Entomology and Plant Pathology

(College of Agricultural Sciences and Natural Resources)

MAJOR

Entomology and Plant Pathology ............. M.S.

Carl J. Jones, Head

Professors:

Bernard, Ernest C., Ph.D. ............ Georgia
Bost, Steven C., Ph.D. ............ Tennessee
Burress, Edward E., Ph.D. ............ NC State
Gerhardt, Reid R. (Liaison), Ph.D. ....... NC State
Hilty, James W. (Emeritus), Ph.D. .... Ohio State
Johnson, Leander F. (Emeritus), Ph.D. 

J. Jones, Carl W., Ph.D. ............ Wyoming
Lambdin, Paris L., Ph.D. ............ VT
Newman, Melvin A., Ph.D. ............ Texas A & M

Patrick, Charles R., Ph.D. ............ Georgia
Pless, Charles D. (Emeritus), Ph.D. .... Clemson
Southards, Carroll J. (Emeritus), Ph.D. 

Trigiano, R. (Bob) N., Ph.D. ............ NC State
Windham, Alan S., Ph.D. ............ NC State
Windham, Mark T., Ph.D. ............ NC State

Associate Professors:

Canaday, Craig H., Ph.D. ............ Ohio State
Gwinn, Kimberly D., Ph.D. ............ NC State
Hale, Frank M., Ph.D. ............ Ohio State
Lentz, Gary L., Ph.D. ............ Iowa State
Owens, Bonnie H., Ph.D. ............ NC State
Skinner, John A., Ph.D. ............ California (Davis)
Vail, Karen M., Ph.D. ............ Florida

The Department of Entomology and Plant Pathology offers a graduate program leading to the Master of Science with a concentration in entomology or plant pathology. Students in entomology may specialize in crop entomology, medical and veterinary entomology, insect biology, insect pest management, or biological control. Students in plant pathology may specialize in foliar and stem fungus diseases, soilborne pathogens, disease physiology, biocontrol, plant nematology, or virology. For specific information, contact the department head.

THE MASTER'S PROGRAM

Admission Requirements

For admission to the M.S. degree program, a student must meet all requirements of The University of Tennessee Graduate Council and must have completed (1) general botany or biology, 8 hours; (2) advanced biological sciences, 8 hours; (3) general inorganic chemistry, 6-8 hours; (4) organic chemistry, 3 hours. In addition, three completed rating forms and a written statement of career goals and interest in entomology or plant pathology are required.

Degree Requirements

The program requires a written thesis based on original research and the completion of a minimum of 24 hours of coursework for graduate credit, approved by the student’s advisory committee. Included in the course requirements are two acceptable seminar presentations for 1 hour each. An oral final exam must be passed to the satisfaction of the advisory committee after the thesis has been completed. A minor is not required but may be selected at the option of the student. The minor will include at least 6 hours and not more than 10 hours of graduate-level credit in the minor department. The student’s committee shall include a member of the faculty from the minor department to assist in designating courses required for the minor.

GRADUATE COURSES

410 Diseases and Insects of Ornamental Plants (3) Symptoms, identification and management of diseases and insect pests that affect plants in greenhouse, nursery, and landscape environments. Prereq: Plant Pathology or Economic Entomology or consent of instructor. Sp.A

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

502 Registration for Use of Facilities (1-15) Re-quired for the student not otherwise registered during
Environmental Engineering

See Civil Engineering
Exercise Science

GRADUATE COURSES

480 Physiology of Exercise (3) Functions of body in muscular work; physiological aspects of fatigue, training and adaptation to environment. Prereq: Biochemistry and Cellular and Molecular Biology 230 Human Physiology or 440 General Physiology. (Same as Biochemistry and Cellular and Molecular Biology 480.)

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

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. S/NC only.

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


508 Research in Exercise Science (3) Research for writing of thesis and institutional review board proposals; presentation of research through free communications and poster presentations; calculation and interpretation of results; use of computer software. Prereq: 480 or 533.

509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 509, Nursing 509 and Social Work 509.)


513 Biomechanics of Orthopedic Rehabilitation (3) Effect of physical activity on musculoskeletal tissue; flexibility development and measurement, surgical implications, and rehabilitation related research. Prereq: 508.

516 Therapeutic Exercise (3) Current research in therapeutic exercise: role of nervous system, soft tissue healing, proprioception, muscle activation patterns, and strength.

521 Analytic Epidemiology (3) Epidemiologic strategies for evaluating research questions concerning causes, prevention and treatment of morbidity and disability. Presentation by experts working with large population-based datasets. Research process: grant writing and protocol preparation. Prereq: Course in statistics or consent of instructor.

525 Epidemiology of Injury and Violence (3) Epide-miologic methods to describe magnitude and examine etiology of unintentional and intentional injury. Alternative approaches for preventing or controlling occurrence of injury and violence in both general population and high risk sub-populations.


533 Exercise Physiology (3) Physiology of human performance; acute and chronic effects of exercise on metabolic, cardiac, pulmonary, and skeletal systems. Prereq: Human physiology or general physiology, general chemistry, 2 hrs and 1 lab.

541 Special Topics (1-3) Advanced study in selected areas of exercise science. May be repeated. Prereq: 508.

563 Laboratory Techniques in Exercise Physiology (3) Laboratory course in experimental method-ology and instrumentation: respiratory and metabolic measurements, blood chemistry, and gas analysis. Prereq: 480 or 533.

565 Advanced Physiology of Exercise (3) Systematic study of skeletal muscle and metabolism related to acute exercise and physical training; lectures, discussions of major scientific reviews, and appropriate laboratory experiments. Prereq: 480 or 533.


569 Clinical Exercise Physiology (3) Cardiac structure and function; interpretation of 12-lead electrocardiograms, exercise considerations for cardiac and pulmonary patient. Prereq: 480 or 533, and 567. (Same as Public Health 569.)

570 Cardiac Rehabilitation Practicum (1-3) Supervised experience in hospital-based exercise programs for participants with cardiac and/or pulmonary disorders. Use of telemetry monitoring, leading safe exercise regimens, counseling participants on safe exercise guidelines. Presenting educational class on topics applicable to participants. Prereq: 533 and 567, or consent of instructor. Coreq: 569. May be repeated. Maximum 6 hrs.

581 Biomechanics Instrumentation (1) Kinematic and muscle activity measurement of human movements using computerized videography, force platforms, electromyography and other relevant instruments. May be repeated. Maximum 3 hrs. S/NC only.

585 Seminar in Gerontology (1) (Same as Human Ecology 585, Counselor Education and Counseling Psychology 585, Nursing 585, Public Health 585, Educational Psychology 585, Social Work 585, and Sociology 585.)

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

600 Doctoral Research and Dissertation (3-15) Prereq: Doctoral student or consent of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

601 Research Seminar in Exercise Science (1) Research topics in different aspects of exercise science. May be repeated. S/NC only.

622 Directed Independent Research (3-6) Prereq: Doctoral student or consent of instructor. May be repeated. S/NC or letter grade.

625 Mortality and Survival (3) Life table and other population-based approaches to studying international and sociodemographic patterns and differentials in mortality, morbidity, and life expectancy. Prereq: 2 graduate statistics courses or consent of instructor.

635 Physical Activity and Positive Health (3) Review of clinical, epidemiological, and experimental evidence concerning relationship and effects of exercise on health-related components of fitness. Prereq: Elementary statistics, 480 or 533 and 567 or consent of instructor. (Same as Public Health 635.)

661 Seminar in Exercise and Applied Physiology (1-3) Selected topics in exercise and environmental physiology. Prereq: 480 or 533. May be repeated with consent of instructor.

664 Research Participation in Exercise Science (1-6) Participation in research with faculty member whose interests coincide with those of student. S/NC only.

681 Practicum (1-3) Intern experience in areas of major interest. May be repeated. S/NC only.

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

Sport Management

GRADUATE COURSES

415 Development and Maintenance of Recreation, Tourism and Athletic Facilities (3) (Same as Recreation and Tourism Management 415.)

440 Sport Marketing (3) Application of fundamental marketing concepts to sport industry. Marketing research, promotions, fund raising, advertising, and assessment of marketing programs specific to sport. Historical development of sport marketing. Prereq: Marketing or consent of instructor.

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

501 Special Project (3) Culminating experience for non-thesis major. Research study suitable for publication, or practicum requiring special written work. Prereq: 536.

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


511 Administration/Supervision In Sport (3) Development of knowledge and analytic skills desirable for managers/administrators in sport business/organization: organizational, administrative, and supervisory strategies related to sport in profit and non-profit settings. Su

512 Application of Legal Concepts to Sport Set- tings (3) Application of contract law, breach of contract, and monetary damages within sport settings; risk assessment and development of effective risk management strategies; development of contracts in sports; and analysis of cases involving discrimination based upon gender, race, and age as well as protection of rights at amateur and professional levels of sport. Sp

530 Sport and Media Issues (3) Gender and race issues within context of media and sport. Development of sport media and influence on sport. F,Sp

532 Research Techniques in Sport (3) Evaluate, compare, and contrast research techniques in sport with consideration for and experiences in appropriate review, design, analysis procedures, and proposal development. F,Su

535 Ethics in Sport Administration (3) Development of analytical skills and knowledge desirable of middle and upper level managers in sport business/organization, Social issues and ethics in sport administration. Sp

540 Sport Economics and Finance (3) Principles of economics and finance as applied to sport organizations. Market structures of sport finance and political economics that form those structures.

544 Theories of Leadership and Leader Behavior in Sport (3) Integration of various theoretical approaches to leadership styles in sport administration within cultural contexts, research, and field experiences. Sp

553 Case Studies in Sport Administration (3) Current issues and problems in sport administration at all levels of amateur and professional sport. May be repeated under different topics. Maximum 9 hrs.

554 Readings in Sport Administration (3) Survey of pertinent literature in refereed and applied journals and texts. Su

555 Evaluation Techniques for Sport Managers (3) Review and application of techniques of evaluation appropriate for sport programs, facilities, and personnel. Sp

570 Event Management (3) Review of current research related to theory and practice in event management and involvement in management capacity with one or more special events. Su

575 Seminar in Sport Management (1) Selected topics in sport management. May be repeated with consent of instructor. Maximum 3 hrs. S/NC only.

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

(University of Florida Business Administration)

MAJOR DEGREES

Business Administration ................. MBA, Ph.D.

James W. Wansley, Head

Professors:

Black, Harold A. (James F. Smith, Jr., Prof.), Ph.D. .................................. Ohio State
Boehm, Thomas P. (AmSouth Scholar), Ph.D. ........................................ New York University
DeGennaro, Ramon P., Ph.D. .............................. Ohio State
Dorwerich, William W. (Emeritus), Ph.D. ......................... Georgia Tech
Ehrhardt, Michael C. (Castagna Prof.), Ph.D. ....................... Florida
Philippatos, George C. (Distinguished Prof.), Ph.D. ............. New York Shives, Ronald E. (Volks Prof.), Ph.D. ........................................... UCLA
Wachowicz, John M., Jr. (AmSouth Scholar), CPA, Ph.D. .............. Illinois
Wansley, James W. (Clayton Homes Chair of Excellence) (Liaison), CPA, Ph.D. .................................. South Carolina

Associate Professors:

Auxier, Al L., Ph.D. ......................... Iowa
Collins, M. Cary (Home Federal Fellow), Ph.D. ......................... Georgia
Daves, Phillip R., Ph.D. ...................... North Carolina
Murphy, Deborah L., Ph.D. .............. Florida

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Finance.

The curriculum offers courses for those interested in careers in corporate financial management, security analysis and investments, banking and financial institutions, and real estate.

Minimum course requirements are three courses: 511 plus two from the following: 512, 525, 532, 581, and 599 (Torch Fund only).

Ph.D. Concentration: Finance.

Minimum course requirements are finance seminars 641, 642, 651, 652.

GRADUATE COURSES

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC or letter grade.

595 Internship (3) Full-time application of previous theoretical and applied knowledge and skills in appropriate sport setting. S/NC only. E

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

511 Strategic Management for Creation of Financial Value (3) Strategic issues in corporate finance, investments, and capital markets; how firms can employ financial strategies to create value. Use of derivatives, risk management, real options, fixed income securities, venture capital, initial public offerings and financial restructuring. Prereq: Business Administration 511, 512, and 513, or consent of instructor.

512 Problems in Financial Management (3) Readings and cases that apply finance theory to real-world investment, financing, and asset management problems. Prereq: 511 and Business Administration 511, 512, 513, and 514, or consent of instructor.

519 Capital Markets (3) Financial markets, asset valuation models, asset allocation decision in global setting; organization and functioning of financial markets; equity and bond valuation; asset valuation models; equity and bond portfolio management; options, forwards and futures contracts; evaluation of portfolio performance; and review of alternative economies and emerging markets. Prereq: 511 and Business Administration 511, 512, 513, and 514, or consent of instructor.

525 Real Estate Investment and Finance (3) Investment process, portfolio applications. Asset allocation decision in global setting; organization and functioning of financial markets; equity and bond valuation; asset valuation models; equity and bond portfolio management; options, forwards and futures contracts; evaluation of portfolio performance; and review of alternative economies and emerging markets. Prereq: 511 and Business Administration 511, 512, 513, and 514, or consent of instructor.


551 Financial Management of a New Enterprise (3) Financial issues associated with formation, control, and long-term planning of new enterprise. Acquisition of venture capital. Prereq: 511 and Business Administration 511, 512, 513, and 514, or consent of instructor.

561 Real Estate Investment and Finance (3) Financial and market analysis used to make real estate investment decisions. Effects of various financing options on rate of return on income-producing properties, effects of various financing options on consumer’s decisions to purchase. Relationship between primary and secondary mortgage markets and impact of those markets on cost and availability of funds for real estate lending. Effects of government intervention (taxation, subsidization, and regulation) in both real estate and mortgage markets. Prereq: 511 and Business Administration 511, 512, 513, and 514, or consent of instructor.

599 Special Topics in Finance (1-3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC or letter grade.

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

641 Seminar in Finance (1-3) Capital markets, utility theory, asset pricing, theory of the firm, capital structure, dividend policy. Prereq: Consent of instructor. S/NC or letter grade.


653 Seminar in Financial Institutions (1-3) Theoretical and empirical studies of financial institutions. Topics: modeling banking firm, efficiencies in banking, capital structure, credit and capital, capital allocation decision in global setting; organization and functioning of financial markets; equity and bond valuation; asset valuation models; equity and bond portfolio management; options, forwards and futures contracts; evaluation of portfolio performance; and review of alternative economies and emerging markets. Prereq: 511 and Business Administration 511, 512, 513, and 514, or consent of instructor.


THE MASTER'S PROGRAM

Applicants must have a B.S. in food technology, food science or a related scientific field.

Thesis Option

1. Prior to research for the thesis, the student must develop a detailed written
research plan. Registration for 6 hours of 500 Thesis is required.
2. In addition to the thesis requirement, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student’s committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student’s progress or background indicates such need.
3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate during their master’s program. Completion of 510 or equivalent is also required.
4. An oral, final examination covering the thesis and coursework is required.

Non-Thesis Option
1. In lieu of a thesis, students are required to complete a problem in cooperation with their employer (company or governmental agency) and their faculty committee. Students working on a problem must register for 6 hours of 503.
2. In addition to the requirement for 6 hours of 503, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student’s committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student’s progress or background indicates such need.
3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate during their master’s program. Completion of 510 or equivalent is also required.
4. Students will be required to take a written comprehensive examination covering their coursework. In addition, an oral, final examination covering the problem and coursework is required. The oral examination will be held on the Knoxville campus.

THE DOCTORAL PROGRAM
1. Completion of a master’s degree in the field, or a closely related field, or passing a special qualifying examination is required for admission.
3. A minimum of 72 hours beyond the Bachelor’s degree, excluding credit for the master’s thesis, is required. Of this, 24 semester hours must be 600 Doctoral Research and Dissertation.
4. At least 24 hours of coursework numbered above 500 are required exclusive of doctoral research and dissertation. At least 6 of the 24 hours must be courses numbered above 500.
5. A minimum of 6 hours of courses for graduate credit must be taken outside the Department of Food Science and Technology.
6. All candidates must complete 601 (2 hrs.) and are expected to attend 601 during their Ph.D. program.
7. Each candidate must pass both written and oral comprehensive examinations prior to admission to candidacy. Major professors will advise candidates on competencies expected. A final oral examination is required that includes a defense of the dissertation and subject matter that the student’s committee considers appropriate.

GRADUATE COURSES
410 Food Chemistry (4) Reactions of water, proteins, lipids, carbohydrates, minerals, enzymes, vitamins, and additives in foods. Prereq: Chemistry 110 Introduction to Organic and Biochemistry, Biochemistry and Cellular and Molecular Biology 310 Physiological Chemistry. 3 hr. 3 credits. F,Sp
420 Food Microbiology (2) Physical, chemical and environmental factors moderating growth and survival of foodborne microorganisms; pathogenic and spoilage microorganisms affecting quality of foods and their control. Prereq: Microbiology 210 General Microbiology. Coreq: 429. F
429 Food Microbiology Lab (3) Methods for examination, enumeration, cultivation and identification of foodborne microorganisms. Prereq: Microbiology 210 General Microbiology. Coreq: 420. F
430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods. Prereq: Basic statistics. 2 hrs and 1 lab. F
460 Meat Science (3) Carcass characteristics of meat animals, muscle structure and composition, cut identification, curing, freezing and cooking. Prereq: Food Industry or consent of instructor. Sp
469 Meat Science Lab (1) Slaughter and processing methods for beef, pork, lamb and poultry. Coreq: 460. Sp
490 Food Laws and Regulations (3) Laws and regulations designed to preserve safety, wholesomeness, and nutritional quality of United States food supply; precedent case studies and their impacts on laws and regulations. Prereq: The Food Industry; consent of instructor for non-majors. Recommended: Prereq: Core courses in Food Science and Technology, F
495 Quality Assurance and Sanitation Practices (3) Design and evaluation of food processing operation to produce safe and acceptable quality food product. Prereq: Food Chemistry, Food Microbiology, Food Preservation or consent of instructor. Sp
500 Thesis (1-15) P/NC only. E
501 Seminar (4) Individual reports and discussion on topics from current literature. May be repeated. Maximum 3 hrs. F,Sp
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
503 Problems in Lieu of Thesis (2-3) May be repeated. S/NC only. E
507 Professional Development Seminar (1) (Same as Agriculture and Natural Resources 507, Animal Science 507, Biosystems Engineering 507, Biosystems Engineering 507, Ornamental Horticulture and Landscape Design 507, and Plant and Soil Sciences 507.) S/NC only. F
510 Instrumental Analysis of Food (3) Modern instrumental methods for control of food manufacturing processes. Prereq: Food Chemistry, 2 hrs and 1 lab. F
511 Color of Foods (2) Chemical basis, measurements, and reactions involved in color changes in foods. Measurement of materials used to modify color of foods. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. F, A
512 Flavor of Foods (2) Chemical basis, measurements, and reactions involved in flavor changes in foods. Manufacture and application of flavorings in foods. Prereq: Food Chemistry or equivalent. 1 hr and 1 lab. F, A
515 Food Carbohydrates, Proteins and Lipids (4) Advanced study of chemical and physical attributes of carbohydrate, protein, and lipid components of foods; effects of components on production of safe and consistent quality food products; and changes during processing and/or distribution of food products. Prereq: Food Chemistry or equivalent. 3 hrs and 1 lab. Sp
521 Advanced Food Microbiology (3) Extrinsic and intrinsic factors associated with foods and food processing that relate to growth, survival, inhibition, detection, and recovery of foodborne pathogens and spoilage organisms; traditional and current approaches to microbiological food safety and quality. Prereq: Food Microbiology and Lab or equivalent. Sp,A
540 Food Product Development (3) Art, science and technology of developing and marketing new food products. Prereq: Food Preservation. 2 hrs and 1 lab. Sp,A
560 Advanced Meat Science (3) Physical and chemical changes that occur in conversion of muscle to meat; effect of postmortem treatments on meat quality, composition and palatability; packaging, preservation and quality control. Prereq: 460. 2 hrs and 1 lab. Sp,A
590 Special Topics in Food Technology and Science (3-6) Critical review of current research and production concerns of food industry. May be repeated. Maximum 9 hrs. F,Sp
593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 6 hrs. E
600 Doctoral Research and Dissertation (3-15) P/ NP only. E
601 Seminar (1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hrs. F,Sp
620 Food Toxicology (3) Basic and applied concepts in food toxicology; toxicological aspects of processed foods. Modes of action, prevention and control of food toxicants in food supply. Prereq: Food Chemistry, 521, or consent of instructor. Sp,A
640 Advanced Food Processing (3) Role of processing treatments in modification of food properties; texture, flavor and color characteristics. Prereq: Food Preservation, 510, 511, 512 or consent of instructor. Sp,A

Forestry, Wildlife and Fisheries
(College of Agricultural Sciences and Natural Resources)

MAJORS

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<td>George M. Hopper</td>
<td>Head</td>
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</tbody>
</table>

Professors:
Barrett, J. W. (Emeritus), Ph.D. .............. Syracuse
Buckner, E. R. (Emeritus, Distinguished Prof.), Ph.D. ..................................... NC State
Core, H. A. (Emeritus), Ph.D. ............... Syracuse
Dearden, B. L., Ph.D. ............... Colorado State
Dimmick, R. W. (Emeritus), Ph.D. .......... Wyoming
Hill, T. K., Ph.D. ................. Auburn
Hopper, G. M. (Liaison), Ph.D. .......... Virginia Tech
Ostermeier, D. M., Ph.D. ............ Oregon State
Peterson, M. R., Ph.D. .............. Georgia State
Rials, Timothy G., Ph.D. ............ Virginia Tech
Schlarbaum, S. E., Ph.D. ........... Colorado State
Schneider, G. (Emeritus), Ph.D. ........... Michigan State
Sharp, J. B. (Emeritus), D.P.A. .......... Harvard
Graduate study leading to the Master of Science with majors in Forestry and in Wildlife and Fisheries Science and the Doctor of Philosophy with a major in Natural Resources is offered by the Department of Forestry, Wildlife and Fisheries. The mission of the Department of Forestry, Wildlife and Fisheries is to advance the understanding and management of natural resources in Tennessee, the region and beyond through programs in teaching, research and extension.

THE MASTER’S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor’s degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must take the general Graduate Record Examination (GRE) with minimum scores required.

Graduate Rating Forms or letters of recommendation from three individuals familiar with the applicant’s academic ability are required. The department also has an application that must be submitted at the time of application to the Office of Graduate Admissions.

Thesis Option

1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. Registration for 6 hours of Thesis (Forestry 500 or Wildlife and Fisheries Science 500) is required.
2. A graduate committee of no fewer than 3 faculty members must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis requirement, a minimum of 24 hours of graduate coursework is required. This work must be approved by the student’s committee and no more than 10 hours of the minimum 30 can be below the 500 level. The committee may require additional coursework if the student’s progress or background indicates such need.
3. All students are required to include Forestry 512 or Wildlife and Fisheries Science 512, Seminar, in their programs. This is required of each graduate student in residence fall semester.
4. An oral examination covering the thesis and coursework is required.

Non-Thesis Option (Forestry only)

1. Thirty-five hours of graduate coursework of which 23 must be at the 500 level or above is required.
2. A graduate committee of no fewer than 3 faculty members will be selected. At least one member shall be from outside the department. The committee will meet and schedule the student’s program during the first semester in residence.
3. Three hours of Forestry 511 are required.
4. Nine hours of coursework in the department must be at the 500 level or above, exclusive of Forestry 511.
5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 28 hours of approved study.

THE DOCTORAL PROGRAM

The doctoral program with a major in Natural Resources emphasizes interdisciplinary research approaches toward the understanding and management of natural resources in a broad context. Areas of study include forest, wildlife, and fisheries biology; ecosystem function and structure; natural resource economics and policy; human dimensions of natural resource management; natural resource organization administration and management; wood sciences; and multidisciplinary natural resources management.

Admission Requirements

Applicants to the Ph.D. program normally should have completed a master’s degree prior to beginning the doctoral program. Specific admission requirements include:
1. A minimum grade-point average of 3.0 on a 4.0 scale.
2. A minimum composite score from the general Graduate Record Examination (GRE) on the verbal, quantitative, and analytical sections of 1500, with a minimum of 1100 on the verbal and quantitative sections.
3. A statement of professional goals, natural resource management philosophy, and reasons for applying to the program.
4. Three letters of reference from individuals capable of evaluating the applicant’s potential for graduate work in interdisciplinary natural resource management.

Degree Requirements

A candidate for the doctoral degree must complete 72 semester hours of coursework beyond the bachelor’s degree. Forty-eight hours must be in graduate coursework approved by the student’s doctoral committee. Up to 24 hours of master’s-level coursework may be applied to the 48-hour requirement. A minimum of 6 hours must be taken in UT course work at the 600-level exclusive of dissertation hours. Specific requirements are:

1. Research Methods and Analysis (9 credits in at least two of the subject areas)
   Research/Experimental Design
   Statistics/Econometrics/Biometrics
   GIS/Remote Sensing
2. Core Subject areas (33 credits to be determined by Doctoral Committee)
3. Professional Development (6 credits)
   Teaching - All students will be expected to complete FWF 601 and assist in teaching a course during their tenure in the program.
   Problem Solving – FWF 610 will be required of all doctoral students that will include participation in an interdisciplinary team to address a significant national or regional natural resource issue.
   Professional Communications – all students will be required to complete FWF 612 as part of their program of study. Part of the seminar requirement will consist of assisting in the development and conduct of FWF 512.
4. FWF 600 Doctoral Research and Dissertation (24 credits)

A doctoral committee consisting of at least four faculty members must be identified by the student and major professor. At least two of the committee members must be from the Department of Forestry, Wildlife and Fisheries and one member must be from an academic unit other than Forestry, Wildlife and Fisheries. Three of the committee members, including the major professor, must be approved by the Graduate Council to direct doctoral research. The committee should be formed during the first year of the student’s program.

All students are required to successfully complete an oral and written examination on all coursework completed as part of the Ph.D. requirements. The exam is scheduled when the student has completed all or nearly all of the coursework. The Ph.D. committee will determine the content, nature, and schedule of the comprehensive exam and certify the results.

During the first year, the student should develop a research prospectus that outlines the research problem to be addressed as part of his/her doctoral research. The prospectus is presented to the student’s committee and the committee will approve the research topic and approach.

All students are required to complete, present, and defend a dissertation. The student should provide each member of the committee a copy of the dissertation at least two weeks prior to the scheduled defense. All students are required to present a seminar on their dissertation as part of the degree requirements. The seminar can be part of the dissertation defense or presented before the formal defense.

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.
Forestry

GRADUATE COURSES

421 Forest and Wildland Resource Economics (3) Production functions, supply-demand and market analysis; non-market programs and projects; economic analysis and decision models; investment and financial analysis; managerial economics; taxes; forest products marketing. Prereq: Forest Resource Analysis or consent of instructor. Sp,A

422 Forest and Wildland Resource Policy (3) Policy formulation; criteria for policy determination; forest and wildland law and regulation; theory of conflict resolution; formal and informal resolution. Prereq: Senior standing or consent of instructor. F

423 Wildland Recreation Planning and Management (3) Planning processes, master and site planning, site design projects; management strategies, methods of visitor and recreation site management; case studies. Weekend field trips. Prereq: Wildland Recreation or consent of instructor. 2 hrs and 1 lab. Sp

433 Wood Adhesives and Glued Wood Products (2) Theory and practice of adhesive bonding of wood; wood-substrate-adhesive interface for bonding; principles of adhesion; wood adhesive types; gluing of solid wood and composite wood manufacturing processes; laboratory manufacture and/or testing of adhesives, adhesive bonding strength; quality control of product performance; day trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. F

434 Wood Processing and Machining (2) Primary roundwood to secondary processing into major products. Fundamentals of machining technology for major types of cutting operations: sawing, boring, planing, veneer cutting, and laser machining; day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. Sp

500 Thesis (1-15) Research required of all graduate students in residence in fall. science, or consent of instructor. Sp,A

512 Seminar in Forestry, Wildlife and Fisheries Science. Sp,A

540 Genetics in Forestry (3) Genetic improvement of forest trees, selection of superior phenotypes; field testing for genetic variability; tree breeding; development of hybrid seed orchards; forest genetics and tissue culture; use of biochemical variation; planning and conducting forest genetics research. Prereq: Silvicultural methods and Biology 220 or consent of instructor. Sp,A

550 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development on forests and associated lands; analysis and critique of specific recreation alternatives. Overnight field trips. Prereq: Senior level in forest recreation or consent of instructor. F,A

570 Management & Policy of Forest Resource Organization (3) Theory and application of management as applied to natural resource organizations; institutional direction and cultural, and strategic management. Development of policy as planning tool and as results from conflict resolution. Linkage between policy development and execution, and structure and management of organizations. Prereq: Forest administration and policy or consent of instructor. F,A

580 Advanced Silviculture (3) Silvicultural characteristics, silvicultural practices and systems applied to commercial importance of the sawtimber and softwoods. In-depth analyses of silvicultural principles involved and tools used, prescribed fire, pesticides, in regeneration and management; computer modeling of stand dynamics, structure, growth/yield. Prereq: Undergraduate silviculture course or consent of instructor. 2 hrs and 1 lab. Sp,A

590 Advanced Topics in Forestry (1-3) Recent advances and concepts, research techniques, and analysis of current problems. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

591 Independent Study in Forestry (1-4) May be repeated. Maximum 6 hrs.

612 Seminar in Forestry, Wildlife and Fisheries (1) May be repeated. Maximum 3 hrs.


610 Seminar in Natural Resources (2) Selected issues in natural resources and natural resource management at regional, national, or international level. Development of interdisciplinary approach to addressing problems: evaluating current state of knowledge, developing alternative actions to address problems, and identifying criteria for evaluation of alternatives.

