the graduate program.

**THE MASTER'S PROGRAM**

Graduate work leading to the Master of Science with a major in Electrical Engineering may be completed during one academic year of full-time study, or two to three years of part-time study.

**Admission Requirements**

Students applying for admission to the Master of Science program and who hold a B.S. in Electrical Engineering are considered for admission on an individual basis. The minimum expectation is an undergraduate cumulative grade-point average of 3.0 out of 4.0 and a GPA of 3.0 for the senior year. All applicants whose native language is not English, including those who have earned degrees at U.S. institutions, must score at least 550 on the TOEFL exam to be considered for admission to the program.

Students who hold the B.S. or B.A. in a field other than electrical engineering are also expected to have a minimum cumulative grade-point average of 3.0 and a minimum senior year average of 3.0 in that field. These students should also have a background equivalent to that obtained by earning credit with a minimum 3.0 grade-point average in the Electrical Engineering courses normally taken at the 200 and 300 levels in the Bachelor's program in this department, and two senior Electrical Engineering courses (and any labs associated with them) in the student's area of interest. Students from fields other than electrical engineering who have met the admission standards except for this background will be admitted only as non-degree students until they have completed coursework to provide this background.

**Master's Degree Requirements**

Students may choose between a thesis option and a project (non-thesis) option M.S. program. All students must file a Master's Program Plan with the departmental graduate committee specifying which option they have selected, a semester-by-semester schedule of the courses they intend to take, and the members of the student's master's committee. Students may change between the thesis and project options, one time, by filing an amended Master's Program Plan.

**Thesis Option**:

Specific requirements of the thesis option are a minimum of 30 semester hours including:

1. Electrical Engineering 503 and 504.
2. Six semester hours of mathematics at the 400 level or above selected from a list approved by the graduate committee, or 6 semester hours of EE courses at the 500 level or above, or 6 semester hours of non-EE courses approved by the student's master's committee and the graduate committee.
3. An additional 12 semester hours of 500-level work in electrical engineering including 6 semester hours in the student's major area of electrical engineering and 6 semester hours in a second area of electrical engineering approved by the student's master's committee.
5. A final oral examination covering the thesis and related coursework.
Non-Thesis Option: Specific requirements of the project (non-thesis) option are a minimum of 33 semester hours including:

1. Electrical Engineering 503 and 504.
2. Six semester hours of mathematics at the 400 level or above selected from a list approved by the graduate committee, or 6 semester hours of EE courses at the 500 level or above, or 6 semester hours of non-EE courses approved by the student's master's committee and the graduate committee.
3. An additional 18 semester hours of 500-level work in electrical engineering courses, with at least 6 hours of 500-level work in each of two areas of electrical engineering.
4. Electrical Engineering 501 (project in lieu of thesis) with a minimum grade of B. This course will be administered by the student's master's committee. A written project proposal describing what the student will do in the course must be submitted in advance for the graduate committee's approval. A written final report and oral presentation is required and one copy of the final draft must be submitted to the graduate committee.
5. A final written examination covering the project and related coursework.

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 opportunity to do their master's thesis at the Fusion Energy Division of the Oak Ridge National Laboratory or at the Plasma Science Laboratory, affiliated with the Electrical Engineering Department. A limited number of Graduate Research Assistantships are available at each location. The Department also participates in a joint program in instrumentation and controls.

Graduate students at ORNL have the unique opportunity to receive career-related training at ORNL while satisfying dissertation requirements of the EE graduate program. Further information about this is available from the Department.

THE DOCTORAL PROGRAM

The Ph.D. degree program with a major in Electrical Engineering may be pursued in the concentration areas of circuit theory, computers, electromagnetics, communication theory, plasma engineering, power engineering, solid-state electronics, power electronics, and control systems.