612 Seminar in Forestry, Wildlife and Fisheries (1) Current issues and developments in forestry, wildlife and fisheries. Required of all doctoral students in residence during fall. May be repeated. Maximum 3 hrs.

Wildlife and Fisheries Science

GRADUATE COURSES

440 Wildlife Techniques (3) Methods of wildlife damage control, forest, farmland, wetland habitat management, identification of wildlife field sign, wildlife capturing techniques and management plan preparation. Weekend field trips. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

442 Fisheries Techniques (3) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques; age determination and growth analysis; stream assessment; equipment and instrumentation usage and maintenance; safety in sampling methods. Weekend field trip. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

443 Fisheries Science (3) Quatification and management of freshwater fisheries: population estimation, age and growth, biological assessment, and stocking. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 2 hrs and 1 lab. Sp

444 Ecology and Management of Wild Mammals (3) Biological and ecological characteristics of game mammals and endangered mammals. Current principles and practices of wild mammal management. Prereq: Principles of Wildlife and Fisheries Manage-
ment or consent of instructor. 2 hrs and 1 lab. One weekend field trip required. Sp

445 Ecology and Management of Wild Birds (3) Biological and ecological characteristics of game birds, endangered birds, and bird pests. Current principles and practices of wild bird management. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 2 hrs and 1 lab. Sp

490 Ethics in Wildlife and Fisheries Management (1) Ethical bases for decision-making and application of methodologies in practice of wildlife and fisheries management. Seminars by ethicists, wildlife and fisheries scientists and managers, and foresters to acquaint students with diverse perspective of ethical behavior in practices of wildlife and fisheries management. Lectures, panel discussions, and case studies. Team taught. Prereq: Senior standing. S/NC only. Sp

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

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. 5/C only. F

512 Seminar in Wildlife and Fisheries Science (1) Current developments in wildlife and fisheries science. Required of all graduate students in residence in fall. May be repeated. Maximum 2 hrs. S/NC only. F

515 Seminar in Avian Ecology and Management (1-2) Readings and discussion based on current literature on contemporary topics in avian ecology and management. Additional credit awarded for writing review paper on contemporary topic of interest to student. Prereq: Consent of instructor. F, A

520 Planning and Administration of Fisheries and Wildlife Programs (2) Factors influencing policy and program planning activities of fisheries and wildlife agencies. Decision-making policies, case histories. Sp,A

525 Endangered Species Management and Conservation of Biodiversity (2) Status, ecology and management of endangered wildlife and plant species. Historic aspects, policy implications and philosophical issues surrounding recovery efforts. Approaches to monitor and manage for biodiversity. Prereq: Graduate standing or consent of instructor. Sp,A

530 Wildlife Diseases (2) Necropsy of birds and mammals. Recalls various diseases and techniques of preparing pathological materials in field and lab. Investigative procedures concerning wildlife diseases. Prereq: 1 yr biology, 444 or 445, or consent of instructor. Same as Comparative and Experimental Medicine - Veterinary Medicine 530. F, A

535 Floodplain Ecosystems (3) Ecology, restoration and management of floodplain ecosystems: biotic and abiotic processes, social considerations, and wildlife and forest management; Lower Mississippi River Alluvial Valley. Prereq: Consent of instructor. F, A

540 Predator Ecology (2) Dynamics of terrestrial vertebrate predator populations in human-altered and relatively undisturbed environments. Prereq: 444 or 445 or consent of instructor. Sp,A

545 Advanced Population Analysis (2) Detailed characteristics, assumptions, goals, methods, and current technologies for fish and wildlife population analysis. Use of computers. Prereq: Animal Science 571 or Statistics 538 or consent of instructor. Sp, A

546 Advanced Habitat Analysis (2) Habitat analysis as tool to evaluate habitat use and predict occurrences of animal and plant species: principles and goals of modeling, habitat analysis theory, GIS and statistical techniques. Use of computer programs. Prereq: Forestry, Wildlife and Fisheries 410 or Geography 411 or consent of instructor. Sp, A

550 Fish Physiology (3) Mechanisms of gas transfer, circulation, excretion, osmoregulation, locomotion and neural/hormonal control of these systems in fishes. Comparisons and contrasts with physiology of terrestrial animals. Practical applications of fish physiology to hatchery operation assessment and fisheries management. Prereq: Senior or graduate standing in life sciences.

555 Fish Culture (3) Principles, concepts and techniques of culturing economically important fish and shellfish species. Prereq: 443 or consent of instructor. 2 hrs and 1 lab. Sp,A

556 Recirculating Aquaculture (3) Growing fish in intensive, indoor, recirculating water systems. Techniques of solids removal, nitrification, and gas balance. Practical experience with operating system. Prereq: 443 or consent of instructor. Sp,A

560 Advanced Topics in Wildlife and Fisheries Science (1-3) Recent advances and concepts, research techniques and analysis of current problems. Prereq: 443, 444, 445, or consent of instructor. May be repeated. Maximum 6 hrs.

593 Independent Study in Wildlife and Fisheries Science (1-4) May be repeated. Maximum 6 hrs. E

French

See Modern Foreign Languages and Literatures

Geography (College of Arts and Sciences)

MAJOR

Geography ........................................ M.S., Ph.D.

Bruce Ralston, Head

Professors:

Associate Professors:
Orvis, Kenneth H., Ph.D. ................. California Shaw, Shih-Lung, Ph.D. ............... Ohio State

Assistant Professor:
Grissino-Mayer, Henri, Ph.D. ............ Arizona

The department offers the Master of Science and Doctor of Philosophy degrees. The master’s degree emphasizes development of professional competence as a geographer and offers opportunities to gain substantial depth in a concentration or a major technique. An emphasis in geographic information science is available for students who have appropriate backgrounds in mathematics and computer science. The doctoral program is for those who have demonstrated proficiency in conducting independent research. The department is particularly well-qualified to direct graduate work in location analysis, transportation geography, urban and rural geography, cultural ecology, and the geography of the natural environment (especially biogeography and geomorphology). The faculty is qualified to direct students from a variety of approaches ranging from historical and humanistic to rigorously analytic and GIS-based.

THE MASTER’S PROGRAM

The department offers the thesis and non-thesis options for the Master of Science. Both options require a minimum of 30 semester hours beyond the completion of a sound undergraduate major program. The M.S. program requires students to have background in quantitative methods equivalent to the course content of Geography 415, and some familiarity with key themes and approaches in both physical and human geography. At least two-thirds of the total hours in the degree program must be at or above the 500 level and must include 501 (at each offering during residency), 504, and 3 semester hours at the 600 level. In the thesis option, 6 hours must be Thesis 500. A final examination is required in both programs.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those who demonstrate proficiency in conducting independent research. Students must have a broad foundation and understanding of the discipline; these should have been achieved in a comprehensive master’s program. Course requirements for the degree shall be determined by the student’s faculty committee in accordance with specific interests and needs. The program must include 504, 515, 535, 9 hrs of 600-level seminars, and (at each offering during residency) 501. A minimum of 9 semester hours must be earned in collaborative fields, with courses selected for their relevance to the special fields. Ph.D. students whose Master’s level work was in a field other than geography and for whom the Master’s area remains close to their Ph.D. specialty areas may petition to substitute geography units in courses outside of their specialty areas for up to 3 of the 9 required outside units. Competency in quantitative methods and basic human and physical geography is required. Additional tools, including languages, will be required as appropriate to the student’s areas of research specialization.

Examinations required for admission to candidacy include a written comprehensive examination, completion of two written examinations in which the student will be tested on his/her knowledge of two special fields, and related areas of geography; an oral examination on the student’s program, the special fields and related areas, and the dissertation proposal. All parts of the written comprehensive examination should be taken within the same semester.

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 on an in-state tuition basis. The Ph.D. program in Geography is available to residents of the states of Alabama, Arkansas, Mississippi, Virginia, or West Virginia. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE COURSES

410 Global Positioning Systems and Geographic Data (3) Theory, field and laboratory use of Global Positioning Systems for capturing digital geographic data; management of geographic data; coordinate systems, datum issues, scanning and digitizing, map standards, and uncertainty in Geographic Information Systems. 2 hrs and 1 2-hr lab.

411 Computer Mapping and Geographic Information Systems (3) Principles of computer mapping, computer hardware, and presentation of data for spatial analysis: cartographic data structure. Prereq: 310 Introduction to Cartography and consent of instructor. (Same as Information Management 431.) 2 hrs and 1 2-hr lab.

412 Advanced Cartography Techniques (3) Cartographic design and data display techniques for reference and thematic maps. Basic principles and methods of map reproduction. Prereq: Introduction to Cartography or consent of instructor. 2 hrs and 2 labs.

413 Remote Sensing: Types and Applications (3) Principles and uses of remote sensing imagery, digital data, and spectral data; geographic interpretation and mapping techniques. Prereq: Introduction to Cartography or consent of instructor.

415 Quantitative Methods in Geography (3) Geographical study of folk culture, traditional material culture and rural settlement, examples from eastern North America and selected foreign areas.

423 Geography of American Popular Culture (3) Geographical study of regional variation in popular cultures, youth cultures in United States. (Same as American Studies 423.)

433 The Land-Surface System (3) Characteristics of surface forms, processes, and surface materials, and their regional interrelationships. People as evaluators and agents of change. Prereq: Geography of the Natural Environment or consent of instructor.

434 Climatology (3) General circulation system leading to world pattern of climates, Climate change and modification, and interrelationships of climate and human activity. Prereq: Geography of the Natural Environment or Meteorology or consent of instructor.

435 Biogeography (3) Changing distribution patterns of plants and animals on a variety of spatial and temporal scales. Effects of continental drift, Pleistocene climatic change, and human activity on world biota. Prereq: Geography of the Natural Environment or consent of instructor.

436 Water Resources (3) Global water resources and hydrologic processes: water availability, flooding, and water quality issues from physical and economic geographic perspectives. Prereq: Geography of the Natural Environment or consent of instructor.

439 Plant Geography of North America (3) Characteristics and distribution of major plant communities of Canada, the U.S., Mexico, and Central America. Prereq: Geography of the Natural Environment or consent of instructor.

441 Urban Geography of the United States (3) Concepts and the role of cities in the United States. Writing emphasis course. (Same as Urban Studies 441.)

443 Rural Geography of the United States (3) Geographical appraisal of rural areas of the United States, including small towns and urban fringes. Prereq: Consent of instructor. Writing emphasis course.

449 Geography of Transportation (3) Examination of transportation systems, their effects on trade patterns, land use, location problems, and development.

450 Process Geomorphology (3) (Same as Geology 450.)

466 Teaching and Learning Geography (3) Preparation of prospective secondary school teachers of geography; learning strategies, and understandings needed for effective teaching and assessment of geography in K-12 schools. Course organization and content, based largely on that of National Geography Standards.

500 Thesis (1-15) P/NP only. Prereq: 449 or consent of instructor. May be repeated. Maximum 15 hrs. May be applied toward graduate degree. S/NC only.

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

504 Introduction to Geographical Research (1) Research interests and methods of departmental faculty. Research frontiers in geography. Required of new graduate students. S/NC only.

505 Directed Research (2-6) Research on problems as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 6 hrs. S/NC or letter grade.

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. May be repeated with consent of instructor. Maximum 6 hrs. S/NC or letter grade.

509 Topics in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs. S/NC or letter grade.

510 Geographic Software Design (3) Algorithms for spatial analysis, software design, and program implementation in stand alone and distributed computing environments. Prereq: Consent of instructor. (Same as Information Management 531.)

513 Topics in Remote Sensing (3) Applied research using imagery for interpretation and mapping of geographic data. Prereq: 413 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

515 Topics in Quantitative Geography (3) Multivariate analysis applied to problems in geography; research problems utilizing appropriate computer programs; usefulness to geographic research of techniques developed by other disciplines. Prereq: 415 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

517 Geographic Information Management and Processing (3) Concepts and methods in management of geographic information. Database design, manipulation, sampling and analysis. Prereq: Consent of instructor. (Same as Information Management 532.)

518 GIS Project Management (3) Interactions between management, technical, and application aspects of Geographic Information Systems project through simulated environments. GIS sites. Prereq: Computer Mapping and Geographic Information Systems or consent of instructor.

519 Graduate Practicum in Cartography/Remote Sensing/GIS (2-6) Prereq: Written consent of department before registration. May be repeated with consent of instructor. Maximum 6 hrs.

521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geogra-

532 Topics in Global Change (3) Emerging trends, anticipated problems and methods in global change research and response. Prereq: 434 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

533 Topics in Physical Geography (3) Trends, problems, and methods in geomorphology or other areas of physical geography. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

534 Topics in Climatology (3) Trends, problems and methods in area of climatology. Prereq: 434 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

535 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography. Prereq: 435 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

536 Topics in Watershed Dynamics (3) Trends, problems and methods in study of watershed processes. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

541 Topics in Urban Geography (3) Analysis of research on urban systems, internal morphology, urban problems and urban spatial behavior. Prereq: 441 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

549 Topics in the Geography of Transportation (3) Examination of trends, problems, and methods in transportation geography and transportation networks. Prereq: 449 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

591 Foreign Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. S/NC or letter grade.

592 Off-Campus Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. S/NC or letter grade.

593 Independent Study (1-15) See College of Arts and Sciences. Prereq: Written consent of department prior to registration. S/NC or letter grade.

599 Geographic Concept and Method (3) Traditional and modern geographic thought, reading, research, theory, scope, problems, and methods of geography. Prereq: Consent of instructor.

600 Doctoral Research and Dissertation (3-15) P/NP only. Prereq: 663 Seminar in Geography of the American South (3) Prereq: Consent of instructor. May be repeated. Maximum 15 hrs.

631 Seminar in Natural Hazards (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

633 Seminar in Physical Geography (3) Prereq: 533 or consent of instructor. May be repeated. Maximum 6 hrs.

634 Seminar in Climatology (3) Prereq: 534, 532 or consent of instructor. May be repeated. Maximum 6 hrs.

635 Seminar in Biogeography (3) Prereq: 535 or consent of instructor. May be repeated. Maximum 6 hrs.

641 Seminar in Urban Geography (3) Prereq: 541 or consent of instructor. May be repeated. Maximum 6 hrs.

643 Seminar in Rural Geography (3) Prereq: 443 or consent of instructor. May be repeated. Maximum 6 hrs.

649 Seminar in Geography of Transportation (3) Prereq: 549 or consent of instructor. May be repeated. Maximum 6 hrs.

663 Seminar in Geography of the American South (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

677 Seminar in Biological Conservation (3) Conduct of original research. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Geological Sciences

(College of Arts and Sciences)

**MAJOR DEGREES**

**Geology** M.S., Ph.D.

William M. Dunne, Head

**Professors:**
Broadhead, Thomas W., Ph.D. ............ Iowa
Byerly, Don W. (Emeritus), Ph.D. .... Tennessee
Driese, Steven G. (Liaison), Ph.D. ....... Wisconsin
Dunne, William M., Ph.D. ............... Bristol
Hatcher, Robert D., Jr. (Distinguished Scientist), Ph.D. ............. Tulane
Kopp, Otto C. (Emeritus), Ph.D. .......... Columbia
Labotka, Theodore C., Ph.D. ............ Caltech
McKinney, Michael L., Ph.D. .......... Yale
McSween, Harry Y. (Distinguished Prof.), Ph.D. .............. Harvard
Misra, Kula C., Ph.D. ..................... Western Ontario
Mora, Claudia I. (Carden Prof.), Ph.D. ......... Wisconsin
Taylor, Lawrence A., Ph.D. .............. Lehigh
Walker, Kenneth R. (Emeritus), Ph.D. ....... Yale

**Associate Professors:**
Clark, G. Michael, Ph.D. ............... Penn State
Mckay, Larry D. (Jones Prof.), Ph.D. Waterlow
Williams, Richard T. II., Ph.D. ......... Virginia Tech

**Assistant Professors:**
Kah, Linda C., Ph.D. ....................... Harvard
Perfect, Edmund, Ph.D. ............... Cornell
Uche, Maria (Jones Prof.), Ph.D. .......... Virginia

The Department of Geological Sciences offers both the M.S. and Ph.D. degrees in Geology. Persons interested in these programs should contact the Director of Graduate Admissions in the department.

For admission, an applicant must provide transcripts of previous university work, two or three letters of recommendation, GRE scores (general), and GRE scores (general). Students are not normally admitted under non-degree status.

Prerequisite for both degrees is a Bachelor's degree, including coursework in mineralogy, optical mineralogy, petrology, stratigraphy, paleontology, structural geology, and field geology. One year each of coursework in calculus and chemistry and one year of coursework in biology, physics, or statistics are also required. Applicants lacking any of these may be admitted, but the deficiencies must be removed within the first year without graduate credit. Substitutions may also be allowed.

**THE MASTER'S PROGRAM**

The department offers the thesis option in the master's program. Graduation requires successful oral defense of a written thesis and a minimum 3.0 GPA in all graduate coursework.

Course requirements are a minimum of 30 hours of graded coursework with at least one course from any three of the following five groups:

1. Six hours of Thesis 500.
2. Registration in 595 in the first two years in residence. Two hours may be counted toward the 30-hour minimum. This requirement may be waived in unusual circumstances.
3. Sixteen hours of geology courses, with at least 14 hours at the 500 or 600 level, including at least one course from any three of the following five groups:
   - Group 1: 410, 460, 475, 480, 530, 563, 556, 557.
   - Group 5: Any 400- or 500-level courses with graduate credit from related departments (allied sciences, mathematics, and engineering), with approval of the advisor.
4. Eight hours of additional graduate coursework.

**THE DOCTORAL PROGRAM**

The prerequisite for the Ph.D. program, in addition to that for the M.S. program, is either a Master's degree in Geology, or a Bachelor's degree plus completion of 24 hours of graded coursework with at least one course from any three of the groups listed in #3 above. These courses may be taken while completing other course requirements.

Graduation requires passing a comprehensive examination, taken no later than the end of the second year, completion of all course requirements with a minimum 3.0 GPA, completion of the language requirement, and successful oral defense of the dissertation.

The comprehensive examination includes both written and oral parts in which the candidate will be tested on his/her knowledge of the area concerning the proposed dissertation and related fields. The candidate is expected to be conversant in a wide field of geological sciences.

A minimum of 24 hours of graded coursework beyond the master's degree is required in addition to the 24 hours of Dissertation 600. The coursework includes the sum of 9 hours of 600-level geology courses, 9 hours of 500-level or higher geology courses, and 6 hours of additional graduate courses. Extra-departmental coursework is encouraged.

The student must demonstrate a reading knowledge of a foreign language in which there is a body of geologic literature, as approved by the student's dissertation committee. The foreign language requirement may be waived for Ph.D. students whose native language is not English and who have demonstrated mastery of the English language.

**GRADUATE COURSES**

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<th>Course Number</th>
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<tr>
<td>401</td>
<td>Quantitative Methods in Geology (3)</td>
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<td>408</td>
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ent, or consent of instructor. (Same as Civil Engineering 485).

486 Hydrogeology Laboratory (1) Application and demonstration of hydrogeological principles in field and laboratory. Prereq or coreq: 485 or Environmental Engineering 535 or consent of instructor.

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

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

505 Structure of the Southern and Central Appalachian (2) Structural development of Southern and Central Appalachians from extensional Late Proterozoic–Early Paleozoic to compressional-marginal through processes related to compressional events producing accretionary elements that formed Appalachian throughout the Paleozoic. Comparisons to similar orogens. Prereq: Structural Geology.

510 Clay Mineralogy (3) Origin, chemistry, structures, and properties of clay minerals; application of mineralogical techniques in clay mineral studies. Prereq: 310 and 568 or equivalent. 2 hrs and 1 lab.

521 Data Analysis in Geology and Environmental Science (3) Application of statistical and other quantitative techniques using computers to analyze geological data: environmental problems.

530 Petrogenesis of Crystalline Rocks (4) Origin and properties of igneous and metamorphic rocks; magmatic and tectonic processes and physical conditions. Laboratory involves petrographic study of crystalline rocks in thin section. Prereq: 410. 3 hrs and 1 lab.

535 Ground Water Hydrology (3) (Same as Environmental Engineering 535.)

540 Seminar in Local Geology (1) Introduction of geology of Southern Appalachians. 1 hr plus fieldtrips.

544 Paleopedology (3) Field, microscopic, and geochemical analysis of pedogenic processes and their comparison with modern analog soils; interpretation of changes in paleoweathering processes, paleoclimate, and paleoatmospheric chemistry over 4.6 billion years of earth history based on paleosols. Prereq: 340 Stratigraphy and Sedimentation or equivalent, general chemistry, or consent of instructor.

545 Sandstone Petrology/Physical Sedimentology (4) Field and microscopic analysis of terrigenous clastic rock types; physical processes of sedimentation, transport of sediment, and formation of sedimentary structures. Prereq: 340 or equivalent. 3 hrs and 1 lab.

546 Carbonate Sedimentology (4) Environments of deposition of modern and ancient carbonate sediments and diagenesis of resultant rocks; field and laboratory analysis of microfacies and preparation of scientific reports. 3 hrs and 1 lab.

550 Regional Geomorphology (3) Integrative approach to study of natural geomorphological regions stressing links and similarities across boundaries, unique characteristics of major divisions, provinces, sections, and districts. May be repeated with consent of instructor. Maximum 6 hrs.

556 Ice-Age Environments and Global Climate Change (3) (Same as Ecology and Evolutionary Biology 556.)

557 Quaternary Ecology (3) (Same as Ecology and Evolutionary Biology 557.)

563 Stable Isotope Geochemistry (3) Theoretical aspects of isotope fractionation and applications to geologic systems. Isotope exchange, variations in natural waters, diageneric, hydrothermal and metamorphic systems. Prereq: General Chemistry or equivalent.


568 Geochemical Analysis (3) Collection and treatment of geochemical data using electron microprobe, x-ray fluorescence, and atomic absorption spectrophotometry techniques. Prereq: 310 or consent of instructor. 2 hrs and 1 lab.

570 Advanced Structural Geology (4) Current topics in structural geology and tectonics of mountain belts: recent literature. Prereq: 370 or equivalent, or consent of instructor. 3 hrs and 1 lab or seminar.

572 Fracture Analysis (3) Field and subsurface characterization, and mechanical deformation of natural fractures: role in groundwater flow. Prereq: Structural Geology or equivalent, or consent of instructor. (Same as Civil Engineering 572.)

575 Tectonics (4) Evolution of Earth’s lithosphere in context of plate tectonics theory. Formation of continents through comparative anatomy of mountain belts, including Appalachians, Alps, Urals, Caledonians, Cordillera, Andes, and Himalayas. Prereq: Structural Geology or consent of instructor. 3 hrs and 1 seminar.

576 Reflection Seismology (3) Imaging subsurface features using reflected seismic waves. Energy sources, modes of wave propagation, field procedures, computer data processing, and pitfalls. Applications to tectonic and environmental problems. Prereq: 470 or consent of instructor.

585 Contaminant Hydrogeology (3) Physical transport processes, isotopes and groundwater age dating, processes influencing inorganic, organic and microbial contaminants, sampling and monitoring methods, remediation of contaminated groundwater, aquifer protection. Prereq: 485 or 535; 460; or Environmental Engineering 553 or equivalent; and consent of instructor.

586 Field and Laboratory Methods in Hydrogeology (3) Research methods. Measurement of hydraulic properties, drilling, sampling and instrumentation, tracer experiments. Formulating hypotheses and research plans. Prereq or coreq: 485 or Environmental Engineering 535; and consent of instructor.

590 Special Problems in Geology (1-15) Directed study of special topics. Prereq: Consent of instructor. May be repeated. Maximum 10 hrs.

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

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

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

595 Selected Topics in Geology (1) Presentation of research by faculty and visiting scientists. Registration required each semester for resident full-time graduate students, except in summer and when registered for 596. S/NC only.

596 Geology Colloquium (1) Preparation and oral presentation of scientific material. Grade based on participation, presentation, and instructor critique in departmental seminar. Taken only once during residence for each graduate student.

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

620 Seminar in Paleontology (3) May be repeated with consent of department. Maximum 9 hrs.

630 Seminar in Petrology (3) May be repeated with consent of department. Maximum 9 hrs.

640 Seminar in Sedimentary Geology (3) May be repeated with consent of department. Maximum 9 hrs.

650 Seminar in Geomorphology and Quaternary Geology (3) May be repeated with consent of department. Maximum 9 hrs.

660 Seminar in Geochemistry (3) May be repeated with consent of department. Maximum 9 hrs.

670 Seminar in Structural Geology (3) May be repeated with consent of department. Maximum 9 hrs.

675 Seminar in Geophysics (3) Advanced treatment of selected topics in geophysics. Prereq: 470 or consent of instructor.

685 Seminar in Hydrogeology (3) May be repeated with consent of department. Maximum 9 hrs.

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**German**

See Modern Foreign Languages and Literatures

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**Health and Safety Sciences**

(College of Human Ecology)

**MAJORS DEGREES**

**Human Health Promotion and Health Education**...

**MAJORS DEGREES**

**Public Health** ........................................ M.P.H., M.S.-M.P.H.

**Safety** ........................................ M.S.

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**Delores Smith, Interim Head**

**Professors:**

Gorski, June, Dr.P.H. ................ UCLA

Hamilton, Charles B. (Liaison), Dr.P.H. ................ Oklahoma

Kirk, Robert H., H.S.D. ............... Indiana

Wallace, Bill C. (Liaison), Ed.D. ................. Southern Colorado

**Associate Professors:**

Camey, Paula (Liaison), Ph.D. .... Wayne State

Clarke, Barbara, Ph.D. ............... Virginia Tech

Keel, Martha, M.S. .................... Tennessee

Pursley, R. Jack, Ph.D. .......... Iowa

**Assistant Professor:**

Klein, Diane S., Ph.D. .............. Arizona State

Smith, Susan M. (Liaison), Ed.D. .... Tennessee

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The Health and Safety Sciences Department offers graduate programs leading to the Master of Science with majors in Health Promotion and Health Education and in Safety; and to the Master of Public Health degree in Public Health. The department provides doctoral preparation through a concentration in Human Ecology. Inquiries should be directed to the department head. Application packets are available by request to department.

The department fosters development of pre-professional and professional competencies by those interested in the disciplines of health education/promotion, public health, and safety. The Health and Safety Sciences academic programs emphasize health promotion (lifestyle behaviors) and health protection (regulatory, environmental and safety) strategies for improving individual and community well-being, directly relating to two UT thematic areas of strength, health and biomedical sciences and children and families. The faculty are committed to the educational value of community-based service learning, applied research, and community outreach. For more information, http://hhs.utk.edu.

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**Health**

A graduate program is available leading to the Master of Science with a major in Health Promotion and Health Education (thesis and
non-thesis options), requiring completion of 30 semester hours. The program emphasizes research skills development by those already employed in the health professions with each student completing a realistic health-related research proposal as a major developmental activity.

The Doctor of Philosophy with a major in Human Ecology offers a concentration in health promotion and the safety sciences to prepare scholars with an interest in improving the health of the nation.

Requirements include:
1. Minimum 21 hours of foundation courses: 610, 620, 6 hours of statistics, 3 hours of specialized research methods, and 6 hours of natural or behavioral sciences.
2. Minimum 21 hours in primary specialization: 530, 540, 650, 655, 660 and 6 hours of electives.
3. Minimum 12 hours in supporting specialization in a focused area: public health, safety, gerontology or a program approved by doctoral committee.
4. Minimum 6 hours in a cognate area.

**GRADUATE COURSES**

400 Consumer Health (3) Survey of major consumer health care providers and health care services; selecting, purchasing, evaluating and financing medical and health care services/products. (Same as Public Health 400.) F, Sp

405 Alcoholism and Alcohol Education (3) Problems of alcoholism. Factors which make alcoholism serious health and safety problem. Various types of instructional/educational and intervention programs.

406 Death, Dying and Bereavement (3) Aspects of dying, death and handling trauma of loss. Medical, financial, physical, legal and social implications of death. F, Sp

420 Sex Education As It Relates to Human Sexuality (3) Exploration of science of human sexuality. Trends, issues, and content of sex education. E

425 Women’s Health (3) Factors influencing women’s health and women consumers in nation’s health service delivery systems. Health problems/concerns of women and techniques for prevention, maintenance and/or correction. (Same as Women’s Studies 425.) E

430 Suicide and Crisis Intervention (3) Factors which make suicide serious health problem. Assessment, intervention, and prevention techniques.

435 Substance Use and Abuse (3) Drug and alcohol abuse problems and suspected causes; pharmacology of drugs and effects on society; strategies for intervention and education. Sp, Su

465 Aging and Health (3) Aging process in health perspective as related to health promotion and wellness of aged. F, Sp

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

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

520 Sex Education and Human Sexuality (3) Advanced in-depth discussion of educational and health counseling theory, techniques, materials used in school, community, or health care facility. Sp

530 Health Promotion and Health Education Program Development. Principles and methodologies of health promotion program development; methodology, marketing, public relations. Health education as vehicle for health promotion. F

540 Evaluation in Health Promotion and Health Education (3) Evaluation principles and methodologies as related to health promotion programs, processes and programs. Construction of instruments for use in assessing health education outcomes. Sp

570 Special Topics (1-3) For graduate students, in-service teachers, or other health professionals. Health/wellness or health promotion issues. May be repeated. Maximum 12 hrs.

590 Research Methods in Health (3) Basic research techniques in various health settings. Development of research skills and problem identification for research topic. (Same as Public Health 590.) F

593 Directed Independent Studies (1-3) Individual identification and study of health/wellness or health promotion program/issue. Specific proposal to instructor before registration. May be repeated. Maximum 12 hrs. E

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

601 Internship/Research in Safety and Health (3-6) (Same as Safety 601.)

610 Critical Analysis of Writing and Research (3) Analysis of writing and research in health related areas. F

620 Advanced Research Techniques in Health (3) Advanced theory and techniques of research design and methodologies in health discipline. Prereq: 590, 610, Sp

650 Health Aspects of Gerontology (3) Knowledge and understanding of biological, psychological and sociological aspects of aging as related to health and wellness of individual. (Same as Public Health 650.) Su

655 Seminar in Nation’s Health (3) Comprehensive study of definition, determinants, resources and health status of nation. (Same as Public Health 655.) F

660 International Health (3) Study of quality of health, health promotion and health services in countries throughout world. (Same as Public Health 660.) Sp

**Public Health**

Graduate study with a major in Public Health leads to the Master of Public Health (M.P.H.). Three professional preparation concentrations are available: community health education, gerontology, and health planning/administration. Preparation for professional practice in improving community health emphasizes a population perspective, service-learning and application opportunities through rigorous internships. The M.P.H. program is accredited by the Council on Education for Public Health. A minor in statistics is available to interested M.P.H. students due to public health affiliation with the Intercollegiate Graduate Statistics Programs.

**ADMISSION REQUIREMENTS**

A statement of the applicant’s educational and career goals and three rating forms are required. Request application packet from the department. Preference for admission to degree status shall be given to those with a minimum undergraduate grade-point average of 2.8 and with at least one year of professional experience in a health-related occupation. As a restricted program, non-degree admission requires department recommendation. Deadlines for completed applications are 1 February for Summer term and 1 April for Fall semester.

**THE MASTER’S PROGRAM**

The M.P.H. is a non-thesis program requiring completion of 38 semester hours of coursework including 9 weeks of field practice. The field internship provides a full-time experience with an affiliated health agency or organization offering one or more health programs. Of importance, field practice allows the student to apply academic theories, concepts, and skills in an actual work setting. Students must complete all assigned prerequisite courses and 21 semester hours of the curriculum with a minimum overall GPA of 3.0 prior to placement in the field.

As an alternative to field practice, preparation of a master’s essay may be used to fulfill the professional skills development component of the curriculum. Approval must be received from the Public Health Academic Program Committee and is contingent on consent of major advisor, formal written proposal by the student, and completion of an additional research methods course. Written guidelines stipulating expectations and eligibility criteria are available.

Requirements include:
1. Public Health Foundation courses (16 hours): 509, 510, 520, 530, 540, 555.
2. Internship (6 hours): 587, 588.
3. Concentration of Study (16 hours). Required and recommended electives will be selected by the student in consultation with the major advisor. A list of courses is available for each concentration: community health education, gerontology, and health planning/administration.

For more information, refer to the website: http://hss.he.utk.edu/pubhealth.

**DUAL M.S.-M.P.H. PROGRAM**

The College of Human Ecology offers a coordinated dual program leading to the conferral of both the Master of Science with a major in Nutrition (public health nutrition concentration) and the Master of Public Health. The dual program allows students to complete both degrees in less time than would be required to earn both degrees independently.

The program is designed to meet the needs of students who are interested in the benefits of majors in both nutrition and public health. Therefore, it accommodates the interests of students who: 1) plan a career in public health nutrition and want to acquire the knowledge and skills of the nutritionist and public health professional; 2) plan a career in nutrition and want to acquire the knowledge and skills and the perspective of the public health professional; or 3) plan a career in public health and want to acquire the knowledge, skills and perspective of the nutritionist.

**Admission Requirements**

Applicants for the M.S.-M.P.H. program must make separate application to, and be competitively and independently accepted by,
the Department of Nutrition for the M.S., Department of Health and Safety Sciences for the M.P.H., and the Public Health Academic Program Committee.

Students who have been accepted by both departments may apply for approval to pursue the dual program anytime prior to, or after, matriculation at either department. Such approval will be granted, provided that dual program studies be started prior to entry into the fourth semester of the M.S. and M.P.H. programs.

Curriculum

A dual degree candidate must satisfy the requirements for both the M.S. (public health nutrition concentration) and the M.P.H. degrees, as well as the requirements for the dual program. All candidates for the dual degree must successfully complete Health and Society (PH 555), two credits of Seminar in Public Health (PH 509), and a minimum of 60 credits. The Department of Nutrition will award a maximum of 9 semester hours of credit toward the M.S. degree for successful completion of approved graduate level courses offered in the Department of Health and Safety Sciences. The Department of Health and Safety Sciences will award a maximum of 11 semester hours of credit toward the M.P.H. degree for successful completion of approved courses offered in the Department of Nutrition. All courses for which such cross-credit is awarded must be approved by the Public Health Academic Program Committee and the student’s graduate committee. A single block field experience (or public health internship) is required of all students and the analytical field paper incorporates public health nutrition and the student’s public health concentration.

Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit towards the M.S. or M.P.H. degree for courses taken in the other program, except as such courses qualify for credit without regard to the dual program.

Approved Dual Credit

M.S. courses to be counted toward the M.P.H. program must include 10 semester hours of Field Study in Community Nutrition (NTR 515) and 1 semester hour of Graduate Seminar in Public Health (NTR 509). M.P.H. courses to be counted toward the M.S. include Public Health Administration (PH 520), Biostatistics (PH 530), and Epidemiology (PH 540).

MINOR IN GERONTOLOGY

Graduate students in Public Health may pursue a specialized minor in gerontology. This interunit/interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT on an in-state tuition basis. The M.P.H. program in Public Health is available to residents of the state of Arkansas. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE COURSES

400 Consumer Health (3) (Same as Health 400.)
410 Worksite Health Promotion (3) Foundations of health promotion programs delivered in worksite that revolve around issues relative to employees and management: theory, program design, implementation and evaluation from perspective of health promotion specialist. Prereq: Health Education, Promotion, and Behavior. Sp
493 Directed Independent Study (1-3) Individual in-depth study of selected issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only, E
509 Graduate Seminar in Public Health (1) In-depth discussion of timely topics reflecting scope of public health as discipline and its interrelationship with many other academic and professional disciplines. Speakers internal and external. May be repeated. Maximum 4 hrs. (Same as Nutrition 509, Nursing 509, Exercise Science 509 and Social Work 509.) S/NC only. F,Sp
520 Public Health Policy and Administration (3) Administrative considerations of community-based health care programs and public health practice. Health policy formulation, political environment and government involvement in health, legal responsibilities, and managerial concepts/techniques/process. F,Sp
521 Organization Theory and Health Care Delivery (3) Administrative and Organization theory related to health facilities; operation and management of community hospital. Case discussions and problem-solving exercises; managerial functions and skills. F
523 Management in Extended Care Settings (3) Managerial concepts and theoretical foundations essential to supervision and administration of domiciliary health services programs. Management and operation of health services programs for patients and clients in settings which provide activities of daily living and special psychosocial environmental needs. Programs for home health services, comprehensive medical rehabilitation, nursing homes, congregate living centers and similar types of programs. Prereq: 521 or consent of instructor. Sp
525 Financial Management of Health Programs (3) Financial management concepts and practices applied to health services programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply techniques. Prereq: 520 or consent of instructor. Sp
530 Biostatistics (3) Application of descriptive and inferential statistical methods to health-related problems and programs. Microcomputer applications, use and interpretation of vital statistics and introductory research methodology preparatory for first course in epidemiology. Prereq: Introductory statistics or consent of instructor. F,Sp
540 Principles of Epidemiology (3) Distribution and determinants of health-related outcomes in specified populations, with application to control of health problems. Historical origins of discipline, hypothesis formulation, research design, data and error sources, measures of frequency and association, etiologic reasoning, disease screening, and injury control. Prereq: or coreq: 530. F,Sp
542 Advanced Epidemiologic Methods (3) Nature, collection, analysis and interpretation of data pertaining to cohort and case-control studies. Surveillance and surveys. Analytic methods; multiple logistic regression and survival analysis. Experience in critiquing professional literature. Prereq: 540 or consent of instructor. Sp
550 Principles and Practices of Community Health Education (3) Theoretical and practical organization and delivery of health education; opportunities for skill development in variety of educational processes; and introduction to community health analysis. F
552 Community Health Problem Solving (4) Dynamics of community organization, community needs assessment, educational interventions, and application of program planning and evaluation techniques. Opportunity to practice skills in realistic setting. Prereq: 550 or consent of instructor. Sp
560 Theories and Techniques in Health Planning (4) Overview of health planning concepts and methodologies; systems-oriented planning process. Major elements of planning: formulation and conceptualization of problem, plan design, evaluation and implementation. Health problems of institutions, communities and selected population groups, appropriate diagnoses, and programs for addressing needs. Sp
568 Physical Activity and Positive Health (3) (Same as Exercise Science 568.)
569 Clinical Exercise Physiology (3) (Same as Exercise Science 569.)
580 Special Topics (3) Prereq: Consent of instructor. May be repeated under different topic. Maximum 6 hrs.
587-88-89 Internship (3,3,3) Internship (community health education, gerontology, or health planning/ administration) arranged in either summer or regular session under supervision of designated preceptor. Prereq: M.P.H. major, one semester advance notice and consent of major advisor. 589: available only for approved extended placements. S/NC only. E
590 Research Methods in Health (3) (Same as Health 590.) F
593 Directed Independent Study (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E
650 Health Aspects of Gerontology (3) (Same as Health 650.) Su
655 Seminar in Nation’s Health (3) (Same as Health 655.) F
660 International Health (3) (Same as Health 660.) Sp

Safety

Graduate study with a major in Safety (thesis and non-thesis options) leads to the
Master of Science degree. Graduate students may concentrate in safety management or in emergency management. The M.S. degree program requires completion of 33 semester hours. Degree requirements include completion of the 18-hour core curriculum and completion of a concentration area (15 hrs.). Concentration course options include specific courses offered by the Departments of Human Resource Development, Industrial Engineering, Civil and Environmental Engineering, and Political Science (Public Administration) in addition to those offered by the Department of Health and Safety Sciences. A list of courses is available for each concentration. Students may elect an internship experience with private industry or non-profit organizations to fulfill part of their course requirements. Curricular experiences will assist graduates in preparation for certified safety professional (CSP) examination.

The graduate program contributes to the University of Tennessee’s mission of health protection by preparing safety professionals with the knowledge and skills necessary to create and maintain safer human environments in the workplace (industrial and commercial), home, school, and community. The offering of all core classes and required concentration courses on an evening class schedule enables those working full-time in a safety-related field to pursue the M.S. degree with a major in Safety on a part-time basis. For more information, refer to the website: http://hss.he.utk.edu/safety.

GRADUATE COURSES

443 Sports & Recreational Safety (3) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and interrelationship in sports injury and control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs and 2 labs. Sp

452 Safety Principles and Practices (3) General principles, practices, and procedures in occupational and community safety. Historic and present safety issues, standards and practices addressed by safety professionals and individuals and groups in work-site, school, community, transportation, and industrial settings. Prereq: Junior or Senior standing or consent of instructor. Su

460 Fire Risk Management (3) Development, implementation, and management of comprehensive fire safety program. Basic fire risk management concepts, interpretation of codes and exposure to basic fire analysis techniques. Prereq: Senior standing or consent of instructor. Su

500 Thesis (1-15) Only. E

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May be repeated. Maximum 12 hrs. E

536 Safety Instrumentation (3) Selection, calibration, maintenance, and use of sampling instruments available to safety practitioner for evaluating exposures of workers to physical stresses and airborne contaminants. F

537 Advanced Emergency Management (3) Advanced study in emergency and hazard mitigation response and recovery. Theory and practice in identification of appropriate emergency warning systems, hazard assessment, facility inspection, plan development and implementation. Prereq: 535. Sp

572 Graduate Workshop in Safety (3) Special safety education programs. For advanced graduate students, teachers, supervisors, and administrators. May be repeated. Maximum 12 hrs. Sp

590 Special Topics (1-3) Advanced study in selected disciplinary or professional area of safety education/management. May be repeated. Maximum 12 hrs.

593 Directed Independent Study (1-3) Individual identification and study of problem/issue in safety. Extensive reading and critical analysis of safety literature. Specific proposal to instructor before registration. May be repeated. Maximum 12 hrs. E

601 Internship/Research in Safety and Health (3-6) Field experience. Significant problem identified, researched, and reported in acceptable form. May be repeated. Maximum 6 hrs. (Same as Health 601.) E

History

(College of Arts and Sciences)

MAJOR DEGREES

History .............................................. M.A., Ph.D.

Todd A. Diacon, Head

Professors:

Bergeron, Paul H. (Emeritus), Ph.D. Vanderbilt

Brummell, Palmira R., Ph.D. ....................... Chicago

Chmielowski, Edward V. (Emeritus), Ph.D. .............. Harvard

Cutler, E. Wayne, Ph.D. ....................... Texas

Farris, W. Wayne, Ph.D. ....................... Harvard

Finger, John R. (Emeritus), Ph.D. .............. Washington

Haas, Arthur G., Ph.D. ....................... Chicago

Hao, Yen-Ping (Emeritus), Ph.D. .............. Harvard

Haskins, Ralph W. (Emeritus), Ph.D. .............. Columbia

Klein, Milton M. (Emeritus) (Distinguished Prof.), Ph.D. .............. California

Moser, Harold, Ph.D. ....................... Wisconsin

Norrell, R. Jeff (Bernadotte Schmitt Prof.), Ph.D. .............. Virginia

Ratner, Lorman A. (Emeritus), Ph.D. .............. Cornell

Uftey, Jonathan G. (Emeritus), Ph.D. .............. Illinois

Wheeler, W. Bruce, Ph.D. ....................... Virginia

Associate Professors:

Appier, Janis, Ph.D. .......... California (Riverside)

Ash, Stephen V., Ph.D. ....................... Tennessee

Bast, Robert J., Ph.D. ....................... Arizona

Bohstedt, John, Ph.D. ....................... Harvard

Bran, Tim, Ph.D. ....................... Cornell

Burman, Thomas E., Ph.D. ....................... Toronto

Diacon, Todd A., Ph.D. ....................... Wisconsin

Fleming, Cynthia G., Ph.D. .............. Duke

Glover, Lorri, Ph.D. ....................... Kentucky

Higgs, Catherine A., Ph.D. .............. Yale

Lulievicis, Vejas G., Ph.D. .......... Pennsylvania

Piehler, G. Kurt, Ph.D. ....................... Rutgers

Pinckney, Paul J., Ph.D. .............. Vanderbilt

Assistant Professors:

Brosnan, Kathleen, Ph.D. .............. Chicago

Dessel, J. P., Ph.D. ....................... Arizona

DeWeerdt, Hilde, Ph.D. ....................... Harvard

Kulkowski, Michael, Ph.D. .............. Toronto

Liu, Lu, Ph.D. .............. California (San Diego)

Sahadeo, Jeff, Ph.D. ....................... Illinois

White, George, Jr., Ph.D. .............. Temple

The Department of History offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. The M.A. program includes a thesis and non-thesis option. The doctoral program has concentrations in American and European history with special focuses in the areas identified under group II doctoral fields and group III teaching fields. Detailed information may be obtained from the Director of Graduate Studies in History who also advises all incoming students.

THE MASTER’S PROGRAM

Admission Requirements

1. Successful completion of a baccalaureate degree from an accredited institution, preferably with a major in history.

2. Acceptable scores on the Graduate Record Examination (general).

General Requirements

Complete 510 and a 600-level research seminar normally during the fall and spring semesters of the first year in the graduate program. Complete 521 in preparation for the M.A. examination. As many as 9 related hours may be taken outside the department. As many as 9 graduate credits taken under any other department may be applied toward the M.A. degree. Except by prior approval of the Director of Graduate Studies, a student’s coursework must be at the 500 level or above.

Thesis Option

Twenty-four hours of coursework and 6 hours of Thesis 500 for a total of 30 hours are required. Thesis students are required to select one M.A. field and write a thesis. At the end of the program the thesis student will stand for a two-hour oral examination on both the thesis and the field.

Non-Thesis Option

A total of 30 hours of coursework is required. At least 6 hours must be completed in each of two M.A. fields. The primary field is examined by a two-hour written paper given within one week by a one-hour oral examination with the single grade of pass/fail given at the conclusion of the oral examination. No examination is given on the second field.

M.A. Fields

United States (colonial to present) Premodern Europe Modern Europe Asia
Retention and Termination
A 3.0 overall grade-point average is required to remain in good standing. M.A. students must take the M.A. examination no later than the semester following the completion of 30 hours. A student who fails the M.A. examination must repeat the examination no later than the following semester. A student who fails the examination a second time or does not take the examination when required will be dropped from the graduate program.

THE DOCTORAL PROGRAM

Admission Requirements
1. Successful completion of the M.A. degree from an accredited institution.
2. Acceptable scores on the Graduate Record Examination (general).

Residence and Coursework
Before being admitted to doctoral candidacy, a student must:
1. Complete History 510 at UT (may be waived for comparable experience elsewhere).
2. Spend two consecutive semesters in residence.
3. Complete 9 hours in one Group I doctoral field. There is no minimum hours requirement for a Group II field. Complete 9 hours in one Group III field, including the appropriate 511, 512, or 513 course and two additional courses at the 500 level. The Group III field must be in a different geographic area from the Group II field. Courses taken to fulfill M.A. degrees may be counted toward all field requirements.
4. Fulfill the foreign language requirement.
5. Complete two 600-level research seminars. (One must be completed at UT.) Students who have completed a master's thesis need complete only one research seminar (must be taken at UT), and History 621.
6. Maintain a 3.0 overall grade-point average in graduate work attempted.
7. Complete 24 hours of graduate coursework (21 hours graded A-F) at UT beyond that required for the M.A. Up to 6 hours may be taken outside of the department.
8. Except by prior approval of the Director of Graduate Studies, a student's coursework must be at the 500 level or above.

Language Requirements
Students must demonstrate competence in one foreign language through coursework or examination. The student's doctoral committee may specify any other languages or research tools, such as statistics, essential for the student's preparation. The foreign language requirement must be fulfilled before taking the comprehensive examination.

Group III (Teaching Field) Examination
This is a one-hour oral exam which must be completed at any time before the comprehensive examination is taken. If a student fails this, he or she may retake the exam one time only and must do so the following semester.

Comprehensive Examination
The comprehensive examination is to be taken no later than the semester following the term in which the student has completed the residence, coursework, and language requirements. A student stands examination in one field selected from Group I and one field selected from Group II below. Both parts are 8 hours, written and taken during the same semester. A general oral exam will be taken following the successful completion of the two written portions. The two written and one oral exams are separate examinations, and Group II must be passed before taking Group II, and the latter passed prior to taking the oral portion. A student who fails any one of the three parts (Group I or Group II or the Oral) which constitute the Comprehensive Exam must repeat the failed exam the following semester, excluding summer. A second failure on any one of the three parts (regardless of which one) will cause the student to be dropped from the History graduate program. Likewise, a student who does not repeat a failed exam within the allotted time (one semester) will be dropped from the program.

Admission to Candidacy
Upon successful completion of the above requirements, a doctoral student may be admitted to candidacy.

Doctoral Fields
Group I:
- Premodern Europe
- Modern Europe
- United States (colonial to present)

Group II:
To be defined by the student's doctoral committee from within one of the following fields:
- United States
- Colonial and Early Republic
- 19th century
- 20th century
- Regional
- Military and Foreign Relations
- Social and Cultural
- American Political
- European
- Medieval
- Early Modern
- Modern
- Political and Diplomatic
- Intellectual and Cultural
- Social and Economic
- National Fields

Group III (Examined Teaching Field):
- World History
- Western Civilization
- U.S. Civilization

Dissertation and Defense
Original research forms the basis for the dissertation. Doctoral candidates must register for a minimum of 3 hours of 600 Dissertation Research each semester and must complete 24 hours of dissertation credit. A final oral defense is given on the dissertation in its historical context. The program must be completed within eight years from admission as a potential candidate.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E.
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E.
510 Foundations of Graduate Study in History (3) Assumptions and methods of historians. Required of all candidates for advanced degrees. F
511 Teaching World History (3) Methodology, conceptualization, historiography, textbook selection and syllabus construction to prepare students to teach courses in world history.
512 Teaching Western Civilization (3) Methodology, conceptualization, historiography, textbook selection and syllabus construction to prepare students to teach courses in western civilization.
513 Teaching United States History (3) Methodology, conceptualization, historiography, textbook selection and syllabus construction to prepare students to teach courses in U.S. history.
521 M.A. Readings (3) Directed readings in preparation for M.A. examinations. Open only to master's candidates in history. May be repeated. Maximum 6 hrs. S/NC only.
532 Topics in Modern Europe (3) Reading seminar: secondary sources on movements and trends that are multinational in focus. Focus varies. May be repeated. Maximum 15 hrs.
533 Topics in European National History (3) Reading seminar: secondary sources on intra-national topics, usually British, Russian, German or French. Focus varies. May be repeated. Maximum 15 hrs.
541 Topics in Early American History (3) Reading seminar: secondary sources on early North American history. Focus varies. May be repeated. Maximum 15 hrs.
542 Topics in 19th-Century United States (3) Reading seminar: secondary sources on 19th-century United States. Focus varies. May be repeated. Maximum 15 hrs.
543 Topics in 20th-Century United States (3) Reading seminar: secondary sources on 20th-century U.S. Focus varies. May be repeated. Maximum 15 hrs.
544 Topics in U.S. Environmental History (3) Reading seminar: secondary sources on U.S. environmental history. Focus varies. May be repeated. Maximum 15 hrs.
551 Topics in the History of Foreign Relations (3) Reading seminar: secondary sources on foreign relations. Focus varies. May be repeated. Maximum 15 hrs.
552 Topics in Military History (3) Reading seminar: secondary sources on military history; military operations, social impact of war and naval strategy in foreign policy. May be repeated. Maximum 15 hrs.
555 Topics in United States Social and Economic History (3) Reading seminar: secondary sources on U.S. social and economic history. Focus varies. May be repeated. Maximum 15 hrs.
556 Topics in European Social and Economic History (3) Reading seminar: secondary sources on social or economic history of European nations. Focus varies. May be repeated. Maximum 15 hrs.
557 Topics in Cultural and Intellectual History (3) Reading seminar: secondary sources on cultural and intellectual history. Focus varies. May be repeated. Maximum 15 hrs.
558 Topics in United States Regional and Local History (3) Reading seminar: secondary sources on regions, states and cities of the South. Focus varies. May be repeated. Maximum 15 hrs.
THE DOCTORAL PROGRAM

Graduate study leading to the Doctor of Philosophy degree with a major in Human Ecology is available in the Departments of Child and Family Studies; Consumer and Industry Services Management; Health and Safety Sciences; Human Resource Development; and Nutrition. Concentration areas are child and family studies, community health, human resource development, nutrition science, textile science, and retail and consumer sciences. A major challenge of the doctoral program in Human Ecology is to draw upon basic research generated from the natural sciences, social sciences, and humanities, and to provide a holistic perspective that contributes to the improvement of individual and family well being. Within the College of Human Ecology, research from one discipline is enhanced by encompassing and utilizing the findings of research from other disciplines.

The Ph.D. is a research degree granted only to individuals who demonstrate proficiency in conducting original research. Course requirements for the degree are determined by the student’s faculty committee, based upon college and departmental requirements and student needs and interests. The Graduate Council sets minimum requirements for the doctoral degree.

More specific information about the course of study is given under the individual academic departments that administer the Ph.D. concentrations.

MINOR IN GERONTOLOGY

An interdepartmental/interdisciplinary minor in gerontology gives the graduate student an opportunity for combining the knowledge and experience about aging in American society with his/her own major concentration.

Core courses and a practicum are offered by the College of Social Work and selected departments within the colleges of Human Ecology, Education, and Arts and Sciences. A cross-listed seminar between contributing programs is designed to integrate experiences from different sources and to demonstrate the multi-faceted nature of working within an aging society.

Declaraton of a Minor

Prior to earning more than one-half the total hours required for this minor, students must complete a “Declaration of a Minor in the College of Human Ecology” form. Copies of this form are available in the Dean’s Office, Room 110, Jessie Harris Building.

Core Experience

Students must complete a core experience of 12 semester hours taken from at least three different departments including nine hours taken from outside the major department. Coursework needs to comply with the following framework:

1. Coursework. 9 hours required. A variety of coursework may be taken toward satisfaction of this requirement. Courses which are offered on a regular basis include: Health 406, 465, Health/Public Health 650, Nutrition 518, Public Health 523, Social Work 566, Sociology 415, Psychoeducational Studies 504, 522, 525, 528.

Admission to Candidacy

When application is made for admission to candidacy, indication of the minor must be noted on the Admission to Candidacy form.

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 on an in-state tuition basis. The Ph.D. program in Human Ecology is available to residents of Alabama, Kentucky, Mississippi, Virginia, or West Virginia. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE COURSES

450 Special Topics: Human Ecology (1-3) Study in selected professional area within College of Human Ecology. Topics vary. May be repeated. Maximum 6 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/or has time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 Integrative Nature of Home Economics (3) History and philosophy of home economics. Analysis of current programs and future directions in field. Examination of research, integrative framework. F,A

520 Directed Study in Human Ecology (1-3) Integrative topics. Prereq: At least 9 hours of graduate study in college including courses from at least two departments or consent of instructor. May be repeated. Maximum 6 hrs. E

525 Practicum in Human Ecology (1-6) Field based experiences. Prereq: Consent of instructor. E


580 Special Topics in Home Economics Education (1-3) Current issues and trends in home economics. Prereq: Consent of instructor. May be repeated. Su,A

581 Directed Study in Home Economics Education (1-3) Prereq: Consent of instructor. May be repeated. E

585 Seminar in Gerontology (1) Scope of gerontology as discipline and as related to other academic and professional disciplines. Speakers both internal and external to UT. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. (Same as Counselor Education and Counseling Psychology 585, Exercise Science 585, Nursing 585, Public Health 585, Psych- oeducational Studies 585, Social Work 585, and Sociology 585.) S/NC only.
Human Resource Development
(College of Human Ecology)

MAJORS DEGREES
Human Ecology ........................................ Ph.D.
Human Resource Development .................. M.S.

Michael Lane Morris, Interim Head

Professors:
Campbell, Clifton P. (Emeritus), Ed.D. Maryland
Cheek, Gerald D. (Emeritus), Ph.D. .......... Kansas State
Coakley, Carroll B. (Emeritus), Ph.D. ...... Wisconsin
Craig, David G. (Emeritus), Ed.D. .......... Cornell
DeJonge, Jacqueline O. (Emeritus), Ph.D. ... Iowa State
Haskell, Roger W. (Emeritus), Ph.D. ....... Purdue
Mathews, John I. (Emeritus), Ph.D. ......... Montana
Petty, Gregory C., Ph.D. ..................... Missouri

Associate Professors:
Kupritz, Virginia, Ph.D. ....................... Virginia Tech
Stout, Vickie J., Ed.D. ................. Tennessee

Assistant Professors:
Bartley, Sharon, Ph.D. ...................... Tennessee
Hastings, Shirley, Ph.D. ....................... Oklahoma State
Lim, Doo, Ph.D. (Emeritus), D.D. .......... Illinois
Pierce, Randal, Ph.D. ..................... Ohio State
Sorter, Ann, M.S. ............................... Clemson

The Department of Human Resource Development advances economic development through the integration of occupational education, training, career development, and organizational development. HRD required (core) courses and HRD electives are offered in evening/online/weekend/or workshop formats enabling working professionals to obtain the master’s or doctoral degree.