Applicants must submit scores on the General Graduate Record Exam. A TOEFL score of 550 is recommended for non-native speakers. The Ph.D. degree program is open to students 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.
2. A minimum of 24 semester hours of coursework beyond the Master's, excluding research and dissertation credit. These hours must include:
   a. A minimum of 12 semester hours in electrical engineering at the 500 level and 600 levels.
   b. A minimum of 9 semester hours of 600-level coursework. At least 3 hours of this work must be in an area other than the student's major area.
   c. A minimum of 6 hours of mathematics courses at the 500 level or above and approved by the electrical engineering graduate committee.
3. One foreign language if the student's faculty committee feels that a reading knowledge of a foreign language is crucial to the student's research efforts.
4. Satisfactory performance on a qualifying examination and on a comprehensive examination. The qualifying examination is prepared by the Electrical Engineering faculty and consists of two 4-hour written examinations covering courses required in the undergraduate electrical engineering curriculum through the junior level. The qualifying examination consists of two written examinations each covering the first two semesters and the second two semesters of the Ph.D. program. A student who fails the qualifying examination must take and pass the examination the next time it is offered to remain in the program. A minimum of 18 hours of coursework must be completed after the student has taken the qualifying examination the first time.
5. A comprehensive examination is required by the Graduate School. In this department the comprehensive exam is administered by the student's committee; the exam results are reported to the graduate committee for approval, and the exam is filed in the department.

The electrical engineering courses are offered in the evening. Engineers working in industry are encouraged to participate in the department's graduate program. Departmental graduate courses are also available at the Space Institute, Tullahoma.

Department actions regarding a graduate student may be appealed in writing, first to the departmental graduate committee and then to the department faculty.

GRADUATE COURSES

Note: Courses required in the Electrical Engineering undergraduate curriculum cannot be used toward a graduate degree in Electrical Engineering except when required by the program.

400 Senior Design (5) Major design project focusing on student's area of concentration. The project utilizes the student's research, and develops the student's ability to design systems. The project is reviewed by the faculty before the final submission.

411 Digital Signal Processing and Filter Design (3) Discrete-time signals and systems, sampling, discrete Fourier transforms, analog filter characteristics, non-recursive and recursive filter design, and CAD tools for filter design. Level 1 design projects which require laboratory work. Prereq: 411.


431 Digital Amplifiers (3) Principles of electromechanical energy conversion, design procedures for AC and DC machines, construction and performance of power amplifiers. Effects of magnetic parameters on steady state and dynamic performances; the d-q model; reference frame.; 433 Linear System Analysis, Digital Filters, and Computer-Aided Analysis. Level 2 design projects. Prereq: 431.


441 Digital Communications (3) Discrete Fourier Transform, binary and M-ary Signaling, digital communication in presence of noise, matched filtering and equalization, information theory. Level 1 design projects. Prereq: 431.

445 Electro-Acoustics (3) Wave equation for sound, radiation from sources, impedance of piston, loudspeakers, horns, speaker systems, phased array; microphone; image reproduction, tape recording and reproduction, noise reducing systems, digital recording. Level 1 design projects. Prereq: 441.

451 Microprocessors and Microcontrollers in Electrical Engineering (4) Project oriented course using microcomputer kit having monitor program and development system with cross-assemblers, file management, and emulation capability. Interfacing and software/hardware tradeoffs in interrupt driven applications. Grade dependent upon number of projects completed.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any sem-
ester when studying in facilities, and a faculty time before degree is completed. May not be used to-
toward degree requirements. May be repeated. S/NC only. E.

503 Modern Transform Methods (3) Frequency-
domain transform methods; relevant fundamentals of com-
plex variable theory. Two-sided Laplace transform, its inver-
sion with residues, and its relation to the Fourier tran-
sform and s-transforms. Sampling theory. Two-sided z-
transform and its inversion by residues. The discrete
Fourier transform and fast Fourier transform.

504 Random Process Theory for Engineers (3) Prob-
ability and random variables as approached by set theory.
Stochastic processes and random variables. Random proces-
ses, stationarity, correlation functions and

505 Digital Signal Processing (3) Discrete-time signals
and systems, sampling, fast Fourier transform (FFT) and
fast convolution, design of FIR filters and IIR filters.

506 Digital Signal Processing II (3) Filter properties in
Z and Fourier transform domains, structures for digital
filters, sampling and reconstruction, hardware implementa-
tion of digital filters.

507 Application of Numerical Linear Algebra in Sys-
tems and Control Engineering (3) (Same as Chemical
Engineering 507 and Mechanical Engineering 507.)

511 Linear Systems Theory (3) State space models of
linear time invariant systems, state tran-
sition map, matrix exponential, controllability, observability, re-
alization theory, and stability theory. Coreq: 503.

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

515 Adaptive Control and System Identification (3)
Adaptive control of linear deterministic and stochastic sys-
tems, adaptive filtering and prediction, parameter es-
timation for deterministic and stochastic systems. Prereq:
511-2 or 518. B.

518 Control Systems Design I (3) Analysis and design of
continuous and discrete time control systems, feed-
back theory, stability, steady-state performance, com-
pensation. Engineering aspects of control systems.

519 Control Systems Design II (3) Digital control, vari-
able structure control, state-space design of SISO sys-
tems, use of estimators and observers, comparison of clas-
sical and state-space methods of control system design,
considerations for control system instrumentation.
Prereq: 518.

521 Power Systems Analysis I (3) Matrix-vector repre-
sentations of power networks, sequence modelling of pow-
er networks, network faults, power system transient faults.
Formulating and solving problems in matrix-vector form
with application to large scale power systems. Prereq:
421 or equivalent.

522 Power Systems Analysis II (3) Operation and con-
trol of interconnected power systems, transient and

dynamic stability. Formulating and solving problems in ma-
tice-vector form with application to large scale power systems.
Prereq: 521.

523 Power Electronics and Drives (3) Forcidentally
commutated inverters, advanced converters, ac

drives, dc machines, repetitive converters, stepper

524 High Voltage Systems (3) Phenomena, gener-

531 Advanced Analog Electronics I (3) Physical opera-

tion of modern electronic devices; semiconductor de-

532 Advanced Analog Electronics II (3) Design and

533 Digital Communication Systems (3) Error detec-

tion and correction. Information theory and band-

534 Digital Communication Systems I (3) Optimum
design of digital communications systems. Statistical
analysis of signals and systems. Baseline transmission
in the presence of noise. Coherent and noncoherent band-

535 Principles of Industrial Plasma Engineering (3) Plas-
ma physics and technology relevant to industrial applic-
ations of plasmas. Basic principles of kinetic theory,
electrodynamics, and plasma physics; sources of elec-
trons, ions, and RF electrical discharges and sources;
RF plasmas and plasma sources. Level 1 design projects.
Prereq: Senior standing.

471 Introduction to Pattern Recognition (3) Design of
and adaptive machines. Elementary decision
theory, perceptron algorithm, Bayes classification rule,
learning algorithms, synthetic pattern recogni-
tion, adaptive classifiers.

472 Introduction to Digital Image Processing (3) Basic meth-
ods for digitizing, storing, processing, and displaying
images. Computational procedures for image enhance-
ment, restoration, coding, and segmentation. Level 1 design projects.
Prereq: Senior standing. Non-majors require consent of instruc-
tor. Also for Electrical Engineering 464.

481 Power Electronics (3) Principles and characteristics of
power semiconductor devices, single-phase and
polyphase phase-controlled converters, converter con-

482 Power Electronics Circuits (3) Voltage-fed inverters,
PWM principles, control of inverters, dc-dc converters,
dc machines, resonance converters, stepper

483 Introductory Microwave Networks and Compo-

dents (3) Device theory of active devices. Project labor-
atory. Prereq: Consent of instructor.