THE MASTER’S PROGRAM
The Master of Science degree with a major in Human Resource Development provides a flexible graduate program for professionals wishing to pursue in-depth study within and across subject areas of Human Resource Development; those who work with individuals to help them enter the workforce; those who train individuals already in the workforce; and those who help individuals in the workforce advance their potential.

The M.S. degree with a major in Human Resource Development offers two concentrations, each providing opportunities for specialized interests. Both concentrations require a thesis. The training and development concentration is designed to meet the needs of professionals who work in programs encompassing all areas of human resource development. Applicants without an undergraduate degree in an area related to human resource development may be required to take 501 as a prerequisite and to complete an internship as part of their program. The teacher licensure concentration is specifically for students who seek initial teacher licensure in family and consumer sciences education, business and marketing education, and technology education. This program requires admission to Teacher Education and has specific prerequisites.

Admission Requirements
Training and Development Concentrations
Applicants are to submit the Graduate Application for Admission, three letters of reference from individuals familiar with their potential for success in academic work, and a statement describing personal career objectives directly to the Department of Human Resource Development. Applicants must hold a bachelor’s degree from an accredited institution and present evidence of ability to do graduate work, including a GPA of at least 2.7 on a 4.0 scale for the last two years of undergraduate work. Any student below this level of academic quality must justify admission via other exceptional credentials. If the applicant has prior work experience in human resource development, a reference letter should also be provided by the work supervisor. Recent Graduate Record Examination scores are required of all applicants except for those applying for the teacher licensure concentration.

Teacher Licensure Concentration
Applicants are to submit the Graduate Application for Admission and are to be admitted to the Teacher Education Program in order to progress in the Professional Education coursework. Admission to the teacher licensure program requires a minimum 2.75 GPA for Technology Education, Business and Marketing Education, Family and Consumer Sciences Education. In addition, applicants are to have a satisfactory student conduct record; a satisfactory speech and hearing evaluation; passing scores on the Pre-Professional Skills Test or an ACT composite score of 21 or an Enhanced ACT composite score of 22 or a SAT combined score of 990; and a satisfactory Admissions Board interview.

Degree Requirements
Training and Development Concentration
This is a 36-hour thesis program that includes 3 hours of research methodology and 3 hours of statistics. All students must take the departmental core of eighteen hours consisting of 504, 510, 511, 512, 557 and 559. The thesis requires six hours of Thesis 505 and an oral comprehensive examination.

Teacher Licensure Concentration
This is a 36-hour thesis program that includes 3 hours of research methodology (504) and 3 hours of statistics. The core (9 hours) of the internship program is 521, 522, 574 and 591 (1 hour). The internship experience (575) is twelve hours of credit and is the culminating experience. Students choose another 3 hours of coursework to support the teaching field. The thesis requires six hours of Thesis 500 and an oral defense.

THE PH.D. CONCENTRATION
Admission Requirements
Applicants are to submit the Graduate Application for Admission, three letters of reference from persons familiar with their potential for success in doctoral work, a statement describing personal career objectives, and a sample of written work directly to the Department of Human Resource Development.

Applicants must hold a master’s degree from an accredited institution and present evidence of ability to do Ph.D. work, including having maintained a graduate GPA of 3.3 on a 4.0 scale or better. If the applicant has prior work experience in human resource development, a reference letter should also be provided by the work supervisor. Graduate Record Examination scores are required of all applicants.

Any person whose native language is not English must submit results of the Test of English as a Foreign Language (TOEFL). A minimum score of 600 is required for admission consideration.

Degree Requirements
The Doctor of Philosophy degree with a major in Human Ecology and a concentration in human resource development is for graduate students who seek careers in higher education or as managers/administrators of HRD. The curriculum is designed to enable students to achieve professional objectives, develop needed competencies, and gain desirable experiences and understanding of human resource development. Students must possess a master’s degree before acceptance to the program. A minimum of 96 hours beyond the baccalaureate is required.

Concentration (12 hours): Must include courses to support Human Resource Development and may be taken from the master’s degree.

Departmental Core (27 hours): Must include 510, 511, 512, 557, 559 or equivalents and 12 hours of 604.

Specialization (12 hours): Must support a career path of university faculty member or manager of education/training.

Cognate (6 hours): Must be obtained from an academic unit outside the department, support specialization, and be represented by a committee member.

Research and Statistics (15 hours): Statistics must include advanced statistics such as multivariate analysis and computer application. 9 hours minimum; research methodology must include 504 and 610 or equivalents, 6 hours minimum.

Internship (6-9 hours): Required for those changing career path.

Dissertation (24 hours): Must be original research project.

The department offers an alternative approach to residence for the Ph.D. degree. This alternative residence involves, among other requirements, a two-year, continuous enrollment in 604, Research Forum in Human Resource Development.

Detailed information regarding the Ph.D. concentration program of study may be
513 Special Topics in Human Resource Development (1-3) Specific objectives, activities, and evaluation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

514 Individual Study in Human Resource Development (1-15) Problem or project. Approval form must be filed in office of department head. May be repeated. Maximum 6 hrs.

515 Microcomputer Operations and Programming in Education (3) Operating procedures and BASIC programming for education and training applications. Hands-on experience in operating and programming microcomputers, writing, debugging, and running educational programs using sequential data files. Prereq: Teaching, administrative, or related experience in education or training, or consent of instructor.

516 Microcomputer Software Development (3) Advanced software design in BASIC: random access and binary files, search and sort algorithms, and stacked graphics for educational environment. Hands-on learning and program development. Prereq: 515 or consent of instructor.

521 Design and Development of Instruction (3) Curriculum development and program planning: design of instruction; development of teaching materials for classroom and educational purposes. Intended for students preparing for professional roles in the field of human resource development, marketing, technology and/or industrial education.


531 Leadership Development for Business Education and Marketing Education Professionals (3) Change management with implications for continuous quality improvement of self and one's work and work place.

550 Administration of Industrial Education Programs (3) Developing, staffing, administering and evaluating trade, technical and technical education programs in secondary and post-secondary school settings. Prereq: Consent of instructor.

551 Supervision of Industrial Education Programs (3) Techniques used to improve industrial education programs. Staff development, curriculum improvement, and program updating techniques. Prereq: 455 or equivalent.

552 History and Philosophy of Industrial Education (3) Social, political, and economic events that influenced the development of industrial education. Philosophical problems: justification, values, principles and concepts of industrial education. Prereq: Consent of instructor.

553 Planning Technical Education Facilities (3) Program planning, facility specifications, site selection, and working relationships with other professionals involved in process of planning technical-education facilities. Prereq: Consent of instructor.

554 Program Planning (3) Instructional systems attending to analysis, design, development, implementation, and evaluation of trade, technical supervisor and related training. Prereq: Curriculum development course and consent of instructor.

555 Curriculum Planning (3) Developing performance-based, criterion-referenced instructional programs.

556 Organizational Development (3) Strategies and interventions for organizational development: training and development, change assessment and institutional change and consultant’s role. Prereq: 512 or consent of instructor.

557 Methods of Teaching Conceptual Content (3) Proper selection and effective application of methods for teaching and learning conceptual content. Communication strategies for conceptual content comprehension, retention, and application.

558 Seminar in Industrial Education (1-3) Current issues, innovations, problems associated with technical programs. Prereq: 12 hrs of graduate courses. May be repeated. Maximum 6 hrs.

559 Program Evaluation (3) Concepts, principles, practices, theories, and trends related to program evaluation. Planning and conducting a comprehensive program evaluation in a variety of settings. Fundamentals of design, measurement, return-on-investment (ROI), and presentation and dissemination of results to stakeholders.

560 International Perspective of Workforce Training (3) Examination of the role of workforce training systems in highly industrialized countries. In-school training programs, out-of-school training systems, update training of incumbent workers, retraining displaced workers, transfer of new technologies, and role and responsibilities of businesses, private sector organizations/agencies, and state and federal government agencies.

562 Grant Writing and Project Implementation (3) Writing grant proposals, negotiating with funding sources, implementing and maintaining funded programs, and closing out projects at end of funding support.

564 Self-Directed Work Teams (3) Theory and practice of implementing self-directed work teams, motivating employees, increasing employee productivity via teams and related issues.

574 Analysis of Teaching for Professional Development (3) Analysis of teaching, evaluation of teaching, and analysis of teaching effectiveness and of professional development. Study and application of various approaches. Coreq: 575.

575 Professional Internship in Teaching (1-6) Intensive practical teaching and teaching-related experiences in selected areas and professional settings in public schools. Enrollment limited to postbaccalaureate students in professional year program. Prereq: Admission to Teacher Education program. May be repeated. Maximum 12 hrs. S/NC only.

591 Clinical Studies (1-4) Group and individual seminars: activities during full-time internship. Application and evaluation of professional core competencies. Completion and presentation of portfolio and analysis of teaching project. Coreq: 575.

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

601 Theory and Practice in Training and Development (3) Theory and application of research related to training and development, transfer of learning, designing effective learning situations, and creation of corporate learning environments. Conceptualization and critical analysis of research and theories related to training and development in field of human resource development. Prereq: Admission to doctoral program.

604 Research Forum in Human Resource Development (2) Development of theoretical framework, research design, evaluation techniques and qualitative and quantitative strategies for investigations of problems and issues in human resource development. Initial enrollment Fall only. Continuous enrollment required for 2 yrs. May be repeated. Maximum 12 hrs. S/NC only.

606 Qualitative Research in Human Resource Development (3) Theory and application of qualitative approaches to social science and human resource development research. Ethnographic methods to obtain in-depth information about behaviors and beliefs of people in natural settings. Methods for analyzing and reporting case studies and case studies; strucured interviews using heuristic elicitation methodol- ogy, participant/observation and case studies. Prereq: Admission to doctoral program.

610 Research Development in Human Resource Development (3) Proposal development, theoretical base, research design, sampling, application of statistics, and evaluation of research in human resource development. Prereq: 18 hrs of advanced statistics courses and consent of instructor.

611 Internship in Human Resource Development (3) Field experience in relevant organizations. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC only.

613 Special Topics in Human Resource Development (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
Industrial and Organizational Psychology

(College of Business Administration)

MAJOR DEGREES
Industrial and Organizational Psychology ........................................ Ph.D.

Robert T. Ladd (Liaison), Director

Committee:
Fowler, Oscar S., Management
James, Lawrence R., Management
Larsen, John M., Jr. (Emeritus), Management
Rentsch, Joan R., Management
Rush, Michael C., Management
Schumann, David W., Marketing, Logistics & Transportation
Wehr, David J., Management

The doctoral program is designed to prepare students for personnel, managerial, and organizational research; for university teaching; and for consulting relationships with industry. The program emphasizes a scientist/practitioner model in applying and conducting research based on accepted theory, organizational behavior, psychology, management, and statistics. The degree program is administered by a committee appointed by the Dean of Graduate Studies on recommendations from the Management Department head and the program director.

It is intended that students entering the I/O program will represent widely different undergraduate and graduate backgrounds including psychology, business administration, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses that will assist the students in attaining a reasonable level of sophistication in areas of deficiency.

ADMISSION REQUIREMENTS
Applicants for admission should request information and application forms from both the Office of Graduate Student Services (218 Student Services Building) and the Director, Industrial and Organizational Psychology Program, (408 Stokely Management Center, The University of Tennessee, Knoxville, TN 37996-0545).

Two separate applications must be completed: one Graduate Application for Admission (apply for major in Industrial and Organizational Psychology) and one application for admission to the Industrial and Organizational Psychology program.

Deadline: New students are admitted in fall by February 1.

The master’s degree in Industrial and Organizational Psychology is generally not required of individuals pursuing a doctoral degree.

General Requirements
At least one year of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade-point average of 3.7 or above is required with no evidence of special weakness in mathematics and physical sciences.

Test scores on each section of the general portion (verbal and quantitative) of the Graduate Record Examination (GRE) are required. Customarily, those students admitted to the program have performed at or above the 69-79th percentile on the general tests. (This corresponds to a raw score of approximately 600 on each of the tests.)

THE DOCTORAL PROGRAM
The Ph.D. degree with a major in Industrial and Organizational Psychology can be completed with a minimum of 90 semester hours in the major. Students must be in residence full time for one year; must maintain an overall 3.0 grade-point average with no more than one grade below B in the I/O Psychology, General Psychology, and Research core; must complete an applied research project prior to beginning dissertation work; must pass a comprehensive examination; and must pass a final oral examination on their dissertation research.

Course Requirements:

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<td>9</td>
</tr>
<tr>
<td>Research Core</td>
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<tr>
<td>Statistical Principles (Statistics 537 &amp; 538 or equivalents)</td>
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<td>Multivariate Statistics (Statistics 579, 679 or equivalent)</td>
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<td>General Psychology Core</td>
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<tr>
<td>One course in each of the following areas: biological bases of behavior, cognitive bases of behavior, history and systems of psychology.</td>
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<tr>
<td>I/O Psychology Seminars</td>
<td>9</td>
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<td>600 level IOPSY courses, from a program committee approved list.</td>
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<td>Approved Electives</td>
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<td>Courses supporting the student’s course of study.</td>
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<tr>
<td>Ethics (635 or equivalent)</td>
<td>3</td>
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<td>Dissertation (600)</td>
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ACADEMIC COMMON MARKET
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GRADUATE COURSES

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<tr>
<td>567-68 Proseminar in Industrial/Organizational Psychology (3,3)</td>
<td>Basic thought, concepts, and issues required for advanced graduate study in industrial and organizational psychology. Must be taken during first year of study in program. Consent of instructor required for non-program students.</td>
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The master’s degree in Industrial and Organizational Psychology is generally not required of individuals pursuing a doctoral degree.

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569 Applied Measurement for Industrial/Organizational Psychology (3) Basic techniques for collection and evaluation of individual and organizational data using both classical and modern psychometric techniques for the development of theorized reliability analysis, and exploratory and confirmatory factor analyses.

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

605 Advanced Research Methods in Psychology (3) Critical analysis of new and evolving techniques for psychological research; new statistical and psychometric methods.

610 Individuals in Organizations Seminar (3) Bridging principles and processes which link individual attributes with more macro organization concerns; culture, climate, and group decision-making.

611 Seminar in Organizational Leadership (3) Current theories, concepts, and issues associated with psychology of organizational leadership. Prereq: 567-68 or consent of instructor.

612 Seminar in Work Motivation (3) Current theories, concepts, and issues associated with psychology of work motivation. Prereq: 567-68 or consent of instructor.

613 Seminar in Performance Appraisal (3) Current issues, problems, and research in performance appraisal and criterion development; applications in compensation. Prereq: 567-68 or consent of instructor.

614 Seminar in Employee Selection (3) Current issues, concerns, and methods used in employee selection. Prereq: 567-68 or consent of instructor.

615 Seminar in Organizational Training and Development (3) Current issues, problems, and research in training and development. Prereq: 567-68 or consent of instructor.

625 Topics in Organizational Psychology (3) Topics vary. May be repeated. Maximum 9 hrs.

626 Topics in Industrial Psychology (3) Topics vary. May be repeated. Maximum 9 hrs.

627 Structural Equation Models in Organizational Research (3) Issues related to analysis of organizational data using structural equation and related techniques.

628 Personality Assessment (3) Review of key domains of social cognition: measurement systems which use individual differences in social-cognitive biases as basis for measuring personality.

635 Ethical and Professional Issues in Industrial/Organizational Psychology (3) Issues involved with ethical practice in research, academic, organizational, and consulting situations.

690 Supervised Practicum, Internship or Field Training in Industrial/Organizational Psychology (1-15) One credit hour per 30 hours of practice. S/NC or letter grade.

Industrial Engineering

(College of Engineering)

MAJOR DEGREES
Industrial Engineering .................. M.S., M.S.-MBA

A. B. Badiru, Head

Professors:

Badiru, A. B., PE, Ph.D. ............ Central Florida
Bontadelli, J. A. (Emeritus), PE
Ph.D. .................................................. Ohio State
Claycombe, W. W. (Emeritus), PE, Ph.D. ... VPI
select an area of specialization from operations research, human factors engineering, information systems engineering, maintenance and reliability engineering, or general industrial engineering.

**Engineering Management**

The engineering management concentration has an additional admission requirement of two years' U.S. industrial experience as a practicing engineer or scientist. This concentration is fully supported off-campus utilizing electronic media for videotaping and interactive distance teaching methods.

**Manufacturing Systems Engineering**

Under the manufacturing systems engineering concentration, students learn strategies for improving product quality, implementing various production strategies, analysis of production planning and scheduling systems, and supplier and distribution integration. Dual degree students can select manufacturing systems engineering as an option.

**Product Development and Manufacturing**

The product development and manufacturing concentration is a non-thesis option, available only to students taking the dual M.S.-MBA program.

**DUAL M.S.-MBA PROGRAM**

The College of Business Administration and the College of Engineering offer an integrated program leading to the conferral of the Master of Business Administration degree with a major in Business Administration (concentration in operations management) and the Master of Science degree with a major in Industrial Engineering (concentration in manufacturing systems engineering or product development and manufacturing).

The Industrial Engineering program is also open to students with undergraduate engineering majors other than industrial engineering.

The establishment of the dual program addresses the critical need for personnel trained in both engineering and management who can integrate an increasingly complex body of knowledge for rapid introduction of new products to the marketplace. The objective of the dual degree program is to prepare graduates to take a leading management role in companies that must react quickly to a dynamic market where forces of competition require rapid changes in design and manufacturing and a short product development cycle.

**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 Office of Graduate Admissions 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 their application the intent to pursue the dual M.S.-MBA program and the Industrial Engineering major (refer to the MBA program for separate instructions). Students accepted for both the MBA and the M.S. with a major in Industrial Engineering degree programs will be assigned to Dual Program Committee advisors, who will be responsible for course approval and supervision of the students' 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 different application dates are established by Graduate Admissions for international students.

**Curriculum**

All engineering students enrolled in the dual program must complete common coursework designed to provide them with an integrated, multidisciplinary teamwork experience. The MBA curriculum consists of 33 hours of common coursework in the College of Business Administration and 15 hours of common coursework in the College of Engineering. Engineering common coursework includes a culminating 3-hour integrated project course requiring a comprehensive report, and a final examination as required by the Dual Program Committee, to be taken during the first session of summer following the second year.

During the second year dual degree candidates will take courses in their engineering major. The coursework for each option is designed to provide students with a concentration in their major and advanced skills to accomplish their teamwork assignments.

**Curriculum for Dual M.S.-MBA Degree**

**August - First Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 509 Project Management I</td>
<td>3</td>
</tr>
</tbody>
</table>

**Fall - First Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 511 MBA Core I</td>
<td>3</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 510 Business Planning and Commercialization</td>
<td>3</td>
</tr>
<tr>
<td>IE 509 Project Management</td>
<td>1</td>
</tr>
<tr>
<td>IE 511 Advanced Topics in Manufacturing Systems</td>
<td>3</td>
</tr>
<tr>
<td>IE 508 Integrated Process, and Manufacturing System Design</td>
<td>3</td>
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</tbody>
</table>

**Summer**

Internship —

**Fall - Second Year**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 503* Survey of Manufacturing Systems Engineering</td>
<td>1-3</td>
</tr>
<tr>
<td>IE 504 Product Development Process</td>
<td>15</td>
</tr>
<tr>
<td>IE 505 Product Selection and Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>IE 508 Integrated Product, Process, and Manufacturing System Design</td>
<td>3</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 509 MBA “hub” course elective</td>
<td>3</td>
</tr>
<tr>
<td>IE 522 Optimization Methods in Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>IE 512* Process Development and Management</td>
<td>3</td>
</tr>
</tbody>
</table>
Market Feasibility 3
Elective (IE 514, 519, or 523) 3
Summer (first session) IE 594 3
Culminating Integrated Project Report 3
TOTAL 66-69

*The IE503 class is required for students enrolling in this option with undergraduate degrees in disciplines other than Industrial Engineering.

**Students in manufacturing systems engineering concentration may substitute other selected IE courses for these courses.

The dual degree candidate must satisfy the curriculum and graduation requirements of the engineering major being pursued and the College of Business Administration.

Students withdrawing from the dual degree program before completing both degrees will not receive credit toward graduation in either degree program for courses taken in the other degree program, except as such courses qualify for credit without regard to the dual degree program. The M.S. and the MBA degrees will be awarded upon successful completion of the requirements of the dual program.

Approved Dual Credit A maximum of 15 semester hours of the common program courses completed in the College of Engineering may be counted toward the MBA degree program.

CERTIFICATE IN MAINTENANCE AND RELIABILITY ENGINEERING

The College of Engineering offers a certificate program in maintenance and reliability engineering. The program is designed primarily for part-time students in that several of the courses are available through distance education.

The 12-credit certificate is earned by completing 483 and 484, which are cross-listed among all participating departments in the College of Engineering, plus two elective courses selected from a list of courses provided by the participating departments. Currently, the available elective courses are Industrial Engineering 516 and 591, Mechanical Engineering 534 and 599, and Nuclear Engineering 483. The selection of elective courses is determined through an advising conference with each individual student, and is based on the student’s personal interests, academic background, and work experience. Applicants must meet the minimum criteria established by the Graduate Council.

Industrial Engineering

GRADUATE COURSES

Note: Any 400-level course required in the Bachelor of Science in Industrial Engineering program at UT may not be used for graduate credit in the M.S. degree program.


403 Production Facilities Design and Material Handling (3) Design of production facilities: plant layout; analysis and planning for overall moving and storage of materials, office layout and service areas. Design of facilities for such diverse groups as hospitals, aerospace, and defense. Prereq: 306 Simulation. Coreq: 401. Sp


421 Information Systems Analysis and Design (3) Systems engineering approach to analysis, design, development, and implementation of systems of information. Informational requirements of industrial engineering systems. Utilization of relevant software packages. Prereq: Senior standing or consent of instructor. 2 hrs and 1 lab. F

422 Senior Industrial Engineering Problems Analysis (3) Application of industrial engineering to field assignments in local organizations, problem definitions, analysis and presentation. Prereq: Expected term of graduation and consent of instructor. E


440 Process Improvement Through Planned Experimentation (3) Fundamentals of continuous improvement, advanced statistical process control techniques, and strategies for short production runs. Use of experimental design and improvement techniques to improve processes: single and multiple-factor designs, blocking and confounding, and fractional designs. Full factorial designs compared to fractional designs to balance experiential efficiency with loss of information. Lab component utilizes statistical and simulation software tools and student experience. Prereq: 300 Engineering Data Analysis and Process Improvement. Sp

483 Introduction to Reliability Engineering (3) (Same as Nuclear Engineering 483, Chemical Engineering 483, and Mechanical Engineering 483.)

484 Introduction to Maintenance Engineering (3) (Same as Nuclear Engineering 484, Chemical Engineering 484, Materials Science and Engineering 484, and Mechanical Engineering 484.)

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

501 Design Project (1-3) Enrollment limited to industrial engineering students in non-thesis program. May be repeated. Maximum 6 hrs. S/NC only.

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

503 Industrial Engineering Methods Review (3) Survey of industrial engineering tools and techniques applied to analysis, design, and improvement of manufacturing systems. Required of dual degree students who do not have an undergraduate degree in industrial engineering. May not be counted toward degree requirements. Prereq: Admission to dual MS-MBA program. S/NC only.

504 Product Development Process (1) (Same as Mechanical Engineering 504).

506 Product Selection and Evaluation (2) (Same as Mechanical Engineering 506).


509 Project Management (1) Venue for multidisciplinary teams to develop and present manufacturing tasks of product to be developed. Project management (budget and schedule), assignment of tasks for team members, and concurrent design and manufacturing. Design concepts and product features reviewed by potential customers/investors. Prereq: Completion of Instructor. May be repeated. Maximum 3 hrs. (Same as Mechanical Engineering 509.)

510 Advanced Topics in Manufacturing Systems (3) Set up time reduction, strategies for improving asset reliability, strategies for improving product quality, implementation of pull systems, analysis of finite capacity scheduling systems, rate-based planning, mixed model scheduling, supplier and distribution integration issues. Prereq: Consent of instructor.

511 Business Planning and Commercialization (3) Complex issues of product development and business planning required to deliver new product from concept to market. Strategic issues that emerge during product development cycle, beginning with concept to development to commercialization to eventual product introduction or dismissal. Management practices for successful product development and product management. Prereq: Consent of instructor.

512 Process Development and Market Feasibility (3) Manufacturing process technologies available to cost-effectively produce specific new products that have been identified and designed. Product cost estimation, estimating capital cost requirements and justification, capacity analysis, layout and design of facilities, identification of potential suppliers, and analysis of business plan. Prereq: 511 and 524.

513 Facilities Planning and Design (3) Modern methods in facility design, computer-aided layout techniques, application of operation research models, and use of these to design manufacturing facility. Prereq: Production Facilities Design and Material Handling or consent of instructor.

514 Advanced Information Systems Analysis and Design (3) Systems analysis and systems control concepts applied to systems of information. Role of IE in office and factory of future. Management support systems, decision support systems, and integrated support systems.

515 Advanced Production and Inventory Systems (3) Advanced topics in production planning and inventory systems, material requirements planning, production planning and master scheduling; just-in-time concepts; distribution requirements planning; and other selected topics. Prereq: 402 or consent of instructor.

516 Statistical Methods in Industrial Engineering (3) Fundamentals of classical techniques to industrial engineering problems. Statistics and statistical thinking in managerial context of organizational improvement; descriptive statistics and distribution theory; relationship between statistical process control techniques and classical statistical tools; parameter estimation and hypothesis testing; goodness-of-fit testing; linear regression and correlation; analysis of variance; single and multiple factor experimental design. Prereq: Probability and Statistics for Scientists and Engineers, or equivalent.

517 Reliability Engineering (3) Continuous time random processes with applications to availability of equipment and manufacturing systems. Failure densities and failure data analysis. Maintainability, Reliability-based criteria for product acceptance. Prereq: 516.

518 Advanced Engineering Economic Analysis (3) Application of engineering economic analysis in com-
plex decision situations. Inflation and price changes; uncertainty evaluation using nonprobabilistic techniques; capital financing and project allocation; evaluations and decision making under uncertainty, replacement, investment, owned utilities, and public works projects; probabilistic risk analysis including computer simulation and decision trees; multiattribute decision analysis; and other advanced topics. Prereq: 405 and Probability and Statistics for Scientists and Engineers, or equivalent.

519 Human Factors Engineering and Ergonomics (3) Application of human factor and ergonomic concepts and principles to design and analysis of work systems: line balancing, set-up time reduction, cost and performance of mass and lean production systems; human as biomechanical system; human information processing; minimization of human error; anthropometry, anatomy and physiology; physical and mental workload; effect of environmental factors: temperature, lighting, weightlessness, and vibration on humans; manual materials handling; product and workstation design; and office ergonomics; design of displays and controls; hand tool design; and cumulative trauma injuries. Prereq: Probability and Statistics for Scientists and Engineers I or consent of instructor.

520 Human Factors and Product Safety Engineering (3) Role of human factors and safety engineering, legal implications in product design, product liability, system safety, and system failure analysis. Product testing, liability, and system safety evaluation techniques. Case histories of accident investigations, reconstrution, causality, and product liability litigation. Prereq: 519 or consent of instructor.

521 Advanced Human Factors Engineering Methodology (3) Advanced methodologies used in human factors engineering. Observational methods; function/task analysis; computerized human factors design methods; human reliability and error prediction; evaluation of human-machine interface; modeling techniques; questionnaire and survey design; experimental design; and other selected topics. Prereq: 519 or consent of instructor.

522 Optimization Methods in Industrial Engineering (3) Classical optimization applied to constrained and unconstrained, non-linear, multi-variable functions; sensitivity analysis; decision making under uncertainty; game theory; and dynamic programming. Prereq: Operations Research or Engineering Management 537.

523 Mathematical Programming (3) (Same as Management Science 531.)


525 Systems Modeling and Simulation (3) Modeling of discrete systems using current simulation software and Monte-Carlo simulation. Problem definition, input distributions, output data analysis, model validation and verification, variance reduction techniques, animation of models, and design of simulation experiments. Case studies in variety of domains for simulation modeling. Prereq: Consent of instructor.

526 Advanced Applications of Systems Modeling and Simulation (3) Modeling of discrete, continuous, and complex dynamic systems using current simulation software. Development of flexible simulation models to enhance accessibility of simulation models for experimentation. Development of distributed simulation models to represent and test production and supply chain systems. Prereq: 306 Simulation or 525. (Same as Management Science 526.)

527 Lean Production Systems (3) Characteristics and performance of lean production systems. Lean production concepts and principles. Planning, designing and implementing lean production systems: just-in-time systems, set-up time reduction, inventory management, maintenance support and other selected topics. Application at enterprise level to achieve strategic competitive goals. Prereq: 515 or consent of instructor.

591-92-93 Special Topics in Industrial Engineering (1-3,1-3,1-3) Individual or group research projects. Prereq: Consent of instructor. May be repeated.

594 Cumulating Integrated Project Report (3) (Same as Mechanical Engineering 594).

601 Operations Research Models in Engineering Economy (3) Mathematical programming techniques applied to capital budgeting; advanced topics in multiple attribute decision analysis; Bayesian analysis of sequential decision making; artificial intelligence in complex decision analyses. Prereq: 518, 523.

602 Nonlinear Optimization (3) (Same as Management Science 651.)


691-92-93 Advanced Topics in Industrial Engineering (3,3,3) Forum to study individually or in groups. Prereq: Graduate standing and consent of instructor. May be repeated with consent of instructor.

535 Management of Technology (3) Development and managing technology projects. Proposal preparation; resource and cost estimation, and project planning, organizing, and controlling; network diagrams and other techniques. Role of project manager; team building, conflict resolution, and contract negotiations. Discussion of typical problems and alternative solutions. Case studies and student projects. Prereq: 537 or consent of instructor.

537 Analytical Methods for Engineering Managers (3) Survey of management analysis and control systems through IE techniques. Qualitative and quantitative systems; methods analysis, work measurement, incentive systems, wage and salary development, production and inventory control, facility layout, linear programming and other research techniques. Not for credit for students with undergraduate degrees in industrial engineering.

538 New Venture Formation (3) Factors other than mechanical or chemical which enter into successful establishment of manufacturers or service enterprise. Organizational and financial planning and evaluation. Cost and location studies and market analysis to determine commercial feasibility of new ventures. Prereq: 539.

539 Strategic Management in Technical Organizations (3) Strategic planning process and strategic management in practice. Corporate vision and mission; product and market, organizational strategy; external factors: commercialization of new technologies; and competition and beyond. Prereq: 533 and Industrial Engineering 518 or consent of instructor.


543 Legal and Ethical Aspects of Engineering Management (3) Legal aspects imposed by government and ethical considerations in engineering practice. Selected readings, lecture, discussion, and student presentations. Current topics from government and industry.
Graduate degree grade-point average for grade-point average of 3.0 or a satisfactory and administration, to the region, both private and not-for-profit sectors, education and professional communities in student body, committed to:

- Collaborative and inclusive governance.
- Exceptional support, and
- Extensive partnerships within higher education and professional communities in both private and not-for-profit sectors, service to the State of Tennessee and to the region.
- The exemplary use of state-of-the-art information technologies in both academics and administration.
- Exceptional support, and collaborative and inclusive governance.

Admission Requirements

Applicants to the Information Sciences program must have a minimum undergraduate grade-point average of 3.0 or a satisfactory graduate degree grade-point average for admission as a potential candidate for the MS degree.

The verbal, quantitative and analytical aptitude portions of the Graduate Record Examination (GRE) are required of all applicants unless a graduate degree has been completed prior to application for admission. Applicants who take the GRE at least one semester in advance of application for admission and are expected to score 1500 points or better.

A personal data sheet and three recommendations (obtained from the School of Information Sciences) should be returned to the admissions office of the school. Foreign applicants are required to take the Test of English as a Foreign Language.

The Master's Degree

The program leading to the Master of Science involves a total of 42 semester hours of graduate courses including 5 courses required of all students. Either a thesis or a non-thesis option is available with 6 hours required for thesis credit. At least 36 hours must be taken in the School of Information Sciences, allowing up to 6 hours outside the school with a maximum of 6 from outside the University.

Required Courses

Five courses are required of all students: 490, 520, 530, 560 and 580. (Students seeking licensure see track requirements below.) These courses address the evolving information environment and the representation of information; information access and retrieval; developing and managing collections; and principles and concepts of the information sciences. Three courses, 490, 520 and 530, are prerequisite to all courses for students enrolled in the M.S. degree program.

Individualized Curriculum Approach

Students, in consultation with their advisor, may wish to pursue a curricular focus to develop an individualized program of study. Graduates of the school have prepared themselves for a variety of careers, including positions as: corporate information specialist, public librarian, reference librarian, youth services specialist, and many others. Students are encouraged to take advantage of the individualized curricular approach.

Whatever individualized curriculum is chosen, all students who complete the program receive an M.S. degree accredited by the American Library Association (ALA). For those pursuing Tennessee Department of Education licensure as a school library information specialist, stipulated requirements apply. See following section.

Tennessee State Department of Education School Library Information Specialist Requirements

The Tennessee Department of Education requires School Library Information Specialists to hold the master’s degree. The School of Information Sciences offers four tracks for School Library Information specialist endorsement.

Initial Endorsement for Non-Licensed Teachers with a Master's Degree in Library or Information Sciences: For those students who do not hold the master’s degree, the requirements for initial endorsement include the 5 required courses plus 551, 567, 571, 572, 585, and 596. In addition, students must complete two corequisite courses from the College of Education (5 credit hours) which do not count toward the master’s degree requirements. Students pursuing the initial endorsement must follow the non-thesis option. Upon completion of the requirements, students will earn a master’s degree in Information Sciences and a Tennessee State Department of Education license as a School Library Information Specialist.

Initial Endorsement for Non-Licensed Teachers with a Master's Degree in Library or Information Sciences: For those students who hold an ALA-accredited master’s degree and have approval of the faculty advisor, the requirements are a maximum of 24 hours within the School’s program, including the required 595. In addition, students must complete two corequisite courses from the College of Education (5 credit hours) beyond the required 24 hours. Upon completion of the requirements, students will earn a Tennessee State Department of Education license in a School Library Information Specialist.

Additional Endorsement for Licensed Teachers with a Master's Degree: The requirements include the 5 required courses plus 551, 567, 571, 572, 585 and 596 (which must be taken twice). Upon completion of the requirements, students will earn a Tennessee State Department of Education additional endorsement as a School Library Information Specialist.

Additional Endorsement for Licensed Teachers without a Master's Degree: The requirements include the 5 required courses plus 551, 567, 571, 572, 585 and 596 (which must be taken twice) plus 3 electives (upon approval of the faculty advisor). Upon completion of the requirements, students will earn a master’s degree in Information Sciences and a Tennessee State Department of Education additional endorsement as a School Library Information Specialist.

Additional Program Requirements

Thesis Option: Students electing the thesis option will write a master’s thesis under close supervision of a thesis committee. Six hours of Thesis (IS 500) must be taken within the 42 hours required for graduation. (Students may register for more than 6 hours of 500, but only 6 hours will count toward graduation.) Students must be registered for IS 500 in the semester they complete and defend their thesis. The oral defense of the thesis (final comprehensive examination) substitutes for the written examination that is taken by non-thesis students. The writing of the master’s thesis serves as the culminating experience.

Non-Thesis Option: Upon completion of the program, all students who elect the non-thesis option must take and pass a written comprehensive examination. A culminating experience is also required which must be completed in one of the student’s last two
terms with a grade of B or better (except as noted) selected from the following and approved by the student's advisor: 590 Problems in Information Sciences, 591 Supervised Readings in Information Sciences, 592 Seminar in Information Sciences, 593 Independent Study, 594 Graduate Research Participation (S/NC only), 595 Student Teaching in School Library Information Center (S/NC only), 596 Student Teaching and Observation in School Library Information Center (S/NC only), 599 Practicum (S/NC only).

FINANCIAL ASSISTANCE OPPORTUNITIES

Employment with the University of Tennessee Libraries may provide a work-study opportunity for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students usually work at least 20 hours each week and thus may extend the period required for the degree. Similar opportunities exist with other libraries and information agencies in the Knoxville area.

Work opportunities in a scientific-technical environment are available through subcontracts with Oak Ridge National Laboratory and the Department of Energy.

A limited number of graduate teaching assistantships are available through the school. Assistantships of this type carry a waiver of tuition and fees as well as a stipend and require that recipients work 10 hours per week in the school.

For application forms and information about financial aid and other information about the M.S. in Information Sciences, write to Admissions, School of Information Sciences, University of Tennessee, 804 Volunteer Blvd., Knoxville, TN 37996-4330

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 on an in-state tuition basis. The M.S. program in Information Sciences is available to residents of the states of Arkansas, Virginia, or West Virginia. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE COURSES

430 History of the Book (3) History of writing and various methods of bookmaking.

450 Writing About Science, Technology and Medicine (3) (Same as Journalism 450.)

485 Introduction to Electronic Communications and Information Resources on the Internet (3) Exploration of worldwide information and communication resources: email, newsgroups, and world wide web. Discussion of information issues: copyright, censorship, privacy and access.

486 Advanced Electronic Communications and Information Resources on the Internet (3) Exploration of advanced information and communications issues, resources and tools: forms, scripting and search engines. Prereq: 485 or consent of instructor.

490 Information Environment (3) Generation, production, organization, preservation, and use of information. Roles of information in society, information seeking and user behavior, information industry, economics of information products and services, technological and organizational change, information professions, and issues. E,A

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

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

520 Organization and Representation of Information (3) Principles of describing, indexing, and indexing intellectual works; current approaches; citation systems, descriptive cataloging, non-subject indexing, pre- and post-coordinate subject indexing, classification and categorization, authority control of index terms; standards. E,A

521 Cataloging and Classification (3) Basic library-oriented cataloging techniques, classification, tools, and supporting operations. Descriptive cataloging, choice and form of non-subject entries, subject heading, bibliographic control, bibliographic utilities, online library catalogs.

522 Organization and Representation of Multime- dia Information Resources (3) Principles and practices of description and access to information resources in non-textual databases, bibliographic utilities, online library catalogs.

523 Abstracting and Indexing (3) Philosophies, standards, and procedures for manual and automatic document indexing, indexing services, bibliographic utility, choice of visual, auditory, and electronic (including Internet) resources.

530 Information Access and Retrieval (3) Media for information storage, logical and physical information structures, query logic and languages, search strategies and heuristics, user interfaces, evaluation of retrieval system performance. Search techniques for various types of databases including multi-media, full-text, numeric, bibliographic. E,A

531 Sources and Services for the Social Sciences (3) Information sources in political science, sociology, economics, political science, and management of regional collections. F

532 Sources and Services for Science and Engineering (3) Information sources in engineering, physical and life sciences.

533 Sources and Services for the Humanities (3) Information sources in philosophy, religion, fine arts, performing arts, literature and language, Organization and management of regional collections. F

534 Government Information Sources (3) Selection, acquisition, organization, and utilization of government information in variety of formats from legislative, judicial, executive, federal, state, local, and international government and intergovernmental agencies. Sp

535 Advanced Information Retrieval (3) Bibliographic, non-bibliographic, full-text databases, electronic publishing, descriptive cataloging, non-subject indexing, authority control, thesaurus construction, and abstracting.

537 Information Industry (3) Issues and trends concerning information industry: products and services. Standards, enabling technologies, choice of distribution media, entrepreneurial opportunities. Legal, ethical, and quality concerns. F

538 Economics of Information (3) Costing and pricing of information; value of information and value added services; cost-benefit analysis and tradeoffs: policy issues related to economic aspects of information exchange and transfer.

539 Information Policy (3) Role of government in creation and exchange of information; review of key national and international policy areas relevant to information creation, production, and distribution; development of information policy for organizations. F

490 Research Methods (3) Research methods in variety of information environments: primary and secondary research, research question design, research results interpretation; analysis of published research; techniques supporting research process. E

550 Management of Information Organizations (3) Supervisory and management concepts, strategies, and techniques applicable to information professional working in libraries, archives, records management, and other information organizations. F

551 School Library Media Centers (3) Planning, implementing, and evaluating school library programs. Current trends in information technology, site-based management, relationships with district and state services. F

552 Academic Libraries (3) Mission, status, and history of academic libraries and academic librarianship in community colleges, universities, and other institutions. Trends in higher education, information technology, and government's impact on public, technical, and administrative services. Sp

553 Corporate Information Services (3) Development and management of business information objectives, information resources external to organization.

554 Public Library Management and Services (3) Development, roles, political environment, governance, organization, fiscal management, services, marketing, and performance evaluations. Sp

555 Scientific and Technical Communications (3) Evolution of scientific and technical communication; current trends; role of formal and informal communication; major STI organizations and their roles.

557 User Instruction (3) Theory, strategy, design, and practice in providing instructional services and technology for end users of information and information systems. Includes practical experience.

560 Development and Management of Collections (3) Selecting and preserving variety of items (tangible and intangible) for particular users, community analysis; policies and procedures; evaluation; purchasing.

561 Contemporary Book Publishing (3) Creation, design, production, marketing, and distribution; various types of publishers.

563 Graphic Design and Media (3) Principles and practices in visual aspects of communications. Graphic design, typography, production techniques and publication design, as these apply to electronic information delivery systems. F

564 Corporate Information Systems (3) Objectives and function elements of records systems, archival programs, management information systems and techniques within various types of organizations. Management of information internal to organizations. Sp


566 Business Intelligence for Information Professionals (3) Principles and practices of gathering and synthesizing business intelligence; competitive intelligence, environmental scanning, and issues management; information evaluation and synthesis; role of strategic information in modern organizations.

567 Information Network Applications (3) Scholarly and community-based electronic communications. National and international standards, tools, resources; identification, analysis, evaluation, and management of tools and resources; construction of local technologies as developed and applicable. F,Sp

569 Advanced Production of Audiovisual Software (3) (Same as Education in the Sciences, Mathematics, Research and Technology 569.) F,Sp


572 Resources for Young Adults (3) Critical survey of books and related materials for young adults; personal, vocational, and recreational needs and interests. Evaluation, selection, and utilization for school and public libraries. Su

573 Programming for Children and Young Adults (3) Philosophy and objectives of public and school library services for children and young adults. Reading, listening, and viewing guidance for individuals and

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groups. Program planning, implementation, and evaluation. Prereq: 571 or 572.

574 Adult Materials and Services (3) Popular informational and recreational materials and services to meet adult interests in variety of formats. Development of specialized collections.

580 Foundations of Information Sciences and Technologies (3) Definitions of information, information sciences, and information technology; theories of information, information representation, retrieval, and transfer; standards and technologies for information processing and distribution; research front; bibliometrics and infometrics; relationships with other disciplines. E,A

581 Seminar in Radio and Television (3) (Same as Broadcasting 580).

582 Library Automation (3) Computer-based applications and systems for libraries including MARC, bibliographic utilities, retrospective conversion, circulation systems, online catalogs, computer-based reference services, acquisition and serials control, systems planning and implementation.

583 Information Systems (3) Systems concept, defining system, analysis and design of information systems. Selecting and using information systems to support various activities. User involvement in the development process. F,Sp

584 Database Management Systems (3) Defining data needs, data structures, role of operating systems in data management, file organization, database management systems, logical data models, internal data models, database administration and evaluation. Design and implementation of applications using database management system. Sp

585 Information Technologies (3) Evolution, trends, capabilities, and limitations of technologies applied to information capture, storage, preservation, access, and distribution. F,Sp

586 Information Retrieval Systems (3) Historical perspective on information retrieval research; statistical and probabilistic retrieval techniques; cognitive user modeling; expert intermediary systems; associations, relations and hypertext.

588 Human-Computer Interaction (3) Survey of human-computer interaction, and introduction to human and technological factors of importance to design of usable information systems. Basic phenomena of human perception, cognition, memory, and problem solving, and relationship to user-centered design. Methods and techniques for interaction design and evaluation. Sp


590 Problems in Information Sciences (3-6) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

591 Supervised Readings in Information Sciences (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F,Sp

592 Seminar in Information Sciences (3-6) Prereq: Consent of instructor. May be repeated with consent of advisor. Maximum 6 hrs.

593 Independent Study (3-6) Prerequisite: Consent of advisor. Maximum 6 hrs. F,Sp

594 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose area coincides with interests of student. Prereq: Consent of advisor and research director. S/NC only. F,Sp

595 Student Teaching in School Library Information Center (9) Planned professional semester: full day school library work and classroom observation activities. S/NC only.

596 Field-Based Experience in School Library Information Centers (2) Prescribed activities to gain competencies in a school library information center setting. Must be taken twice. May be repeated. Maximum 6 hrs. S/NC only.

599 Practicum (3-6) Opportunity to translate theory into practice under guidance of qualified information professionals. Prereq: Completion of core and pertinent advanced courses relevant to student’s practicum design. Minimum 3.0 cumulative GPA. Written consent of advisor and approval of practicum coordinator. May be repeated. Maximum 6 hours. S/NC only. E

601 Advanced Seminar in Information Sciences (3) Theories, research, and traditional practices of information representation, organization, and access and retrieval. Research opportunities and methods. Relation to and interaction with other disciplines.

Instructional Technology, Curriculum and Evaluation

(College of Education)

MAJOR DEGREES

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

Michael Waugh, Head

Professors:

Counts, Edward L., Ed.D. ............ Texas A&M

Dessart, Donald J., Ph.D. .......... Maryland

Doak, E. Dale (Emeritus), Ed.D. ....... Colorado

French, Russell, Ph.D. .............. Ohio State

Hipole, Theodore W., Ph.D. ........ Illinois

Myer, M. E. (Emeritus), Ed.D. ......... Florida

Roeske, Edward L. (Emeritus), Ed.D. .......... Tennessee

Waugh, Michael, Ed.D. .......... Georgia

Associate Professors:

Connelly, Mary Jane, Ed.D. ............ VPI

Grant, A. D., Ph.D. ...................... Wisconsin

O’Bannon, Blanche, Ed.D. ............ Memphis

Assistant Professor:

Norris, Aileen, Ph.D. .................. Virginia

The Department of Instructional Technology, Curriculum and Evaluation offers graduate programs leading to degrees, majors, and concentrations in:

Master of Science

Education

Track 1-curriculum

Track 1-instructional technology

Educational Specialist

Education

Curriculum

Instructional technology

Doctor of Education

Education

Curriculum, educational research, and evaluation

Instructional technology

Doctor of Philosophy

Education

Curriculum, educational research, and evaluation

Instructional technology

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

The mission of department focuses on the preparation of teachers and instructors in curriculum 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. F,Sp

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

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

521 Computer Applications in Education (3) Use and integration of technology in educational settings to support teaching and learning. Prereq: Basic computer operations or consent of instructor. F

532 Instructional Research: Analysis and Application (3) Analysis of research on instruction. Translation and application of research findings into instructional performance.

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.) Sp,Su

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

552 School Law for Educators (3) Case and statutory material for public school educators; problems concerning law and public education.

557 The Junior High and Middle School Curriculum (3) Curriculum and instructional design for junior high and middle school. Characteristics of students, curriculum designs, instructional patterns, and organization and structure of junior high and middle school. Sp

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. E

560 Student Assessment (3) Processes 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. F

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

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

569 Media and Technology Production Techniques (3) Workshop strategy: basic photography, audio production, multi and single camera TV production, basic digital video editing, and other media/technology techniques important for improving communication in
variety of presentation or instructional settings. (Same as Information Sciences 569.) Su

570 Instructional Systems Design (3) Application of theory and research of instructional systems design to solve instructional problems in educational settings. F

571 Desktop Publishing for Educators (3) Use of computer-based desktop publishing software and related hardware in designing and producing instructional and informational products. Prereq: 521, 570 or consent of instructor. Sp

573 Introduction to Multimedia in Instruction (3) Selected computer-based multimedia production tools and use to produce instructional materials based on specific learner characteristics and objectives. Prereq: 521 or consent of instructor. Sp

575 The Internet: Implications for Teaching and Learning (3) Investigation of Internet, its origin and historical development. Hands-on use of Internet. Relevant issues regarding legal and ethical issues, evaluation, responsible use, proprietary rights. F

576 Advanced Interactive Multimedia for Instruction (3) Design and production of educational and interactive Web sites using advanced software. Development of effective interactive methods for enhancing teaching and learning supported by principles of planning, designing, creating, testing, and evaluating. Prereq: 521, 570, 573, 575. Sp

578 Web Design (3) Design and development of instructional Web sites using basic design principles and visual web editor software. Prereq: 575. Sp

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

588 Instructional Theory and Design (3) Relationship of curriculum to instruction; examination of instructional and related learning theories; instructional models and teaching styles. Su

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

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

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

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

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

623 Using Research for Curriculum Improvement (3) Research methodology; application to descriptive survey curricular materials. Critical reading of research, methodological development in descriptive and survey areas. Sp

630 Seminar in Assessment and Evaluation (3) Trends and issues in assessment, data analysis, personnel evaluation, and program evaluation; and examination of current state, regional and national assessment and evaluation projects. Prereq: Consent of instructor.

631 Application of Assessment/Evaluation (3) Systems designs, instruments, procedures, reporting formats used in personnel and program evaluation and student assessment; analysis, synthesis and interpretation of data sets. Prereq: 630.

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: 581. F, Sp

672 Interpretation and Application of Curriculum and Instruction Research (3) Analysis of research in curriculum and instruction, newer methodologies and strategies. Utilization of research to improve curricular and instruction practice, application of research principles in context of specific professional assignments. Prereq: Consent of instructor.

674 Designing and Implementing Personnel Assessments (3) Models and methods for assessing performance of educators and other professionals. Critique of systems currently in use and design of evaluation system.

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


678 Seminar in Instructional Technology (1) Readings and discussions based on current literature, research, theories and practices in instructional technology. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. F

679 Trends and Issues in Instructional Technology (3) Literature: history and origins, integration and application, teacher preparation, future developments, diffusion of change and philosophical/theoretical perspectives. F

680 Designing Problem-Based Learning Environments (3) Development and integration of problem-based learning pedagogy into curriculum. Examination of literature to understand theoretical perspective for design of this type of learning environment. Prereq: 521, 570, 573, 575, or consent of instructor. Su

689 Internship (1-3) Experience 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

Interdisciplinary Programs

(College of Arts and Sciences)

The College of Arts and Sciences offers a series of interdisciplinary undergraduate majors and minors through its Interdisciplinary Programs. These programs include African and African-American Studies, American Studies, Asian Studies, Cinema Studies, Comparative Literature, Environmental Studies, Latin American Studies, Legal Studies, Judaic Studies, Linguistics, Medieval Studies, Urban Studies and Women’s Studies. Certain courses within these programs are available for graduate credit as listed below. See the Undergraduate Catalog for program descriptions and directors.

African and African-American Studies

GRADUATE COURSES

421 Comparative Studies in African and African-American Societies (3) Education, religion, and social stratification. Views African-Americans and Africans have of each other and concept of Pan-Africanism. F

443 Topics in Black Literature (3) (Same as English 443.)

450 Issues and Topics in African-American Studies (3) Problems, topics, issues, and individuals. May be repeated. Maximum 6 hrs.

452 Black African Politics (3) (Same as Political Science 452.)


483 African-American Women in American Society (3) Historical and contemporary socio-eco-political factors in American society as related to Black women. (Same as Women’s Studies 483.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

American Studies

GRADUATE COURSES

423 Geography of American Popular Culture (3) (Same as Geography 423.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Asian Studies

GRADUATE COURSES

471 Selected Topics in Asian Studies (3) Content varies. May be repeated. Maximum 9 hrs.

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Cinema Studies

GRADUATE COURSES

400 Special Topics (3) May be repeated. Maximum 6 hrs.

420 French Cinema (3) (Same as French 420.)

421 Topics in Italian Literature and Cinema (3) (Same as Italian 421.)

423 History of Film and Modern Art (3) (Same as Art Media/Photography 433.)

434 Hispanic Culture Through Film (3) (Same as Spanish 434.)

465 Latin American Film and Culture (3) (Same as Spanish 465 and Latin American Studies 465.)

469 Sexuality and Cinema (4) (Same as Women’s Studies 469.)

489 Special Topics in Film (3) (Same as English 489.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Comparative Literature

GRADUATE COURSES

401-02 Special Topics in Comparative Literature (3,3) Content varies. May be repeated. Maximum 9 hrs.

452 Modern Drama, 1880-1945 (3) (Same as English 452.)

454 Twentieth-Century International Novel (3) (Same as English 454.)

510 Special Topics (3) May be repeated. Maximum 6 hrs.
Judaic Studies

GRADUATE COURSES

405 Modern Jewish Thought (3) (Same as Religious Studies 405.)
425 Early Christian and Byzantine Art, to 1350 (3) (Same as Art History 425.)
431 Medieval Art of the West, 800-1400 (3) (Same as Art History 431.)

Latin American Studies

GRADUATE COURSES

456 Latin American Government and Politics (3) (Same as Political Science 456.)
465 Latin American Film and Culture (3) (Same as Spanish 465 and Cinema Studies 465.)
479 Disenchanted Texts in Hispanic Literature (3) (Same as Spanish 479.)
510 Special Topics (3) May be repeated. Maximum 6 hrs.

Legal Studies

GRADUATE COURSES

400 Mass Communications Law and Ethics (3) (Same as Communications 400.)
430 United States Constitutional Law: Sources of Power and Restraint (3) (Same as Political Science 430.)
431 United States Constitutional Law: Civil Rights and Liberties (3) (Same as Political Science 431.)
442 Administrative Law (3) (Same as Political Science 442.)
451 Criminal Justice (3) (Same as Sociology 451.)
455 Society and Law (3) (Same as Sociology 455.)
470 International Law (3) (Same as Political Science 470.)
490 Language and Law (3) (Same as English 490 and Linguistics 490.)
496 The Rhetoric of Legal Discourse (3) (Same as English 496.)

435 Structure of the German Language (3) (Same as German 435.)
436 History of the German Language (3) (Same as German 436.)
471 Sociolinguistics (3) (Same as English 471 and Sociology 471.)
472 American English (3) (Same as English 472.)
474 Teaching English as a Second or Foreign Language I (3) (Same as English 474.)
475 Teaching English as a Second or Foreign Language II (3) (Same as English 475.)
476 Second Language Acquisition (3) (Same as English 476.)
477 Pedagogical Grammar for ESL Teachers (3) (Same as English 477.)
485 Special Topics in Language (3) (Same as English 485.)
490 Language and Law (3) (Same as English 490 and Legal Studies 490.)
510 Special Topics (3) May be repeated. Maximum 6 hrs.

Medieval Studies

GRADUATE COURSES

510 Special Topics (3) May be repeated. Maximum 6 hrs.

Urban Studies

GRADUATE COURSES

401 The City in the U.S. (3) (Same as Planning 401.)
411 Linguistic Anthropology (3) (Same as Anthropology 411.)
425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, and Spanish 425.)
426 Methods of Historical Linguistics (3) (Same as German 426, French 426, and Spanish 426.)
429 Romance Linguistics (3) (Same as French 429 and Spanish 429.)
431 Topics in Hispanic Linguistics (3) (Same as Spanish 431.)

Women’s Studies

GRADUATE COURSES

400 Topics in Women’s Studies (3) Content varies. May be repeated.
410 Gender Role Development: Implications for Education and Counseling (3) (Same as Counselor Education and Counseling Psychology 410.)
422 Women Writers in Britain (3) (Same as English 422.)
425 Women’s Health (3) (Same as Health 425.)
434 Psychology of Gender (3) (Same as Psychology 434.)
466 Rhetoric of the Woman’s Rights Movement to 1930 (3) (Same as Speech Communication 466.)
469 Sexuality and Cinema (4) Exploration of issues surrounding sexuality, gender and cinema from points of view of feminist film criticism. (Same as Cinema Studies 469.)
476 Rhetoric of the Contemporary Feminist Movement (3) (Same as Speech Communication 476.)
483 African-American Women in American Society (3) (Same as African and African-American Studies 483.)
510 Special Topics (3) May be repeated. Maximum 6 hrs.
593 Independent Study (1-6) Prereq: Consent of Chair of Women’s Studies.

Journalism

GRADUATE COURSES

403 International Communications (3) Development and operations of world mass communications channels and agencies. Comparative analysis of media, media practices, and flow of news throughout world. Print and broadcast systems in terms of relevant social, political, economic, and cultural factors. Relation of communication practices to international affairs and understanding.
412 Opinion Writing (3) Analysis of editorial positions, practices, and pages. Writing of editorials and columns for newspapers, magazines and company publications: study and use of rhetorical devices and logic. Prereq: Writing for Mass Communication or consent of instructor. (Same as Public Relations 412.)
414 Magazine Article Writing (3) Techniques of writing in-depth articles of mass circulation and specialized magazines. Organizing and presenting material, problems in specialized areas: business, science, agriculture, humanities. Prereq: Writing for Mass Communication or consent of instructor.
416 Issues in Journalism (3) Topics vary. Prereq: of instructor. May be repeated. Maximum 6 hrs.