545 Microelectronic Devices and Circuits (3) Current.

546 Linear Integrated Circuits (3) Fundamentals of
linear and nonlinear integrated circuit analysis.

547 Advanced Digital Logic Design (3) Design and

548 Digital Logic Design II (3) Designing digital systems

549 Engineering Design I (3) Introduction to engineering

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

601 Project in lieu of Thesis (3) Capstone course taken
under supervision of student's major professor and
major's committee. Individual project involving literature
survey, development of some software or hardware,

602 Digital Image Processing (3) Spatial and transform
processing of images. Neighborhood operators, image
egmentation, restoration, and bijective tech-

603 Quantum Electronics I (3) Introduction to electron-

604 Technology, wave reflection and transmission, gen-

605 Electromagnetic Fields (3) Maxwell's equations,

606 Random Processes (3) Time-continuous and

607 Electromagnetic Waves (3) Electromagnetic

608 Digital Signal Processing II (3) Filter properties in

609 Introduction to Digital Image Processing (3) Basic meth-
ods for digitizing, storing, processing, and displaying
images. Computational procedures for image enhance-
ment, restoration, coding, and segmentation. Level 1 design projects.
Prereq: Senior standing. Non-majors require consent of instruc-
tor. Also for Electrical Engineering 464.

640 Computer Organization and Architecture (3) In-
terface between computer hardware and a

641 Computer Architecture (3) Hardware and

642 Computer Architecture II (3) High-level

643 Digital Logic Design II (3) Designing digital systems

644 Computer Architecture III (3) Designing digital sys-

645 Principles of Industrial Plasma Engineering (3) Plas-
ma physics and technology relevant to industrial applic-
ations of plasmas. Basic principles of kinetic theory,
electrodynamics, and plasma physics; sources of elec-
trons, ions, and RF electrical discharges and sources;
RF plasmas and plasma sources. Level 1 design projects.
Prereq: Senior standing.

646 Applications of Industrial Plasma Engineering (3) Plas-
ma treatment of surfaces; ion interactions with solids;
plasma deposition and etching. Level 2 design projects.
Prereq: Consent of instructor.


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

599 Special Topics (1-3) May be repeated. Maximum 9 hrs.

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

614 Optimal Control (3) Deterministic and stochastic dynamic programming with linear and discrete time minimum principle and maximum principle, computational methods in optimal control. Prereq: 611.

617 Special Topics in Systems Theory I (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

618 Special Topics in Systems Theory II (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503.

623 Advanced Power Electronics and Drives (3) Phase-controlled converters, cycloconverter-fed ac drives, resonant converters, vector and scalar control of synchronous machines, static Kramer drives, static Scherbius drives, VSCF generation, modern control theory in ac drives.

624 Electrical Insulation (3) Principles, testing, and case studies. Basic principles of aging, losses, charging, conduction, and breakdown in vacuum, gas, liquid, solid, and composite insulation systems. Testing with low-noise instrumentation, pulse height analysis, optical, acoustic, and bridge test; 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. Fundamentals of physical processes in instrumentation transducers: thermoelectric, magnetoelectric, electromechanical, and quantum-mechanical devices. Prereq: 531 and consent of instructor.

632 Advanced Topics in Electronic Instrumentation II (3) Physical operation of modern discrete, monolithic, and hybrid electronic structures and their applications in signal processors. Resolution, sensitivity, response time, noise considerations in signal processors used in modern electronic instrumentation.

643 Detection and Estimation Theory (3) Detection theory; coding theory; system identification. Signals with unknown parameters; optimal filter synthesis; adaptive systems; sequential detection; suboptimal detection. Prereq: 504 or consent of instructor.

644 Coding and Information Theory (3) Structure of algebraic and probabilistic codes, linear codes, convolutional codes, error-correcting codes, decoding methods. Identification schemes, scheme complexity, 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 methodology. Prereq: 551-2 or consent of instructor.

652 Computer-Aided Design of VLSI Systems II (3) Computer-aided design tools; design and implementation of fully custom very large scale integrated (VLSI) circuits; design for testability; testing of fabricated circuits. Prereq: 551.

653 Advanced Plasma Physics I (3) Basic concepts of high temperature plasma physics. Magnetohydrodynamics and kinetic descriptions of plasma, plasma transport, plasma waves, equilibrium, and stability. Prereq: Physics 541-2, 461-2 or 563-4, or consent of instructor. (Same as Physics 663.)


671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, multi-sensor system. Prereq: 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereo vision, shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning and navigation. Prereq: 672.