MAJOR DEGREES

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

Paul Ashdown, Acting Director

Professors:

Adamson, June N. (Emeritus), M.S. ......................... Tennessee
Ashdown, Paul G., Ph.D. ........ Bowling Green
Bowles, Dorothy, Ph.D. ................. Wisconsin
Cade, Dozier C. (Emeritus), Ph.D. .............. Iowa
Caudill, C. Edward, Ph.D. ........ North Carolina
Crook, James A. (Emeritus), Ph.D. Iowa State
Everett, George A. (Emeritus), Ph.D. ...... Iowa
Haskins, Jack B. (Emeritus), Ph.D. Minnesota
Leiter, B. Kelly (Emeritus), Ph.D. ................ Southern Illinois
Littmann, Mark (Chair of Excellence), Ph.D. ................ Northwestern
Miller, M. Mark, Ph.D. ................ Michigan State
Singletary, Michael W., Ph.D. Southern Illinois
Teeter, Dwight L., Jr., Ph.D. ................. Wisconsin
Tucker, Willis C. (Emeritus), M.S. ...... Kentucky

Associate Professors:

Foley, Daniel, M.S.J. ................ Northwestern
Heller, Robert B., M.A. .................. Syracuse
Morrow, Jerry L., Ph.D. ................. Toledo

Assistant Professors:

Fall, Lisa T., Ph.D. ......................... Michigan State
Riechert, Bonnie P., Ph.D. .............. Tennessee
White, Candace L., Ph.D. ................. Georgia

The School of Journalism and Public Relations 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.

Linguistics

GRADUATE COURSES

400 Topics in Linguistics (3) Content varies. May be repeated. Maximum 6 hrs.
411 Linguistic Anthropology (3) (Same as Anthropology 411.)
423 The Development of Diachronic and Synchronic Linguistics (3) Development of Western linguistic thought from Hebrews and Greeks through modern times. Readings from Boas, Sapir, Bloomfield, and others. Prereq: 9 hrs of courses required for Linguistics major (300-level or above) or consent of instructor.
425 Introduction to Descriptive Linguistics (3) (Same as French 425, German 425, and Spanish 425.)
426 Methods of Historical Linguistics (3) (Same as German 426, French 426, and Spanish 426.)
429 Romance Linguistics (3) (Same as French 429 and Spanish 429.)
431 Topics in Hispanic Linguistics (3) (Same as Spanish 431.)
420 Print Media Management (3) Current business practice among print news media, especially newspapers. Problems in management and production and outlook in related technologies. Prereq: 6 hrs math, statistics and/or accounting and senior standing. Sp


433 Advanced Editing (3) Sensitivity to language and editing skills. Headline writing, layout, and production. Prereq: Editing. Sp

444 Journalism as Literature (3) Study of writers from 17th century to modern era whose works have endured as both journalism and literature. Emerging genre called literary journalism: means of cultural reporting with personal narrative style. Prereq: Consent of instructor.

450 Writing About Science, Technology, and Medicine (3) Writing workshop to analyze examples of successful science writing and write series of articles for general public based on scientific journals, news conferences, technical meetings, and interviews. Prereq: Consent of instructor. (Same as Information Sciences 450.)

451 Environmental Reporting (3) Writing for news media on such environmental issues as strip-mining, water pollution, air pollution, allergens, nuclear power, fossil fuel power, and solid wastes. Presentations from experts and interviews of experts in environmental science and reporting. Exemplary popular literature in environmental reporting. Prereq: Consent of major; consent of instructor for non-majors.

455 Issues in Science Communications (3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

456 Science Writing as Literature (3) Survey of important science writing for general public across spectrum of science, engineering, and medicine. Works by authors such as Arthur C. Clarke, Stephen J. Gould, and Richard Selzer. Analysis of literary qualities in quest to understand why some science writing succeeds. Prereq: Consent of instructor.

460 Mass Communications History (3) Development of press and role of mass communications in American history. Newspapers, radio, television, and magazines. F

465 Women and Mass Media (3) Media effects on women. Media coverage and portrayal of women. Historical and current status of women in mass communication industries.

490 Advanced Photojournalism (3) Advanced principles and methods of black-and-white photography. Introduction to color photography. News and feature photographs and photo essays. Prereq: Photojournalism or consent of instructor. Sp

520 Political Communications (3) Relationships among mass media, public relations and government and their roles in democratic society. Governmental public relations, political campaigns, military, executive, legislative and judicial branches of government, special interest groups and public access to government information. (Same as Public Relations 520.) F

525 Public Opinion (3) Role of press in developing and influencing public consensus. Social theories of public opinion and analysis of mass media’s response. (Same as Public Relations 525.)

535 Publications Management (3) Problems in management, production, market analysis, and design. Techniques of writing, editing, and presenting comprehensive articles and other material; regional and specialized magazines. Individual editorial projects. Prereq: 420 or consent of instructor.

550 Writing and Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, finance, science, technical and general publications. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

560 Publishing on World Wide Web (3) Electronic research and publishing. Social, legal and ethical challenges surrounding new media. Project planning and storyboarding techniques for designing and creating site on Web. (Same as Public Relations 560.)

580 Seminar in Visual Communication (3) Behavioral aspects of communication with images. Theories of psychological effect in color, shape, texture, and design of objects. Prereq: Permission to attend. Article examining Creative Strategy or Electronic Field Production or equivalent.

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

598 Internship (3) Professional work in journalism supervised by editor or manager with faculty approval. No retroactive credit for previous work experience. Prereq: Completion of core curriculum.

Public Relations

GRADUATE COURSES

412 Opinion Writing (3) (Same as Journalism 412.)

416 Issues in Public Relations (3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

470 Public Relations Campaigns (3) Research, planning and communication and evaluation of major public relations campaigns. Oral and written presentation of a public relations project from inception to completion. Extensive out-of-class work. Prereq: 320 Public Relations Communications and 370 Public Relations Cases or consent of instructor. F, Sp

516 Seminar in Public Relations Issues (3) Topics vary. May be repeated. Maximum of 6 hrs.

520 Political Communications (3) (Same as Journalism 520.)

525 Public Opinion (3) (Same as Journalism 525.)

530 Fund Raising and Proposal Writing (3) History, philosophy and practice of philanthropy in U.S. Sources of funds from foundations, corporations and public agencies. Research and preparation of fund-raising proposals.

560 Publishing on World Wide Web (3) (Same as Journalism 560.)

571 Public Relations Management (3) Analysis and problems of management in communication between institutions and organizations and their publics. Measurement and evaluation of effectiveness of communications programs. Prereq: 470 or consent of instructor.

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

598 Internship (3) Professional work in public relations supervised by communications manager with faculty approval. No retroactive credit for previous work experience. Prereq: Completion of core curriculum.

Large Animal Clinical Sciences

See College of Veterinary Medicine and Comparative and Experimental Medicine

Law

(Major of College) (Law... DEGREES)

MAJOR

Law.................. J.D., J.D.-MBA, J.D.-M.P.A.

Thomas C. Galligan, Jr., Dean

Professors:

Ansley, Frances Lee, LL.M........... Harvard
Best, Reba, M.L.S. ................... Florida
Blaze, Douglas A., J.D. .............. Georgetown

Cohen, Neil P., LL.M .................... Harvard
Cook, Joseph G., LL.M.............. Yale
Galligan, Jr., Thomas C., LL.M..... Columbia
Hardin, Patrick, J.D. ............... Chicago
Hess, Amy M., J.D. ................... Virginia
King, Joseph H., J.D. ................. Pennsylvania
Le Clercq, Frederic S. (Emeritus), LL.B., Duke
Lloyd, Robert M., J.D. ............... Michigan
Phillips, Jerry J., J.D. ............... Yale
Picquet, Cheryn, M.S.L.S .......... Tennessee
Reynolds, Glenn H., J.D. ............ Yale
Rivkin, Dean H., J.D. ............... Vanderbilt
Sewell, Toxey H. (Emeritus), .

LL.M. .................... George Washington
Sobieski, John L., Jr., J.D. ......... Michigan
Stark, Barbara, J.D. ............... New York
Stein, Gregory M., J.D. .......... Columbia
Stephens, Otis H., J.D. .......... Tennessee
Wirtz, Richard S., J.D. ............. Stanford
Zwier, Paul J., II, LL.M .......... Temple

Associate Professors:

Aarons, Dwight, J.D. ............ UCLA
Anderson, Gary L., LL.M ......... Harvard
Barton, Benjamin H., J.D. ....... Michigan
Beintema, William J., J.D. ...... Miami
Black, Jerry P., Jr., J.D. .......... Vanderbilt
Cornett, Judy M., J.D. .......... Tennessee
Davies, Thomas Y., J.D. ........ Northwestern
Gray, Grayfred B., J.D. .......... Vanderbilt
Heminway, Joan M., J.D. ........ New York
Kennedy, Deserée A., LL.M ...... Temple
Kuney, George W., J.D. , California (Hastings)
Leatherman, Don A., LL.M....... New York
Medill, Colleen E., J.D. ........ Kansas
Parker, Carol M., J.D. .......... Illinois
Pierce, Carl A., J.D. ............. Yale
Plank, Thomas E., J.D. .......... Maryland
Pulsinelli, Gary A., J.D. , California (Boalt Hall)
White, Penny J., LL.M .......... Georgetown
Williams, Paulette J., J.D. ...... Loyola
Price, Loretta, M.S.L.S......... Tennessee

The College of Law offers the Doctor of Jurisprudence degree program; a dual degree program with the College of Business Administration leading to the J.D. and the Master of Business Administration degree; and a dual degree program with the Department of Political Science, College of Arts and Sciences, leading to the J.D. and Master of Public Administration. In addition graduation students may be eligible to take a limited number of law courses to count toward a graduate degree.

Current information regarding admission, financial aid, course requirements, academic policies, extracurricular activities, and student services is available from the Admissions Office, The University of Tennessee, College of Law, 1505 W. Cumberland Ave., Knoxville, Tennessee 37996-1810. Completed application should be received before February 1 of the year of requested admission.
DEGREE OF DOCTOR OF JURISPRUDENCE

The degree of Doctor of Jurisprudence will be conferred upon candidates who complete, with the required average, six semesters of resident law study and who have 89 semester hours of credit, including all required courses. The required average is 2.0 and that average must be maintained on the work of all six semesters and also for the combined work of the grading periods in which the last 28 credit hours taken in residence were earned. Averages are computed on weighted grades. Grades are on an alphabetical scale from A+ to F. No credit toward the J.D. degree is awarded for grades of D- or F.

Eligible law students may receive up to six (6) semester hours of credit toward the J.D. degree for acceptable performance (a grade of B or higher) in upper-level courses that materially contribute to the study of law and which are taken in other departments at The University of Tennessee. Course selection and registration are subject to guidelines approved by the law faculty which include the requirement that any such course be acceptable for credit toward a graduate degree in the department offering the course. Refer to the Law Catalog and Student Handbook for current degree requirements.

DUAL J.D.-MBA DEGREE PROGRAM

The College of Business Administration and the College of Law offer a coordinated dual program leading to the conferment of both the Doctor of Jurisprudence and the Master of Business Administration. The dual program saves the student approximately 15 hours (one semester) over the time that would be required to earn both degrees independently.

The establishment of the dual program recognizes the increasing complexity 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 Office of Graduate Admissions 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 are started prior to entry into the last 28 semester hours of J.D. coursework and prior to the third semester of the MBA program. Students interested in entering the dual 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 6 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. During the first year in the MBA program, students register as graduate students. After the first two years, any term in which students take law coursework or a mixture of law and graduate courses, they are classified and registered as law students. If taking only graduate courses, they are classified and registered as graduate students.

Approved Dual Credit

MBA courses in which the student has earned a B or higher and are to be counted toward the J.D. program must include 9 semester hours approved by the College of Law. The 6 hours of law courses in which the student has earned a 2.3 or higher and are to be counted toward the MBA must be selected from those approved by the Asst. Dean of the MBA Program.

DUAL J.D.-M.P.A. PROGRAM

The College of Law and the Department of Political Science in the College of Arts and Sciences offer a coordinated dual degree program leading to the conferment of both the Doctor of Jurisprudence and Master of Public Administration degrees. In this program, a student may earn the M.P.A. and J.D. degrees in about four years rather than the five years that otherwise would be required. Students pursuing the dual degree program should plan to be enrolled in coursework or an internship for one summer term in addition to taking normal course loads for four academic years.

Admission

Applicants for the J.D.-M.P.A. program must make separate application to, and be independently accepted by, the College of Law for the J.D., the Department of Political Science and the Office of Graduate Admissions for the M.P.A. degree. Applicants must also be accepted by the Dual Degree Committee. All applicants must submit a Law School Admission Test (LSAT) score. An applicant's LSAT score may be substituted for the Graduate Record Examination (GRE) score, which is normally required for admission to the M.P.A. program.

Application may be made prior to or after matriculation in either the J.D. or the M.P.A. program, but application to the dual program must be made prior to entry into the last 29 semester hours required for the J.D. degree and prior to entry into the last 15 hours required for the M.P.A. degree.

Curriculum

A dual degree candidate must satisfy the requirements for both the J.D. and the M.P.A. degrees as well as the requirements for the dual program. The College of Law will award a maximum of 9 semester hours of credit toward the J.D. degree for successful
completion of approved graduate level courses (500 or 600 level) offered in the Department of Political Science. The M.P.A. program will award a maximum of 9 semester hours of credit toward the M.P.A. degree for successful completion of approved courses offered in the College of Law. All courses for which such cross-credit is awarded must be approved by the J.D.-M.P.A. coordinators in the College of Law and the Department of Political Science. All candidates for the dual degree must successfully complete Administrative Law (Law 821). An internship is strongly recommended for students in the dual degree program, as it is for all M.P.A. candidates, but an internship is not required.

During the first two years in the dual program, students will spend one academic year completing the required first year of the College of Law curriculum and one academic year taking courses solely in the M.P.A. program. During those first two years, students may not take courses in the opposite area without the approval of the J.D.-M.P.A. in both academic units. In the third and fourth years, students are strongly encouraged to take both law and political science courses each semester. Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit toward either the J.D. or the M.P.A. degree for courses taken in the other program except as such courses qualify for credit without regard to the dual program.

Awarding of Grades

For grade recording purposes in the College of Law and the Department of Political Science, grades awarded in courses in the other unit will be converted to either Satisfactory or No Credit and will not be computed in determining a student’s GPA or class standing. The College of Law will award a grade of Satisfactory for an approved M.P.A. course in which the student earns a grade of B or higher and a grade of No Credit for any lower grade. The Political Science Department will award a grade of Satisfactory for an approved law course in which the student earns a grade of A or higher and a grade of No Credit for any lower grade. 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.

POLICY FOR GRADUATE STUDENTS TAKING LAW COURSES

Students pursuing a graduate degree in another college may, upon approval of the College of Law and the major chairperson, take up to 6 semester hours of law courses and receive credit toward the graduate degree. The graduate student must register for the course during regular registration at the College of Law requesting an S/NC grade only. If a C or above is earned in a law course, an S will be recorded on the transcript. If a student earns below a C, an NC will be recorded, and the course cannot be used toward degree requirements. Grades for law courses will not be reflected in the cumulative average. Law courses may be taken for credit only by students enrolled in a graduate degree program.

Different rules apply to the student enrolled in the Dual J.D.-MBA or J.D.-M.P.A. Programs. Grades must be earned according to the grading system of the respective college, e.g. numerical grades for law courses, letter grades for graduate courses. Refer to section on Grades for the grading scale acceptable toward meeting degree requirements. Cumulative GPA for law courses only will be carried until graduation, at which time both the graduate and the law cumulative GPAs will be shown on the permanent record.

PROFESSIONAL COURSES

801 Civil Procedure I (3) Binding effect of judgments, selecting proper court (jurisdiction and venue), ascer- taining applicable law, and federal and state practice.


803 Contracts I (3) Basic agreement process and legal protections afforded contracts; offer and acceptance, consideration, contract formation, the Statute of Frauds, unconscionability and other controls of promissory liability. Introduction to relevant portions of Articles 1 and 2 of the Uniform Commercial Code.

804 Contracts II (3) Contract formation and interpretation, duty of good faith; conditions, impracticability and frustration of purpose; remedies; third party beneficiaries; assignment and delegation. Considerable coverage of Articles 1 and 2 of the Uniform Commercial Code with respect to remedies, anticipatory repudiation, impracticability and good faith.

805 Legal Process I (3) Lawyer-like use of cases and statutes in prediction and persuasion. Analysis and synthesis of common law decisions; statutory interpretation; foundations of expository legal writing and legal research.

806 Legal Process II (3) Continuation of Legal Process I. Formal legal writing, appellate procedure, and oral advocacy.

807 Torts I (3) Intentional torts, defenses and privileges related to intentional torts; negligence: standard of care, assumption of risk, failure to take precautions, duty rules; and questions of joint and several liability.

808 Torts II (3) Vicarious liability and related concepts; strict liability for dangerous animals and abnormally dangerous activities; products liability; nuisance, defamation and invasion of privacy; economic torts: misrepresentation and interference with contract and prospective opportunities; immunity: those of government, governmental employees, charities and family members, and damages.

809 Criminal Law (3) Substantive aspects of criminal law: general principles applicable to all criminal conduct; specific analysis of particular crimes; defenses to crimes.

810 Property (4) Introductory course treating issues of ownership, possession, and title in the areas of: landlord-tenant relations; estates in land and future interests; co-ownership and marital property; real estate sales agreements and conveyances; title assurance and recording statutes; servitudes; and selected aspects of nuisance law, eminent domain and zoning.

812 Constitutional Law (4) Fundamental principles of American constitutional law: federalism, separation of powers, equal protection of law, and constitutional protection of other fundamental individual rights.

813 Evidence (4) Rules regulating introduction and exclusion of oral, written and demonstrative evidence at trials and other proceedings, including relevance, competence, impeachment, hearsay, privilege, expert testimony, authentication, and judicial notice. Coreq: 920 for students electing concentration in advocacy.

814 Legal Profession (3) Legal, professional and ethical standards applicable to lawyers. Not open to students who have taken 815.

815 Introduction to Advocacy and Professional Responsibility (3) Theory and morality of advocacy in adversarial system, and legal, ethical, and professional standards applicable to lawyers and especially lawyers as advocates.

818 Fundamental Concepts of Income Taxation (3) Introduction to basic statutory analysis, fundamental principles of federal individual income tax, and perva- sive income tax concepts and consequences. Federal concept of gross income, pattern of exclusions, exemptions and deductions from gross income used to arrive at tax base; special treatment of capital gains and losses; and rate structure.


821 Administrative Law (3) Analytical study of administrative decision-making processes and judicial review of administrative decisions; procedural standards for informal and formal administrative adjudication and rule-making (attention to formal administrative procedures); constitutional standards in administrative settings; and availability, scope and timing of judicial review of agency actions.

822 Legislation (3) Interpretation and drafting of statutes, legislative process, and legislative power; comparison of judicial views on legislative process with both realities of legislative process and applicable constitutional principles.

826 Introduction to Business Transactions (2) Non-technical introduction to accounting, finance, and the functions and relationships among various actors in business transactions. Analysis of business transactions with view toward needs of business clients. Not available for students with business background.

827 Business Associations (4) Legal problems associated with raising of capital by new and growing enterprises; securities transactions by promoters, officers, direc- tors and other insiders; regulation of public-held companies; litigation under Rule 10b-5 and other antifraud provisions, and provision of legal and other professional services in connection with business transactions. Recommended prereq or coreq: 827.

828 Corporate Finance (3) Legal issues arising in conjunction with corporate financial transactions: issu- ance of debt and various types of equity securities, distributions to shareholders, mergers and other cor- porate acquisitions. Legal valuation of corporate securities.

830 Securities Regulation (3) Basic structure of federal securities law. Legal problems associated with raising of capital by new and growing enterprises; securities transactions by promoters, officers, direc- tors and other insiders; regulation of public-held com- panies; litigation under Rule 10b-5 and other antifraud provisions, and provision of legal and other profes- sional services in connection with securities transac- tions. Recommended prereq or coreq: 827.


834 Antitrust (3) Federal antitrust laws; monopolization, price fixing, and other anticompetitive practices generally; government enforcement techniques and private treble damage suits.

840 Commercial Law (4) Basic coverage of most significant provisions of Uniform Commercial Code.
security interests in personal property (Art. 9 of U.C.C. and relevant Bankruptcy Code provisions); commercial paper, including checks, notes and other negotiable instruments (Art. 3 of U.C.C.); sales of goods, including coverage of portions of Art. 2 of U.C.C. not covered in Contracts.

842 Contract Drafting Seminar (2) Practical fundamentals of drafting contracts of different types.

843 Debtor-Creditor Law (3) Basic elements of federal bankruptcy law; claims, property of estate, automatic stay; proofs of claims; avoidance powers, assumption and rejection of contracts, priority of distributions, and distinction between liquidation and rehabilitation. Enforcing judgments outside of bankruptcy.

847 Advanced Constitutional Law (2-3) Study of issues in American constitutional law. Specific course offerings vary. Subjects include: constitutional structure of American governmental institutions, federalism, separation of governmental powers: relationship between legislative and executive branches, relationship among states and between states and federal government, and constitutional amendment process; state constitutional law, Tennessee constitution and differences between state and federal constitutional law; Bill of Rights and 14th Amendment to Constitution in a historical, constitutional, and statutory context; selected cases. Prerequisites are Bill of Rights and 14th Amendment. Prereq: 812. May be repeated under different topic.

848 Civil Rights Actions (3) Litigation to vindicate constitutional rights in private actions against the government and its officials as well as rights protected by other civil rights legislation: elements of cause of action under 42 U.S.C. sec. 1983; actions against federal government officials under the Bivens doctrine; institutional and individual immunities; relationship between state and federal courts in civil rights actions; and remedies for violations of constitutional and other civil rights.

849 Discrimination and the Law (3) Comparison of race, sex, and other forms of discrimination with respect to education, employment, housing, political participation, protection of civil liberties and freedoms, historical landmarks and current issues in discrimination law.

850 Supreme Court (3) History of Supreme Court and of procedures by which Court arrives at decisions; influences of justices' ideology and role of Court in political system.

854 Criminal Procedure I (3) Police practices and constitutional rights of persons charged with crimes; arrest; search and seizure; identification; interrogation and confessions; electronic eavesdropping; and right to counsel.

855 Criminal Procedure II (3) Pre- and post-trial procedures in a criminal case: bail; preliminary hearing; grand jury; prosecutorial discretion; discovery; speedy trial; plea bargaining; trial; doubts about guilt; and post-conviction relief. Federal Rules of Criminal Procedure.

859 Criminal Law Seminar (2) Advanced problems in criminal law and administration of justice. Prereq: 809.

862 Family Law (3) Survey of laws affecting formal and informal family relationships; premartial disputes; ante-nuptial contracts; creation of common law and formal marriage; legal effects of marriage; support obligations within family: legal separation, annulment, divorce, alimony, and property settlements; child custody and child support; abortion; illegitimacy.

863 Children and the Law (3) Legal relationships between children, families and state; juvenile justice; foster care; adoption; educational issues; special education; child abuse and neglect; health care and income maintenance; advocacy for children and families.

866 Environmental Law and Policy (3) Study, through case law and readings, of the relationship between law and environmental policy; the role of the courts in environmental cases; judicial review; environmental impact assessment; and legal limits on federal government action.

867 Environmental Law Seminar (2) Selected topics in environmental law.

873 American Legal History (3) Selected topics in American legal history.

877 Jurisprudence (3) Critical or comparative examination of legal theories, concepts, and problems: legal positivism; natural law theory; legal realism; idealism; historical jurisprudence; utilitarianism; Kantianism; sociological jurisprudence; policy science; and critical studies.

879 Law and Economics (3) Relationship between legal and economic thought; application of basic economic concepts to economic analysis; legal decisionmaking; scholarly support for and criticism of economic analysis of law. Designed for students with no undergraduate background in economics or mathematics.

881 Law and Literature (3) Reading literary works, development of philosophy and reading technique applicable to both law and life.

886 Public International Law (3) Law-creating processes and doctrines, principles and rules of law that affect states and other entities in international system.

887 International Business Transactions (2-3) Doing business with foreign persons and in foreign countries: acquisition and use of property within foreign country; regulation of international business transactions by international organizations and foreign governments; analysis of international conventions and laws of foreign countries affecting business and comparison of those conventions and laws with United States law.

895 Labor Relations Law (3) Political, social and economic influences in development of federal labor relations laws: employer-union relations, strike, union and employer unfair labor practices; strikes, lockouts, boycotts, and collective bargaining processes; enforcement of collective agreements; individual rights of employees; federal preemption and state regulation.

896 Employment Law (3) Legal regulation of employment relationship: legal, social and economic influences in employment; relationship, employment discrimination; legally prescribed minimum standards of compensation and safety; restraints on termination of employment; regulation of retirement systems.

898 Arbitration Seminar (2) Arbitration of labor agreements; judicial and legislative developments; nature of process; relationship to collective bargaining; selected arbitration problems on various topics under collective agreements; and role of lawyers and arbitrators. Prereq: 895.

899 Labor Relations Seminar (2) Selected labor relations law problems. Prereq: 895.

905 Advocacy Clinic (6) Supervised fieldwork requiring students to assume substantial responsibility for representing clients in all areas of criminal and civil law. Development of skill in fact investigation. Ways of resolving disputes without litigation. Not open to students who have taken 904 or 906.

907 Trial Advocacy (3) Study and development of trial skills; trial preparation, direct and cross-examination, expert witnesses, jury selection, instruction, testimony, and motion practice. Prereq: 920.

927 Interviewing, Counseling and Negotiation (3) Development of conceptual and practical frameworks for understanding interviewing, counseling and negotiation. Selection of different methods, strategies and perspectives from recent literature involving lawyering skills. Simulations and videotape critiques, drafting of documents. Relevant ethical issues and techniques of dispute resolution. Not open to students who have taken 927.

928 Case Development and Resolution (4) Theory and development of skills for case development and management; interviewing, counseling, and fact investigation. Ways of resolving disputes without litigation. Not open to students who have taken 927.

935 Gratuitous Transfers (4) Nature, creation, termination, and modification of trusts; fiduciary administration; intestate succession; administration, revocation, probate and contest of wills; creation and construction of various types of future interests; construction of limitations; application of the rule against perpetuities.


940 Land Finance Law (3) Financing devices: mortgages, deeds of trust and land contracts; problems of pre-foreclosure; mechanics', contractors', and materialmen's liens; probate and contest of wills; construction of various types of legal devices; construction of limitations; application of the rule against perpetuities.


943 Land Use Law (3) Private land use controls: nuisance, easements, real covenants, equitable servitude and home owner associations; public land use controls: zoning, subdivision controls, eminent domain, and regulatory takings.

950 Computers and Law (3) Impact of computers on law and practice of law: expert systems; legal skills required in building expert systems; common law office uses of computers; and computerized research. Preparation of lawyers to think effectively concerning use of computers. Prior computer experience not necessary.

956 Entertainment Law (3) Role of law and lawyer in entertainment industry. Course content varies. Music industry: music copyright laws; artist/musician relationships; recording contract negotiations; industry labor/management, and performing right organizations.

957 Law, Science and Technology (3) Legal implications of advanced technologies; adaptation of law to challenges posed by new kinds of knowledge and new ways of power on the nation. Examination of the relationship of scientific research, space law, legal issues relating to new information technologies, nanotechnologies, and others designated by instructor.

958 Women and The Law (3) Treatment and status of women in American legal system. Simulation of various legal actors, as family members, as participants in workforce, as targets of violence and as members of legal profession, introduction to current competing approaches to gender justice.
959 Intellectual Property (3) Intellectual property and related interests under federal and state law: patents; trademarks; trade secrets; copyright; right of publicity; unfair competition.


962 Law and Medicine Seminar (2) Effects of legal rules on delivery and quality of medical care; nature of medical malpractice, informed consent, medical education and specialization; hospital staff privileges; medical malpractice liability; standards of care, professional causation, defenses, and damages; protection of patient autonomy: consent, informed consent, conception and abortion, control of treatment, and death and dying; control of communicable diseases; organ transplantion and medical resource allocation.


973 Wealth Transfer Taxation (3) Taxation of gratuitous transfers of wealth during life (gift tax) and at death (estate tax) and of generation skipping transfers. Prereq or coreq 455.

975 Tax Theory (3) Method and purposes of government revenue collection through examination of economic and political theory; comparative analysis of various actual and proposed patterns of taxation: income tax, consumption tax, sales tax, and value-added tax. Required preparation of expository essay on aspects of tax theory chosen by student. Limited enrollment.

978 Transactional Tax Planning (3) Advanced study of tax avoidance and tax planning. Focus on business acquisitions, tax planning for financially troubled entities, and review of recent transactions involving cutting-edge tax planning and shaping changes in law. Limited enrollment. Prereq: 818 and 972.

980 Insurance (3) Types of insurance: life, property, health, accident and liability insurance; regulation of insurance industry; interpretation of insurance contracts; insurable interest requirement; conditions, warranties and representations; coverage and exclusions; duties of agents; excess liability; subrogation; and bad faith actions. Liability insurance: general liability, product liability, excess liability, personal liability, property damage: duties to defend, notice and cooperation issues, and conflicts of interest.

983 Products Liability (3) Scope of doctrine and theories of recovery; potential plaintiffs and defendants; statutory and contractual limitations on recovery; damages; causation; and defenses.

985 Workers’ Compensation (3) Workers’ Compensation system for compensating victims of work-related accidents and diseases: requirements for covered employers; work-related diseases and injuries; occupational diseases arising out of and in course of employment; causation; nature of medical disability; levels of benefits; exclusions of compensation remedy against employer and co-employees; and rights and liabilities of non-employers; administrative and procedural aspects of Workers’ Compensation system; and statutory law reform measures.

990 Issues in the Law (3) Selected topics. May be repeated.

991 Issues in the Law Seminar (2) Selected topics. May be repeated.

993 Directed Research (1-2) Independent research and writing under direct supervision of faculty member. Proposals must be approved by supervising faculty member and the Dean or the Dean’s designee. Maximum of once each semester during last two years of study. Prereq: Second-year standing.

994 Independent Study (1-4) Independent study under direct supervision of faculty member. Proposals must be approved by supervising faculty member and the Dean or the Dean’s designee. Maximum of once each semester during last three semesters of study.

996 Law Review (1) Performance of duties as staff member or editor of Tennessee Law Review. Responsible for assignment. Laboratory assignments in Tennessee Law Review Policy Manual: writing of casenote, comment or article, and/or performance of other assignment. Study of Tennessee Law Review. Completion of potentially publication comment or article for Tennessee Law Review satisfies expository writing requirement. May be repeated. S/NC only. (Does not count toward total number of elective upper division courses taken S/NC.)

997 Moot Court (1) Participation as member of faculty-supervised interscholarship moot court competition. May be repeated. S/NC only. (Will not count toward total number of elective upper division courses taken S/NC.)

998 Planning and Drafting Project (1) Preparation and completion of planning and drafting project under faculty supervision in conjunction with substantive courses when such planning and drafting option is provided by course instructor. May be repeated.

Life Sciences (College of Arts and Sciences)

MAJOR DEGREES

Life Sciences ......................... M.S., Ph.D.

Jeffrey Becker, Chair

The program leading to the M.S. and Ph.D. degrees in Life Sciences are interdepartmental and intercollegiate and are designed to augment offerings of individual departments in two concentrations: genome science and technology, and plant physiology and genetics. Students interested in these areas should contact either the Life Sciences chairperson or the director of the area of interest. Each concentration is administered separately and has unique admission requirements.

CONCENTRATIONS

Genome Science and Technology

The University of Tennessee-Take Ridge National Laboratory Graduate School of Genome Science and Technology (GST) is a unique and multidisciplinary program for full time graduate study leading to the M.S. or Ph.D. degree. The program focuses on developments in the biological and computational sciences relating to genome sequences, and the program is designed to take advantage of collaboration of The University of Tennessee and the Oak Ridge National Laboratory. Students will be trained in emerging areas of genome science, with emphasis on mammalian genomics, structural biology, proteomics, computational biology and bioinformatics, and bioanalytical technologies. Scientists from both campuses will participate in research projects pursued for either the M.S. or Ph.D. degrees are mentored jointly by a faculty member from each campus. A year-long introductory course in Genome Science and Technology focuses on inquiry conducted on a genome-wide scale. Laboratory rotations during the first year offer students hands-on experience in a variety of focus areas. Applicants are expected to have a background in the biological, physical or computational sciences. Requirements for admission are one year of general biology or the equivalent; two years of chemistry, including one year of general chemistry and one year of introductory organic chemistry with laboratory; one year of calculus; one year of physics; at least eight semester hours in cognate science in the program; a combined GRE score of 1800 for the verbal, quantitative, and analytical sections is highly desirable; three letters of recommendation; and a minimum grade point average of 3.0 out of 4.0. Coursework in genetics, cell biology, and related sciences is advantageous. Superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the program admissions committee. Deficiencies will be made up as a part of the courses taken by the individual student.

Requirements for the Ph.D. degree are satisfactory completion of the genome science and technology core courses, (Life Sciences 505, 515-16, 520-21, 540-41; Biochemistry and Cellular and Molecular Biology 511 and 512) and satisfactory completion of GST laboratory, satisfactory completion of formal advanced courses in the areas of the student’s interest, passing both written and oral comprehensive examinations, a dissertation reporting the results of original and significant scientific research (a minimum of 24 semester hours of course 600 is required), a final oral/examination on the dissertation, and a formal seminar presentation of the dissertation research. Participation in at least one seminar during each semester of residence after the first year is strongly recommended. The master’s degree requires a minimum of 30 semester hours of study approved by the student’s committee, a thesis, and an oral examination.

Plant Physiology and Genetics

This program provides the opportunity for intensive training and research experience in areas transgressing the usual boundaries of botany, biochemistry, and agricultural plant sciences. Solutions of problems concerning the interactions of physiology and genetics in applied and fundamental aspects of plant sciences are the focus.

Admission requirements are a Bachelor’s degree with a major in a biological, behavioral, or physical science; GRE (general) score; three letters of recommendation; and coursework including a year of calculus (differential and integral), one year of chemistry and a year of physics. Specific course deficiencies may be corrected during the first year.

Required courses are Life Sciences 510; Botany 521, 522; Biochemistry and Cellular and Molecular Biology 511, 512; Plant Sciences and Landscape Systems 471 or Ecology and Evolutionary Biology 560; Microbiology 410. The master’s degree requires a minimum of 30 semester hours of study approved by the student’s committee, a thesis, and an oral examination. The minimum requirements for the doctoral degree include at least 6 hours above the 600 level, 24 semester hours of course 600, courses approved by the student’s committee, a comprehensive examination, a doctoral dissertation, and a defense of dissertation.
Graduate Courses

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

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

503 Graduate Research Participation (3-12) Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated. Maximum 4 hrs.

505 Research Rotation (2) Laboratory rotations with faculty member on clearly defined projects. Written proposal and oral report. May be repeated. Maximum 6 hrs.

506 Computational Biology and Genome Informatics (3) Computational basis of nucleotide and protein sequence analysis; pairwise sequence comparison, multiple sequence alignments; gene and species trees. Genome annotation and feature finding. Computational protein structure analysis; threading homology modeling, ab initio methods. Prereq: Computer Science 140 Data Structures or consent of instructor.

510 Special Topics in Life Sciences (1-3) Specialization in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethology; plant, physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

515-16 Introduction to Genome Science and Technology I, II (1,1) 515—Introduction to research in genome science & technology concentration. 516—Science and ethics of practice of science. S/NC only.

520-21 Genome Science and Technology I, II (4,4) 520—Overview of genomics, advanced genetics principles, computational biology and bioinformatics. 521—Computational biology and informatics, analytical technologies and special techniques.

540-41 Colloquium (1,1) Overview of methods and models for understanding supply chain flows and processes. Introduction to management strategies and techniques applicable to design of systems in logistics and operations processes. Prereq: Business Administration 511, 512, and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC or letter grade.

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

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

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

595-96 Special Topics in Genome Science and Technology (1-3) Tutorials or lectures in variety of special topics to be chosen by instructor. May be repeated. Maximum 4 hrs.

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

610 Advanced Topics in Life Sciences (1-3) Topics vary. May be repeated. Maximum 6 hrs.

695-96 Advanced Topics in Genome Science and Technology (1-3) Tutorials or lectures on variety of advanced topics to be chosen by instructor. May be repeated. Maximum 4 hrs.

Management

(College of Business Administration)

Major

Business Administration .............. MBA, Ph.D.

Oscar Fowler, Head

Professors:

Boling, Ronald W. (Emeritus), Ph.D... Stanford

Dewhurst, H. Dudley (Emeritus), Ph.D... Texas

Gilbert, Kenneth C., Ph.D. .......... Pennsylvania

James, Lawrence R. (Pilot Chair of Excellence), Ph.D. ..................... Tennessee

Judge, William Q., Ph.D. ............. North Carolina

Keally, A. H. (Emeritus), MBA ... Pennsylvania

Ladd, Robert T., Ph.D. ................. Georgia

Larsen, John M., Jr. (Emeritus), Ph.D. Purdue

Miller, Alex (W. B. Stokely Prof.), Ph.D. ................. Washington

Neel, C. Warren, Ph.D. .................. Alabama

Noon, Charles E., Ph.D. ............... Michigan

Rentsch, J. R., Ph.D. .................... Maryland

Rush, Michael C., Ph.D. ............... Akron

Srinivasan, M. M., Ph.D. ............. Northwestern

Stahl, Michael J., Ph.D. ............... Pennsylvania

Whitlock, G. H. (Emeritus) (Distinguished Prof.), Ph.D. ................. Tennessee

Wooehr, D. J., Ph.D. .................... New York

Associate Professor:

Bowers, Melissa R., Ph.D. ............. Clemson

Edirisinghe, Charanka P., Ph.D. .......... British Columbia

Elkonov, Detelin S., Ph.D. ......... MT

Fowler, Oscar S., Ph.D. ............... Georgia

Haley, Usha C. V., Ph.D. .......... New York

Assistant Professor:

Smith, Anne D., Ph.D. ............... North Carolina

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Operations Management

Minimum course requirements: 540, 541, and one course from the following: Management Science 526, 551, Statistics 566, Industrial Engineering 522, 526, or an applicable course approved by designated faculty.

Ph.D. Concentration: Management

Minimum course requirements are: For operations management -- 541 and 542; two semesters of 640 (may be repeated for credit); one additional semester of approved doctoral seminar work. For strategic management -- 610, 611, 612, 613.

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

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

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

511 Organizational Theory: Integrated Structure and Behavior (3) Cases, group projects, discussion; organizational theories, organizational effectiveness; contextual factors of organizations; environment, size, technology, organizational structure configurations, organization design; social influences on organization effectiveness: motivation, leadership, group behavior, intergroup relations, organization change and development.

521 Human Resource Management (3) Personnel functions and human resources management. Community relations, recruiting, selection, training, performance evaluation, wage and salary administration, legal framework as it affects personnel.

531 Management of Technology-Based Organizations (3) Role of technology and innovation in formulation and implementation of strategy. Management of research and development function and coordination with other functions. Management of scientists and engineers.

540 Logistics and Operations Management (3) Analysis of methods and models for understanding supply chain flows and processes. Introduction to management strategies and techniques applicable to design of systems in logistics and operations processes. Prereq: Business Administration 511, 512, and/or consent of instructor. (Same as Logistics and Transportation 510.)

541 Operations Management (3) Techniques applicable to design of systems in operations planning and control in manufacturing and service industries. Modeling real-world systems through problem definition, supporting data structure design, model design, solution, implementation, and maintenance.

551 Management of New Ventures (3) Integration of various functional disciplines and their application to general management of ventures formed both within larger corporations and independently. Preparation of a venture plan, case analysis.

571 International Management (3) Analysis of environment of international business firms and impact of internal and external factors on managerial decisions.

581 Environmental Management (3) Managerial frameworks for addressing environmental issues. Most pressing environmental challenges; options compatible with sustained business performances. Cases, field projects, research papers.

593 Directed Independent Study (1-3) Topic of mutual interest. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hrs. S/NC or letter grade.

595 Selected Topics in Current Management Issues (3) In-depth consideration of current issues. Managerial impact of emerging topics. Prereq: Consent of instructor.

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

601 Research Methods (3) Seminar covering broad research issues; research process as applied to study of strategic management. Literature and examples of research. Research proposal.

610 Seminar in Advanced Organization Theory (3) Analysis of functioning of complex organizations. Classical and open systems models, organization growth and change, organizational effectiveness and design of complex organizations.

611 Seminar in Strategic Management I (3) Analysis of concepts and research in strategic management.

612 Seminar in Strategic Management II (3) Analysis of concepts and research in strategic management.

613 Seminar in Strategic Management III (3) Review and analysis of important books and monographs in Management
strategic management. Understanding evolution of thought and emergence of distinct paradigms.

Management Science
(College of Business Administration)

MAJORS DEGREES
Management Science .................. M.S., Ph.D.
Kenneth C. Gilbert, Chairperson

Committee:
Bowers, Melissa R., Management
Bozdogan, Hampsarum, Statistics
Edirisinghe, Chanaka P., Management
Fowler, Oscar S., Management
Gilbert, Kenneth C., Management
Leitnaker, Mary G., Statistics
Noon, Charles E., Management
Ralston, Bruce A., Geography
Srinivasan, Mandyam M., Management

THE MASTER'S PROGRAM
The M.S. program in Management Science is designed as preparation for a career in the application of quantitative techniques for the solution of complex problems. The program's flexibility also makes it appropriate as preparation for doctoral study in Management Science.

Management Science coursework will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program requires concentrated study in a supporting area.

Supporting areas are available in other departments of the College of Business Administration as well as in computer science, public administration, geography, health, and other areas, subject to approval by the Management Science Committee.

Admission Requirements
The master's program requires three applicant recommendation forms and the GRE or GMAT. Applications are encouraged from all majors, but a mathematics background equivalent to the completion of at least two years of college calculus and proficiency in a computer language is required. The program is designed to be completed in four semesters by full-time students. However, students may start the program in any semester and may pursue an M.S. degree program in Management Science on a part-time basis.

Course Requirements
Core Requirements
Management Science 531, 532, 533, 534, and 691 or 692
Statistics 563
Applied specialization area (approved by advisor) 9
Technical elective: 6
Statistics (500 level or above as approved by advisor) 9
Mathematics (400 level or above as approved by advisor) 9
Industrial Engineering (400 level or above as approved by advisor) 9
Other elective (as approved by advisor) 9
Electives selected from mathematics, statistics, computer science, business, management science, industrial engineering, or other approved area 9
Total 40

A thesis option is available to qualified students. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student's first semester and must approve all courses on a semester-by-semester basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. The total course load will remain 40 hours for all students.

THE DOCTORAL PROGRAM
The Ph.D. program in Management Science is designed to prepare students for research related to the application of mathematical tools to complex decision making. Three primary objectives of the program are:

1. to provide, through management science coursework, a thorough knowledge of common Management Science/Operations Research mathematical models and their uses;
2. to provide sufficient advanced study in a supporting area to qualify the graduate for a joint faculty position in the supporting area and management science. The candidate may choose from the business functional areas (accounting, finance, marketing, management, and transportation and logistics) or other disciplines, (e.g., computer science, forestry, ecology, and public administration);
3. to develop in the student, through coursework in mathematics, statistics and computer science, a high degree of mathematical maturity to enhance a potential career in management, research, or teaching.

Admission Requirements
The doctoral program requires three applicant recommendation forms and the GRE or GMAT, in addition to the Graduate Council's requirements.

Coursework
A minimum of 48 semester hours of coursework taken for graduate credit (exclusive of thesis or dissertation) is required. Some of this may be the coursework from a master's program although a master's is not a prerequisite for the doctorate. The candidate must complete a minimum of 24 semester hours at The University of Tennessee, at least 6 of which must be at the 600 level. Both of these requirements are also exclusive of thesis or dissertation credits. Entering students who have completed graduate studies in applicable fields will be granted course credits for work which is equivalent to required courses in the program.

The program includes approximately 16 to 20 semester hours of coursework in the applied area.

Qualifying Examinations
The student must demonstrate mastery of probability theory and statistical inference, Statistics 563, 564, by passing a written qualifying examination.

Mastery of 12 to 14 semester hours in mathematics coursework must be demonstrated by passing a written qualifying examination. Topics normally included include numerical analysis, either Mathematics 471, 472, 453, and 571, or 571-572, and real analysis, Mathematics 445-446. Other options may be approved. In exceptional circumstances, the faculty will consider waiving the mathematics and/or statistics qualifying examinations.

These requirements generally are completed by the end of the first year of the program.

There is no foreign language requirement.

Comprehensive Examination
Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written comprehensive examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis. Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.

Research and Dissertation
The student must complete 24 semester hours of Management Science 600: Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate. This effort, which is beyond the minimum 48 hours of coursework, normally is completed in the third year of the program.

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

PREREQUISITES FOR MANAGEMENT SCIENCE COURSES
The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose prior coursework does not match the prerequisites are encouraged to
seek the instructor's guidance and consent to enroll.

**GRADUATE COURSES**

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

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

526 Advanced Applications of Systems Modeling and Simulation (3) (Same as Industrial Engineering 526.)

531 Mathematical Programming (3) Linear programming solution procedures, duality, sensitivity, and parametric analysis, linear-fractional, piecewise-linear, separable and integer programming, transportation linear programs. Prereq: Fundamentals of matrix algebra. (Same as Industrial Engineering 523.)

532 Stochastic Models in Management Science (3) Discrete-time Markov chains, Poisson processes, continuous-time Markov chains, renewal theory, and queuing theory. Prereq: Statistics 563 and Mathematical Analysis or consent of instructor. Sp

533 Computational Mathematical Programming (3) Computational aspects of mathematical programming models, in particular for large systems. Prereq: S31 and proficiency in computer language.

534 Management Science Methods in Business (3) Application of methods from 531, 532, and 533 to real world problems in business/industry.

551 Leveraging Information Through Descriptive and Prescriptive Modeling (3) Concepts and tools for emulating business operations (descriptive modeling) and for determining optimal operational or tactical strategies (prescriptive modeling). Visualization, optimization, and simulation concepts reinforced through hands-on experience with technologies: geographic information systems (GIS), spreadsheet-based models, simulation packages, and supply chain optimization software. (Same as Information Management 522.)

593 Management Science Problems (1-6) Directed study on subject of mutual interest. E

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

621 Network Flows (3) Treatment of network optimization algorithms, transportation and transshipment models and primal-dual and primal-based tree methods. Prereq: S31 or equivalent.

631 Integer Programming (3) Theoretical and computational aspects of linear programming with integer variables, branch and bound, cutting plane, and group theoretic algorithms. Prereq: S31 or equivalent.

651 Nonlinear Optimization (3) Kuhn-Tucker theory in nonlinear programming, solution procedures for constrained and unconstrained nonlinear programs, search techniques, quadratic programming, duality and sensitivity analysis. Prereq: S31 or equivalent, proficiency in computer language. (Same as Industrial Engineering 602.)

681 Special Topics (3) Prereq: S31, S32 and consent of instructor. May be repeated. Maximum 9 hrs.

691-92 Management Science Seminar (1, 1) Subjects selected from current literature. S/NC only.

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**Marketing, Logistics and Transportation**

(College of Business Administration)

**MAJOR DEGREES**

Business Administration ............... MBA, Ph.D.

Robert B. Woodruff, Head


**BUSINESS ADMINISTRATION CONCENTRATIONS**

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

**MBA Concentration:** Logistics and Transportation, Marketing.

Minimum course requirements for logistics and transportation—510 and two courses approved by the logistics faculty. For marketing—520 and two courses approved by the marketing faculty.

**Ph.D. Concentration:** Logistics and Transportation, Marketing.

Minimum course requirements for logistics and transportation—611, 612, 614, 615. For marketing—611, 612, 613, 614, 615, and 616.

**Logistics and Transportation**

**GRADUATE COURSES**

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

510 Principles of Management for Non-MBA Students (3) For students from other disciplines interested in obtaining knowledge of marketing discipline at graduate level.

520 Marketing and Customer Value (3) Frameworks, techniques, and processes required for customer relationship management and demand planning in organizations. Twin problems of analyzing markets and customers and translating these analyses into actionable marketing strategies. Prereq: Business Administration 511, 512, and 513 or consent of instructor.

530 MBA Marketing Concentration (6) Product management: Complex, interdisciplinary nature of product development and product management. Strategic issues during product life cycle, from idea conception to product development to commercialization to eventual product dismissal. Integrated communications: Strategies and tactics associated with communicating value to customers. One-to-one marketing approaches, role of personal selling in communication mix, and advertising and promotions management. Global marketing management: Cross-national forces that enable firms to design and maintain competitive marketing and supply chain networks across multiple geographic locations. Prereq: 522 and Business Administration 511, 512, 513, and 514.

546 Logistics and Supply Chain Strategy (3) Development of strategy for logistics systems and supply chain processes. Executive-level integration of logistics strategy with marketing, production, finance, and other decision areas. Prereq: 510 and Business Administration 511, 512, 513, and 514.


593 Independent Study (3-6) Directed research and study. Prereq: Consent of instructor. May be repeated.

599 Special Topics Seminar (3-6) Seminar designed to study specific current problem areas in logistics and transportation. Topic announced prior to offering. Prereq: Consent of instructor. May be repeated.

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

611 Seminar in Theoretical Foundations (3) (Same as Marketing 611.)

612 Research Methods I (3) (Same as Marketing 612.)

614 Seminar in Evolution of Logistics Thought (3) Survey of concepts, frameworks, theory, research issues, and empirical research in content areas related to logistics and supply chain management. Conceptual foundations, issue controversies, and future directions.

615 Seminar in Logistics and Transporation (3) Analysis of contemporary models and methodologies in logistics and transportation research, topical coverage at discretion of instructor.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and faculty. May be repeated. Prereq: Consent of instructor.

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**Marketing**

**GRADUATE COURSES**

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

510 Principles of Management for Non-MBA Students (3) For students from other disciplines interested in obtaining knowledge of marketing discipline at graduate level.

520 Marketing and Customer Value (3) Frameworks, techniques, and processes required for customer relationship management and demand planning in organizations. Twin problems of analyzing markets and customers and translating these analyses into actionable marketing strategies. Prereq: Business Administration 511, 512, and 513 or consent of instructor.

530 MBA Marketing Concentration (6) Product management: Complex, interdisciplinary nature of product development and product management. Strategic issues during product life cycle, from idea conception to product development to commercialization to eventual product dismissal. Integrated communications: Strategies and tactics associated with communicating value to customers. One-to-one marketing approaches, role of personal selling in communication mix, and advertising and promotions management. Global marketing management: Cross-national forces that enable firms to design and maintain competitive marketing and supply chain networks across multiple geographic locations. Prereq: 522 and Business Administration 511, 512, 513, and 514.

546 Logistics and Supply Chain Strategy (3) Development of strategy for logistics systems and supply chain processes. Executive-level integration of logistics strategy with marketing, production, finance, and other decision areas. Prereq: 510 and Business Administration 511, 512, 513, and 514.


593 Independent Study (3-6) Directed research and study. Prereq: MBA Core and consent of instructor. May be repeated. Maximum 6 hrs.

599 Special Topics Seminar (3) Topics vary: market forecasting, market segmentation, services marketing, marketing channels, and related issues. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

600 Doctoral Research and Dissertation (3-15) P/NP only. E
611 Seminar in Theoretical Foundations (3) Theoretical foundations and frameworks common to business research. Historical and philosophical science perspectives. (Same as Logistics and Transportation 611.)

612 Research Methods I (3) Research process: philosophical foundations, problem formulation, grounded theory, qualitative methods and analysis, measurement, sources of error, experimental design and analysis, and survey design and analysis. (Same as Logistics and Transportation 612.)

613 Research Methods II (3) Practical application of data analysis techniques. Experience with sophisticated statistical techniques, using real marketing databases.

614 Contemporary Marketing Thought (3) Representative topics comprising content of marketing knowledge: macromarketing, markets, channels, and competitor behavior; marketing strategy; marketing mix tools; and ethical issues in marketing. Examination of research for contributions to advancing knowledge and opportunities for new research.

615 Seminar in Buyer Behavior Research (3) Theoretical perspective and research processes describing people in their roles as buyers, users, and evaluators of goods and services. Important research issues and practical applications related to buyer behavior.

616 Measurement (3) Measurement and measurement process: design and development of tools, process of testing, and determination of reliability and validity.

617 Special Topics (3) Topics vary: marketing strategy, advanced consumer behavior, influence and persuasion theory and strategy, pricing issues, international marketing issues, and nonprofit organization marketing issues.

693 Independent Study (1-6) Directed research on subject of mutual interest to student and staff member. May be repeated.

Materials Science and Engineering

(College of Engineering)

MAJORS DEGREES
Materials Science and Engineering M.S., Ph.D.
Polymer Engineering ........................................... M.S., Ph.D.

Raymond A. Buchanan, Interim Head

Professors:
Benson, R. S., Ph.D. .................... Florida State
Brooks, C. R. (Emeritus), Ph.D. .... Tennessee
Buchanan, Raymond A. (Liaison), PE, Ph.D. ............................. Pennsylvania
Clark, Edward S. (Emeritus), Ph.D. .... California
Dahotre, N. B. (UTSI), Ph.D. .......... Michigan State
Dahotre, N. B. (UTSI), Ph.D. .......... Michigan State
Fellers, J. F. (Emeritus), Ph.D. ................. Akron
George, Easo P., Ph.D. .................. Pennsylvania
Hansen, Marion G., Ph.D. ............... Wisconsin
Liaw, P. K. (Rachelle Chair of Excellence), Ph.D. ............................ Northwestern
Lowndes, Douglas H., Ph.D. .............. Colorado
Lundin, Carl D., Ph.D. ................. Rensselaer
McHargue, Carl J., Ph.D. ............. Kentucky
Oliver, Belinda (Emeritus), Ph.D. .... Pennsylvania
Pedraza, A. J., Ph.D. ......... La Plata (Argentina)
Pharr, George M., Ph.D. ............... Stanford
Phillips, Paul J., Ph.D. ................. Liverpool (UK)
Spruiell, Joseph E., Ph.D. ............. Tennessee
Stansbury, E. E. (Emeritus), Ph.D. .... Cincinnati

Assistant Professors:
Choo, Hahn, Ph.D. ...................... Illinois IT
Klit, Kevin, Ph.D. ....................... Delaware
Rack, Philip D., Ph.D. .................. Florida
Ravon, Claudia J., Ph.D. .............. Arizona

Graduate programs are offered leading to the degrees of Master of Science and Doctor of Philosophy in Materials Science and Engineering or Polymer Engineering. Both the Materials Science and Engineering and Polymer Engineering programs are flexible and interdisciplinary in nature. Students may be admitted from a wide range of disciplines: these include physics, chemistry, chemical engineering, mechanical engineering, electrical engineering, materials engineering, and engineering science programs.

Areas of concentration within the Materials Science and Engineering degree program include metallurgy, polymers, and materials. Specializations include, but are not limited to: ceramics; composites; electronic materials; physical, biological, and mechanical properties of materials; and composite materials.

Areas of concentration within the Polymer Engineering degree program include polymer morphology; mechanical, physical and chemical properties of polymers; and composite materials.

THE DOCTORAL PROGRAM

Thesis Option
A total of 30 semester hours is required for the M.S. degree in either Materials Science and Engineering or Polymer Engineering. Additional requirements include:
1. A major consisting of 12 semester hours of graduate courses in materials science and engineering or polymer engineering. The materials science and engineering major must include 511, 512, 515, and 516 for the metallurgy concentration; 511, 512, 540, and 541 for the polymers concentration; and 511, 512, and two graduate specialization courses approved by the student's faculty committee for the materials concentration. The polymer engineering major must include 540, 541, 543, 546, 549, and 550 unless similar material has been covered in prior coursework.
2. Additional courses up to 12 hours total in related areas.
4. Satisfactory performance on a comprehensive oral examination administered by the faculty committee.

Non-Thesis Option
Any candidate may apply for a non-thesis option. Upon acceptance, a supervisory committee of three will be appointed. At least two members of the committee will be from the faculty in the major area, either materials science and engineering or polymer engineering. The requirements for completion of the non-thesis option are as follows:
1. Completion of a total of 30 hours of graduate coursework. At least 18 of those hours must be in the department, and at least 12 hours may be in related areas. Three hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements. The materials science and engineering major and the polymer engineering major must include the same courses required for the thesis option. The candidate's degree program must be approved by the faculty committee.
2. Satisfactory completion of a culminating experience such as MSE 580 (Critical Review).
3. Satisfactory performance on a comprehensive examination administered by the faculty committee.

THE DOCTORAL PROGRAM

After one year in residence and with the approval of the faculty, a student may proceed directly to the doctoral program without completion of a master's degree. Departmental requirements for completion of the doctoral degree are the same as for the non-thesis option. For students proceeding directly to the Ph.D. from the baccalaureate degree: 48 graduate course credit hours with at least six hours of 600-level courses. Six hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements. At least 30 credit hours must be courses taught in the department. The materials science and engineering major and the polymer engineering major must include the courses required for the master's program.

b. For students having a master's degree in Materials Science and Engineering, Polymer Engineering, or Metallurgical Engineering: 18 additional graduate course credits with at least six hours of 600-level courses. Three hours of MSE 503 or 504, Seminar, graded Satisfactory/No Credit, may be counted toward degree requirements. At least 12 credit hours must be courses in the department.

2. Students must complete at least 24 hours of dissertation credits.
3. Satisfactory performance on a comprehensive examination, usually given in two parts, and covering such topics as materials science and engineering, metallurgical or polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.
4. Active participation in graduate seminars conducted by the department. Resident students must register for the appropriate 503 or 504 every semester offered.