591 Advanced Graduate Seminar (1) Research in department. May be repeated. S/NC or letter grade.

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

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**Engineering Science**

See Mechanical and Aerospace Engineering and Engineering Science

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**English**

(College of Arts and Sciences)

**MAJOR**

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<th>DEGREES</th>
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<td>English</td>
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**Professors:**

- Adams, Percy G. (Emeritus), Ph.D. (Texas)
- Carroll, D. Allen, Ph.D. (North Carolina)
- Cox, Don R., Ph.D. (Missouri)
- Curry, Kenneth (Emeritus), Ph.D. (Yale)
- Drake, Robert Y., Ph.D. (Yale)
-Ensor, Allison R., Ph.D. (Indiana)
- Finneran, Richard J. (Hodges Chair of Excellence), Ph.D. (North Carolina)
- Fisher, John H. (Emeritus), Ph.D. (Pennsylvania)
- Garner, Stamet B., Jr., Ph.D. (Princeton)
- Gill, J. E., Ph.D. (North Carolina)
- Goslee, David F., Ph.D. (Yale)
- Goslee, Nancy M. (Distinguished Prof.), Ph.D. (Indiana)
- Heffernan, Thomas J., Ph.D. (Cambridge)
- Hutchinson, George, Ph.D. (Indiana)
- Kallet, Marilyn, Ph.D. (Rutgers)
- Keene, Michael, Ph.D. (Texas)
- Kelly, Richard M. (Lindsay Young Prof.), Ph.D. (Dublin)
- Leggett, W. B. (Distinguished Prof.), Ph.D. (Florida)
- Leki, Ilona, Ph.D. (Illinois)
- Leto, Michael A., Ph.D. (Maryland)
- Maland, Charles J. (Lindsay Young Prof.), Ph.D. (Michigan)
- Penner, A. Richard, Ph.D. (Colorado)
- Reese, Jack E. (Univ. Prof.), Ph.D. (Kentucky)
- Sanders, Norman J. (Emeritus), Ph.D. (Duke)
- Schneider, Daniel J. (Emeritus), Ph.D. (Northwestern)
- Sharr, Dorothy M., Ph.D. (North Carolina)
- Shaw, William (Emeritus), Ph.D. (North Carolina)
- Stewart, Bain T. (Emeritus), Ph.D. (Northwestern)
- Stillman, Robert, Ph.D. (Pennsylvania)
- Traherm, Joseph B., Jr., Ph.D. (Princeton)
- Wier, Allen, M.F.A. (Bowling Green)
- Wiberg, Thomas V., Ph.D. (North Carolina)
- White, Jon M. (Emeritus), M.A. (Cambridge)
- Wright, Nathalie (Emeritus), Ph.D. (Yale)

**Associate Professors:**

- Atwill, Janet, Ph.D. (Purdue)
- Bensel-Meysers, Linda D., Ph.D. (Oregon)
- Dumas, Bethany K., Ph.D. (Arkansas)
- Dunn, Allen, Ph.D. (Washington)
- Finn, Russell, Ph.D. (Rensselaer)
- Howes, Laura L., Ph.D. (Columbia)
- Jennings, La Vina, Ph.D. (North Carolina)
- Papke, Mary E., Ph.D. (McGill)
- Smith, Arthur, Ph.D. (Houston)
- Zornick, John (Liaison), Ph.D. (Columbia)

**Assistant Professors:**

- Anderson, Misty G., Ph.D. (Vanderbilt)
- Bhat, Rakesh, Ph.D. (Illinois)
- Black, Joseph L., Ph.D. (Toronto)
- Eye, John O., Ph.D. (Duke)
- Hamontz, Patsy G., M.A. (Tennessee)
- Moksin, Kenneth, Ph.D. (Berkeley)
- Voss, Randi G., Ph.D. (Texas)

The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. Thesis and non-thesis options are available for the M.A. as well as a special concentration in writing.

Detailed information about the master's and doctoral programs, and about individual graduate courses, may be obtained by writing to the Director of Graduate Studies in English, 306 McClung Tower. A prospective student must contact the department to receive the proper information and forms with which to apply. For additional information, please visit the graduate website through the College of Arts and Sciences homepage at www.arisci.uky.edu.

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.

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**THE MASTER'S PROGRAM**

**Requirements**

**Coursework:** A minimum of 24 semester hours in English beyond the B.A. to include 6 hours at the 600 level; 12 additional hours at the 500-600 level (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 6 hours for graduate credit at any level, including the 400 level. In this coursework, students must maintain at least a 3.0 GPA.

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

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

**Language Requirement:** Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:

1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT Knoxville with a grade of B or better.
The requirements for the writing concentration are the same as those for the thesis option above with the following exceptions:

Coursework: Writing projects may substitute two 400-level writing courses for two 500-level courses. Students must take at least 9 hours in writing and 9 in literature, the remaining 6 to be selected from any English courses at the proper level. Of the courses in writing, at least 3 hours must be taken at the 500 level; additional 500-level courses are strongly recommended.

Writing Projects: One of the following writing projects for six hours of credit:
1. A thesis, using research to analyze some aspect of writing or rhetorical theory.
2. A creative project, such as a collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose.

The nature and length of each project will be determined by the Director of Graduate Studies after consultation with the student and the project director. In addition to the director, two other English 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 (only 3 hours of 593 Independent Study may be applied toward the M.A. and 3 after the M.A.); a special three-hour course in teaching composition; and 12 additional hours at any level, including the 400 level. Up to 6 of these additional hours may be taken in some cognate field or fields such as history, philosophy, French. These courses must be drawn from those approved for graduate credit. All other coursework must be in the English department. In this coursework, students must normally maintain a 3.5 GPA.

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

Language Requirement: A language requirement met in one of the following ways:
1. Two languages approved by the Director of Graduate Studies in English. The requirement for each language may be fulfilled by (a) completion of French 302 or German 302 with a grade of B or better; (b) completion at UT Knoxville of any two courses on the 300 level or above in the foreign language or literature with at least a B grade in each course; (c) passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.
2. One modern language approved by the Director of Graduate Studies in English. This requirement must be fulfilled by a passing grade on the language examination given by UT Knoxville and completion of two courses given in the foreign language at the 400 level or above, at least one course to be at the 500 or 600 level. A minimum grade of B must be received in each course.
3. One modern language approved by the Director of Graduate Studies in English and intensive study of the English language. This requirement must be fulfilled by completion of (a), (b), or (c) in option 1. for one foreign language; and completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509 History of the English Language (offered in alternate years only). For the other 3 hours, the student must either complete the history of the language sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the comprehensive examination in linguistics.

Examinations: (1) A 4-hour qualifying examination taken before the end of the first year of Ph.D. coursework; this examination is given three times a year, with the M.A. written examination. (2) A comprehensive written examination which may be divided as the department directs; see the English Department graduate brochure. The comprehensive examination is given twice a year, normally in March and September. Before a student may take it, he/she must have completed all coursework required. A student must also have met all requirements for foreign languages before beginning the first part of the examination.

Dissertation Defense: A one-hour examination on the dissertation and other related areas.

Residence Requirement: Two consecutive semesters as a full-time student. For students not on teaching assistantships, full-time consists of at least 9 or more hours of coursework and/or dissertation hours each semester. For students on assistantships, full-time consists of at least 6 hours of courses and/or dissertation hours and 3 hours of teaching each semester.

**GRADUATE COURSES**

Note: Students enrolling in English graduate courses must first register in the office of the Director of Graduate Studies in 306 McClung Tower.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.
402 Chaucer (3) Reading and analysis of Canterbury Tales and Troilus and Criseyde in Middle English.
404 Shakespeare I: Early Plays (3) Shakespeare’s dramatic achievement before 1601. Reading and discussion of selected 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, Welton.
411 Literature of Restoration and Early Eighteenth Century: Dryden to Pope (3) Survey of English literature and culture from 1660 to 1715.
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.