GRADUATE COURSES

405 Structural Characterization of Materials (4) X-ray diffraction and fluorescence; scanning and transmission electron microscopy; microanalytical techniques.

421 Mechanical Behavior of Materials II (3) Description of stress and strain; linear elastic constitutive equations, isotropic and anisotropic moduli in various materials; yield criteria; brittle fracture; crazing; plastic strain constitutive equations, forming operations and

516 Mechanical Metallurgy (3) Deformation and fracture of metals and alloys: dislocation theory, strengthening mechanisms (dislocations, slip, twinning, and cleavage), work hardening, effect of temperature, loading rate effects; effect of ordering and solid solution alloying; polycrystalline behavior in terms of single crystal deformation mechanisms; texture formation. Prereq: 501, 320 or consent of instructor.

522 Defects in Crystals (3) Analytical and experimental analysis of defect interactions in solids. Prereq: 421 or consent of instructor.

523 Plastic Deformation of Metals (3) Geometry and mechanics of single crystal deformation; slip, twinning, and cleavage, work hardening, effect of temperature, loading rate effects; effect of ordering and solid solution alloying; polycrystalline behavior in terms of single crystal deformation mechanisms; texture formation. Prereq: 501, 320 or consent of instructor.

524 Metallurgical Thermodynamics (3) Applications of chemical thermodynamics to metallurgical problems: refining, oxidation, surface treatments, alloy systems. Prereq: 570 or equivalent.

525-26 Welding Metallurgy (3,3) Welding processes: physical metallurgy of welding; phase transformations; heat flow; residual stresses; theories of hot cracking; void cracking and porosity formation; applications to process utilization.

528 Ceramic Matrix Composites: Material and Mechanics (3) (Same as Engineering Science 528.)

31 Advanced Corrosion (3) Analyses of corrosion processes in terms of polarization measurements and Pourbaix diagram. Influence of environmental and mechanical factors contributing to pitting, crevice, fretting, wear, fatigue and stress corrosion. Prereq: 470 or consent of instructor.


541 Polymer Rheology (3) Deformation and flow of polymeric materials. Development of empirical models; linear viscoelasticity and strain rate behavior; material functions, temperature dependence and rheometry with applications to synthesis and processing. Elementary kinetic theory of elastic and plastic materials. Chemical Engineering 424 Fluid Flow and Heat Transfer or equivalent. (Same as Chemical Engineering 541.)

542 Further Topics in Polymer Processing (3) Description and analysis of selected polymer processing operations. Prereq: 541.


544 Polymer Solution Thermodynamics and Characterization (3) Theories of solutions, statistical thermodynamics. Characterization, treatment of chromatography, viscosity, light scattering and osmotic pressure. Prereq: Undergraduate physical chemistry.

546 Mechanical Properties of Solid Polymers (3) Types of mechanical behavior; Hookian and rubber elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; viscoelastic behavior; introduction to mechanical properties of polymeric composites.

549-50 Laboratory Methods in Polymer Engineering (1,2) Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, calorimetry, microscopy, mechanical properties of solid polymers, polymer processing operations, Correq: 540 or consent of instructor. 549-S/NC only.

560 Principles of Ceramic Processing (3) Treatment of ceramic processing; raw materials preparation and characterization; powder consolidation; drying, firing, sintering, and sintering techniques, mechanisms and kinetics. Prereq: 360 or equivalent.

571 Electron Microscopy (3) Operation of electron microscope; kinematical and dynamical diffraction theories; structure determination; analysis of lattice defects. Prereq: 405 or equivalent.

572 X-Ray Diffraction (3) Symmetry of crystals, space group theory, reciprocal lattice and application to definition of structures; powder and single crystal x-ray techniques; introduction to crystal structure determination; orientation of crystals; application to inorganic, metallic and polymer structures.

576 Special Topics in Materials Science and Engineering (3) Topics of current significance and interest. Prereq: Consent of instructor. May be repeated.


600 Doctoral Research and Dissertation (3-15) Pr. Only. E

621-22 Theoretical Metallurgy (3,3) Topics in solid state physics as applied to metallurgy: introduction to quantum theory, specific heats, electron theory of solids, electrical and thermal conductivity, magnetic properties, theories of alloy formation. Prereq: Consent of instructor.

623 Solidification and Crystal Growth (3) Theories of solidification, fluid flow effects, magnetohydrodynamics of incompressible fluids, growth stabilization, thermodynamic applications, rapid solidification, metastability. Prereq: Consent of instructor.

625 Materials Lifetime Science and Engineering I (3) Fundamentals of aqueous and high-temperature corrosion and fatigue; methods of materials lifetime modeling. Prereq: 531 and 532, or consent of instructor.

626 Materials Lifetime Science and Engineering II (3) Interactions between corrosion and fatigue at ambient and high temperatures; lifetime modeling of materials continually subjected to corrosion and fatigue. Prereq: 625.

627 Case Studies in Materials Lifetime Science and Engineering (3) Studies of, and participation in, industrial analyses of lifetimes of structural materials subjected to service environments. Prereq: 531 and 532, or consent of instructor.

628 Graduate Seminar in Materials Lifetime Science and Engineering (1) Seminars by students, faculty, and visiting scholars on materials lifetime science and engineering; processes, mechanisms, and materials lifetime modeling. Prereq: 531 and 532, or consent of instructor. S/NC only.

641 Advanced Rheology and Viscoelastic Theory (3) Continuum mechanics, formulation of viscoelastic theories for describing deformation and flow of polymeric materials. Application to polymer processing problems. Recommended for M5 candidates working in polymer science.

642 Advanced Topics in Polymer Processing (3) Application of theories of rheological behavior and of structure development to analysis of polymer processing operations. Prereq: 541. (Same as Chemical Engineering 505.)

643 Phase Transformations in Polymers (3) Glass transition and glassy state; annealing of polymeric glasses; crystallization of polymers; nucleation, growth and morphology; secondary nucleation theory; solidification of copolymers; crystallization under stress. Prereq: 543.

671 Quantitative Microscopy (3) Principal acoustic, optical, x-ray, neutron and field-ion techniques for examination of microstructures of materials. Prereq: 405.
Chen, Xia, Ph.D. .................................................................................. Case Western

Assistant Professors:

Kimble, K. R. (UTSI), Ph.D. ................................................................. Ohio State

Guan, Bo, Ph.D. ................................................................. Massachusetts

Gavrilets, Sergey, Ph.D. ......................................................... Moscow State

Freire, A., Ph.D. ....................................................... Princeton

Associate Professors:

Wade, W. R., Ph.D. ................................................................. California (Riverside)

Thistlethwaite, M. B., Ph.D. ......................................................... Manchester

Sundberg, C., Ph.D. ................................................................. Wisconsin

Soni, K. (Emeritus), Ph.D. ......................................................... Oregon State

Rosinski, J., Ph.D. ............................................................... Wroclaw

Reddy, K. C. (UTSI), Ph.D. ............................................................... Indian IT

Plaut, Conrad, Ph.D. ............................................................... Maryland

McConnel, R. M. (Emeritus), Ph.D. ................................................. Duke

Miller, D. (Emeritus), Ph.D. ................................................. Michigan

Mulay, S., Ph.D. ................................................................. Purdue

Plaut, Conrad, Ph.D. ................................................................. Maryland

Rajput, B. S., Ph.D. ......................................................... Illinois

Reddy, K. C. (UTSI), Ph.D. ............................................................... Indian IT

Richter, Stefan, Ph.D. ................................................................. Michigan

Rosinski, J., Ph.D. ............................................................... Wrocław

Schaetzel, P. W., Ph.D. ................................................................. Maryland

Serbin, Steve (Emeritus), Ph.D. .................................................. Cornell

Simpson, H., Ph.D. .............................................................. Cal Tech

Soni, K. (Emeritus), Ph.D. ................................................................. Oregon State

Sonju, P., Ph.D. ................................................................. Oregon State

Stallman, F. W. (Emeritus), Ph.D. ................................................. Giessen

Stephenson, K. R., Ph.D. ....................................................... Wisconsin

Sundberg, C., Ph.D. ................................................................. Wisconsin

Thistlethwaite, M. B., Ph.D. ......................................................... Manchester

Wade, W., Ph.D. ................................................................. California (Riverside)

Wagner, C. G., Ph.D. ................................................................. Duke

Mathematics

(College of Arts and Sciences)

MAJOR DEGREES

Mathematics ......................................................... M.M., M.S., Ph.D.

John B. Conway, Head

Professors:

Alexiades, V., Ph.D. ......................................................... Delaware

Anderson, D. F., Ph.D. ................................................................. Chicago

Bradley, John S. (Emeritus), Ph.D. ............................................. Iowa

Carewright, J. H. (Emeritus), Ph.D. .................................................. Louisiana State

Clark, C. E. (Emeritus), Ph.D. ......................................................... Louisiana State

Conway, J. B., Ph.D. ................................................................. Louisiana State

Daverman, Robert J., Ph.D. ......................................................... Wisconsin

Dobbs, D. E., Ph.D. ................................................................. Cornell

Dyak, J. Ph.D. ................................................................. Warsaw

Frandsen, Henry (Emeritus), Ph.D. ............................................. Illinois

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

Hinton, D. B., Ph.D. ................................................................. Tennessee

Husch, L. S. (Emeritus), Ph.D. ......................................................... Florida State

Johannson, K., Ph.D. ................................................................. Bielefeld

Jordan, G. Samuel, Ph.D. ................................................................. Wisconsin

Karakashian, O., Ph.D. ................................................................. Harvard

Kuperstorm, B. A. (UTSI), Ph.D. ......................................................... MT

Lenhart, S., Ph.D. ................................................................. Kentucky

McConnel, R. M. (Emeritus), Ph.D. ................................................. Duke

Mathews, H. T. (Emeritus), Ph.D. ........................................ Tulane

Miller, D. (Emeritus), Ph.D. ............................................................. Michigan

Mulay, S., Ph.D. ................................................................. Purdue

Plaut, Conrad, Ph.D. ................................................................. Maryland

Rajput, B. S., Ph.D. ......................................................... Illinois

Reddy, K. C. (UTSI), Ph.D. ............................................................... Indian IT

Richter, Stefan, Ph.D. ................................................................. Michigan

Rosinski, J., Ph.D. ............................................................... Wrocław

Schaetzel, P. W., Ph.D. ................................................................. Maryland

Serbin, Steve (Emeritus), Ph.D. .................................................. Cornell

Simpson, H., Ph.D. .............................................................. Cal Tech

Soni, K. (Emeritus), Ph.D. ................................................................. Oregon State

Sonju, P., Ph.D. ................................................................. Oregon State

Stallman, F. W. (Emeritus), Ph.D. ................................................. Giessen

Stephenson, K. R., Ph.D. ....................................................... Wisconsin

Sundberg, C., Ph.D. ................................................................. Wisconsin

Thistlethwaite, M. B., Ph.D. ......................................................... Manchester

Wade, W., Ph.D. ................................................................. California (Riverside)

Wagner, C. G., Ph.D. ................................................................. Duke

Associate Professors:

Collins, Charles R., Ph.D. ......................................................... Minnesota

Feng, Xiaobing, Ph.D. ................................................................. Purdue

Freire, A., Ph.D. ................................................................. Princeton

Gavrilets, Sergey, Ph.D. ......................................................... Moscow State

Guan, Bo, Ph.D. ................................................................. Massachusetts

Kimble, K. R. (UTSI), Ph.D. ......................................................... Ohio State

Kuo, Y., Ph.D. ................................................................. Cincinnati

Xiong, Jie, Ph.D. ................................................................. North Carolina

Assistant Professors:

Chen, Xia, Ph.D. ................................................................. Case Western

Davis, Reid, Ph.D. ................................................................. Tennessee

Denzler, Johannes, Ph.D. ......................................................... ETH Zurich

Dwyer, Jerry, Ph.D. ................................................................. Ireland

Kachi, Yasuyuki, Ph.D. ................................................................. Tokyo

Matthews, Gretchen, Ph.D. ......................................................... Louisiana State

Schulze, Timothy, Ph.D. ......................................................... Northwestern

Todorova, Grozdena, Ph.D. ......................................................... Moscow State

Tzermias, Pavlos, Ph.D. ................................................................. California


The Mathematics Department has three graduate degrees: (1) the Master of Mathematics degree, intended primarily for teachers, (2) the Master of Science degree, designed to prepare students for industrial employment and for teaching, and (3) the Doctor of Philosophy degree, designed to prepare students for industrial employment and for college and university teaching and research. Contact the department office for additional information.

A student offering mathematics as a minor for the master’s degree is required to take at least 6 hours of resident graduate credit in courses numbered above 400 and approved by both the major department and the Department of Mathematics.

For additional information, please visit the graduate website on the Department of Mathematics' homepage at www.math.utk.edu.

THE MASTER OF MATHEMATICS PROGRAM

Before admission to the Master of Mathematics program, the applicant must have either (a) certification for teaching secondary mathematics in at least one state, or (b) three years of elementary school, secondary school, or community college teaching experience. Applicants must have successfully completed one year of calculus (141–42 or equivalent) and a course in matrix algebra (251 or equivalent).

The following requirements must be met:

1. Complete 30 hours of coursework of which 21 must be at the 500 level. The coursework must include at least 504 during the summer.

2. Demonstrate proficiency in one foreign language examination.

3. In exceptional circumstances, part of admission requirement (b) might be satisfied concurrently with coursework. Normally Master of Mathematics degree students will start the program by taking 504 during the summer.

THE MASTER OF SCIENCE PROGRAM

The department offers two options for the Master of Science degree. The first option requires a thesis for which 6 hours must be earned along with 24 additional hours of work in acceptable courses numbered above 400. Of the additional hours, 6 may be in an area outside the department and 15 must be in courses in mathematics numbered above 500.

After one semester of graduate study, a student whose advisory committee gives its approval may choose the non-thesis option, for which 30 hours in courses numbered above 400 are required. Of these, 21 hours (at least 15 of which must be in mathematics) must be in courses numbered above 500. Of the 30 hours, 9 in courses approved by the advisory committee may be taken in fields other than mathematics. For this option it is also required that a written final examination be passed and that credit be received for a reading course (598) in which a term paper or project is required.

Concentration in Applied Mathematics

For this concentration, available under the thesis or the non-thesis option, the student must complete the following:

1. Prerequisite courses:
   d. Matrix Algebra II 453.

2. One hour of Seminar in Applied Mathematics 519 or Seminar in Mathematical Ecology 589.

3. One course from each of the following five areas:
   e. Statistics - Statistics 525, Stochastic Modeling 527, Statistical Methods 571 (Statistics), Biometry 560 (Ecology and Evolutionary Biology).

THE DOCTORAL PROGRAM

For the Ph.D. program in Mathematics, the student must meet the following four requirements in addition to those of the Graduate Council:

1. Satisfy either the standard program or the interdisciplinary mathematical ecology concentration. A student intending to work in mathematical ecology may complete either but is encouraged to complete the interdisciplinary mathematical ecology concentration. A student may elect to switch from one to the other provided the constraints of the latter option have not been violated. A student’s status after electing such transfer is determined by the complete history of the student’s earlier mathematics examinations from the standard program and the interdisciplinary mathematical ecology concentration. Descriptions of both programs are given below.

2. Demonstrate proficiency in one foreign language, normally French, German or Russian. This requirement must be met prior to the examination in the area of specialization. A student’s doing doctoral community may require the student to pass a second language examination.
Standard Program


Mathematical Ecology Concentration

The student must pass written examinations in three subjects:
2. A subject from Groups I, II, and III of the standard program.
3. A subject represented by a year-long graduate-level sequence from outside the Department of Mathematics. The sequence must be approved in advance by the mathematical ecology faculty and by the departmental Graduate Committee. At least one member of the mathematical ecology faculty must be involved in the grading of the examination. The examination in this subject may be taken only twice. The student also must earn grades of B+ or better each semester in the courses associated with two additional subjects from the groups listed in the standard program. This requirement may not be satisfied with courses from outside the department. At least one of the subjects used to meet this requirement or the written examination subject in 2. must be from Groups I and II. Except for the privilege of utilizing as a Group IV course a course from outside the department, this concentration is subject to the constraints and privileges specified in the standard program, including the restrictions on related subjects, the conditions a. through d. placed on the taking of written examinations, and the option to pass a written examination in lieu of earning a grade of B+ or better each semester in a sequence from Group I, II or III.

GRADUATE COURSES

400 History of Mathematics (3) Development of major ideas in mathematics from prehistoric times to the present and influence of ideas in science, technology, philosophy, art, and other areas. Writing emphasis course: at least one in-class essay examination and 3000 words of writing outside classroom. Prereq: Matrix Algebra I and Introduction to Abstract Mathematics.
401 Mathematics and Microcomputers (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts and problems in mathematics. Does not satisfy the major requirements for a B.S. or M.S. in mathematics. Prereq: Calculus I.
403 Mathematical Methods for Engineers and Scientists (3) Matrix computations, numerical methods, partial differential equations, Sturm-Liouville Theory, and special functions used in engineering and science. Does not satisfy major requirements for a B.S. or M.S. in mathematics. Prereq: Calculus II, 301 Differential Equations I, 241 Calculus III, and familiarity with operating system and programming language.
404 Applied Vector Calculus (3) Topics from multivariable and vector calculus, line and surface integrals, divergence theorem and theorems of Gauss and Stokes. Prereq: Calculus III.
405 Models in Biology (3) Difference and differential equations models of biological systems. May not be counted toward graduate degree. Prereq: Calculus II or Biocalculus II.
421 Combinatorics (3) Introduction to problems of construction and enumeration for discrete structures: sequences, partitions, graphs, finite fields and geometries, or experimental design. Prereq: Probability and Statistics or consent of instructor.
423 Probability I (3) Axiomatic probability, multivariate distributions, conditional probability and expectation, methods of moment generating/characteristic functions. Laws of large numbers and central limit theorem. Prereq: 300-level probability or consent of instructor.
424 Probability II (3) Elements of stochastic processes: Random walk, Markov chains and Poisson processes. Other topics as selected by instructor. Prereq: 423.
425 Statistics (3) Derivation of standard statistical distributions; F and *2; independence of sample mean and variance; estimation, Neyman-Pearson theorem; likelihood ratio and other parametric and non-parametric tests; sufficient statistic. Prereq: Probability I or consent of instructor.
443 Complex Variables I (3) Theory of functions of complex variable: residue theory and contour integrals. Prereq: Calculus III. Recommended prereq: 300- or 400-level mathematics course.
445-46 Advanced Calculus I,II (3,3) Theory of sequences, series, differentiation, integration, and special functions of one or more variables. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.
543 Matrix Algebra II (3) Matrix theory including Jordan canonical form. Prereq: Matrix Algebra I.
555-56 Abstract Algebra I,II (3,3) Algebraic structures: groups, rings, fields, vector spaces and linear transformations. Prereq: Matrix Algebra I and Introduction to Abstract Mathematics, or consent of instructor.
557-58 Honors: Abstract Algebra I,II (3,3) Honors version of 545-56. Prereq: Matrix Algebra I and Introduction to Abstract Mathematics, or consent of instructor.
560 Geometry (3) Axiomatic and historical development of Euclidean, non-Euclidean, and hyperbolic geometry stressing proof technique and critical reasoning. Models of Non-Euclidean geometries. Prereq: Introduction to Abstract Mathematics, or consent of instructor.
561 Topology (3) Topology of line and plane, separation properties, compactness, connectedness, and continuity functions, homeomorphisms, continua and topological invariants. Prereq: Calculus III and Introduction to Abstract Mathematics, or consent of instructor.
571 Numerical Analysis (3) Computation, instabilities, and rounding, Interpolation and approximation by polynomials and piecewise polynomials. Quadrature and numerical solution of initial and boundary value problems of ordinary differential equations, stiff sys-

475 Industrial Mathematics (3) Modeling, analysis, and computation applied to scientific/technical/industrial problems. Prereq: Differential Equations I and either Computer Literacy for Mathematics or Numerical Algorithms, or consent of instructor.

490 Readings in Mathematics (1-3) Open to superior students. Requires permission of department head. Independent study with faculty guidance. Prereq: Consent of faculty mentor to supervise independent work. May be repeated. Maximum 9 hrs.

499 Seminar in Mathematics (1-3) Topics vary. Requires out-of-class projects and in-class presentations by students. Credit hours announced for each seminar. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

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

502 Registration for Use of Facilities (1-15) Required for students who are otherwise registered during any semester when students use University facilities and/or faculty time before degree is completed. May not be used to satisfy degree requirements. May be repeated. S/NC only. E

504 Discrete Mathematics for Teachers (3) Mathematical logic and methods of argument, sets, functions and relations, combinatorics. Normally first graduate course toward earning M.S. degree. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

505 Analysis for Teachers (3) Development of differential and integral calculus, proofs of basic theorems. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to algebra. Elementary number theory, polynomials. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics.

507 Probability and Statistics for Teachers (3) Probability models and random variables. Binomial, hypergeometric, and Poisson distributions. Continuous random variables. Normal distributions. Sampling theory. For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: 1 yr calculus or equivalent.

509 Seminar for Teachers (3) For students in Master of Mathematics program and for students in graduate programs in College of Education. May not apply toward M.S. degree in mathematics. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. (Same as Teacher Education 509.)

510 Applied Mathematics Laboratory (1) Computer applications in applied mathematics: software packages for matrix analysis, symbolic algebra, and differential equations. Coreq: 511 or 512. May be repeated.


513-14 Mathematical Principles of Fluid Mechanics (3,3) Equations of motion, compressible and incompressible, inviscid and viscous, Navier-Stokes equations. Prereq: 431, 435, and 445-448 or 404, or consent of instructor.

515-16 Analytical Applied Mathematics (3,3) Analysis of advanced techniques in modern context for applied problems; dimensional analysis and scaling, perturbation theory, variational approaches, transform theory, wave phenomena and conservation laws, stability and bifurcation, distributions, integral equations. Prereq: 446 or 448, 453, and either 511-12 or both 431 and 435.

517-18 Mathematical Methods in Physics (3,3) (Same as Physics 571-72.)

519 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hrs.

521-22 Enumerative Combinatorics (3,3) Sieve methods, recursion, generating functions, and enumeration groups applied to enumeration of discrete structures, incidence algebras and combinatorics of partially ordered sets.

523-24 Probability (3,3) Pertinent facts from measure theory, de Moivre-Laplace theorem, Kolmogorov’s existence theorem; series of independent random variables and laws of large numbers; general theory of distributions and random variables associated with their characteristic functions; weak convergence concept, weak compactness and Levy’s continuity theorem in Euclidean spaces; potentially infinite distributive structures; central limit theorems; properties of conditional expectation, martingales, Doob’s martingale and optional sampling theorems. Prereq: 445-46. Recommended prereq: 423.

525-26 Statistics (3,3) Pertinent facts from probability theory; formulation of statistical models; sufficiency, Fisher-Neyman factorization theorem, exponential families, Bayesian models; methods of estimation and optimality theory; uniform minimum variance unbiased estimates, asymptotic efficiency and optimality; the confidence procedures and hypothesis testing; optimal tests and confidence intervals, the Neyman-Pearson lemma, uniformly most powerful tests; general linear models, estimation and tests in linear models; non-parametric models, rank methods for comparison, linear independence; robust tests; topics from decision theory. Prereq: 445-46. Recommended prereq: 425.

527 Stochastic Modeling (3) Models in probability applied to real world situations; queueing theory; branching processes; Monte Carlo simulation. Prereq: 445-46 or consent of instructor.


534 Calculus of Variations (3) Necessary conditions for extremum, Euler’s equation, broken extremals, Weierstrass-Erdmann conditions. Sufficiency conditions for extrema-Legendre’s and Jacobi’s conditions, conjugate points. Multiple integrals. Prereq: 431.

535-36 Partial Differential Equations (3,3) First order equations, classification of equations and properties of solutions, elliptic, hyperbolic, and parabolic equations in several variables. Prereq: 445-46 and 231 or consent of instructor.


539 Seminar in Differential Equations (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.


549 Seminar in Analysis (1-3) May be repeated. Maximum 9 hrs.

551-52 Modern Algebra (3,3) Groups, rings, modules and linear algebra, fields and Galois theory. Must be taken in sequence. Prereq: 455-56 or consent of instructor.

553 Linear Programming (3) Theory and applications. Prereq: Consent of instructor or 453 and programming ability.


555-56 Number Theory (3,3) Introduction to algebraic number theory. Prereq: 455-56 or consent of instructor.

559 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.


567-68 Differential Geometry (3,3) Classical differential geometry in two and higher dimensions: curves and surfaces in Euclidean space, Gauss map, curvature, Gauss-Bonnet theorem, hyperbolic geometry, Manifolds and Riemannian metrics; connections, geodesics, Jacobi fields, sectional curvature. Differential forms and moving frames. Prereq: 445-46 or consent of instructor.

569 Seminar in Topology (1-3) May be repeated. Maximum 12 hrs.


574 Finite Element Methods (3) Finite element techniques for solution of elliptic, parabolic, and hyperbolic and parabolic equations in several variables. Variational formulation. Finite dimensional subspaces and their approximating properties; rates of convergence. Computer implementation. Prereq: 435, 471, and either 453 or 472. Recommended prereq: 445-46, 573. (Same as Computer Science 574.)

575 Matrix Theory and Techniques in Numerical Analysis (3) Advanced topics in linear and direct methods for large systems of linear equations: sparse matrix analysis, relationship to modern computer architectures. Prereq: 453, 471-72, or consent of instructor. May be repeated. Maximum 9 hrs. (Same as Computer Science 575.)

577 Optimization (3) Major topics in optimization with problems developed from real-world applications including constrained and unconstrained optimization with analysis of major algorithms and utilization of appropriate software. Prereq: Numerical Algorithms, 453, 445-46.

578 Numerical Methods for Partial Differential Equations (3) Introduction to numerical analysis of solutions of partial differential equations including conservation laws and hyperbolic, parabolic, and elliptic problems. Derivation, physical meaning, and implementation of schemes. Prereq: 435 or 512 or 515, Fortran C, or consent of instructor.

579 Seminar in Numerical Mathematics (1-3) May be repeated. Maximum 12 hrs.
581-82 Mathematical Ecology (3,3) Deterministic and stochastic models of populations, communities, and ecosystems. Prereq: 431, 453 or consent of instructor. (Same as Ecology and Evolutionary Biology 581-882.)

583 Mathematical Evolutionary Theory (3) Populations and evolutionary ecology. Prereq: 431, 453 or consent of instructor. (Same as Ecology and Evolutionary Biology 585.)

585 Optimal Control Theory (3) Deterministic optimal control. Examples involving calculus of variations, optimal trajectories, and engineering control problems. Introduction to stochastic control. Prereq: 431, 445-46 or consent of instructor.

589 Seminar in Mathematical Ecology (1-3) May be repeated. Maximum 12 hrs.

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

598 Graduate Reading in Mathematics (1-3) Independent study with faculty guidance. Prereq: Graduate standing and consent of instructor. May be repeated. Maximum 6 hrs.

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


619 Seminar in Applied Mathematics (1-3) May be repeated. Maximum 12 hrs.

623-24 Advanced Probability (3,3) Selected topics in modern theory of probability and stochastic processes: Ito's calculus and stochastic differential equations, integration prediction theory, ergodic theory, probability on algebraic structures, limit theorems, geometry and probability in Banach spaces, probability methods in analysis. Prereq: 523-24 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

629 Seminar in Combinatorics (1-3) May be repeated with consent of department. Maximum 12 hrs.

631-32 Advanced Ordinary Differential Equations (3,3) Theory of ordinary differential equations from advanced viewpoint. Topics from current literature. Subject matter varies according to interests and preparations of students. Prereq: 531-32 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.


643-44 Harmonic Analysis (3,3) Fourier series and Fourier transforms on Euclidean spaces or topological groups: convergence, summability, uniqueness, inversion, duality, Plancherel transform, Hilbert transform, Hardy-Littlewood maximal function, interpolation of operators, or Fefferman-Stein duality. Prereq: 541-42 and 543. May be repeated with consent of department. Maximum 12 hrs.

649 Seminar in Analysis (1-3) May be repeated with consent of department. Maximum 12 hrs.

651-52 Advanced Modern Algebra (3,3) Selected topics in modern algebra or number theory. Prereq: 551-52 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

659 Seminar in Algebra (1-3) Prereq: Consent of instructor. May be repeated with consent of department. Maximum 12 hrs.


663-64 Algebraic Topology (3,3) Homology, cohomology and homotopy theories: duality theorems and Hurewicz theorems. Prereq: 561-62 and 1 yr of abstract algebra, 455-56 or 551-52. May be repeated with consent of department. Maximum 12 hrs.

667-68 Advanced Differential Geometry (3,3) Selected topics from Riemannian geometry and analysis on manifolds: Lie groups, metric geometry, spectrum of Laplacian, Hodge Theory, variational problems, curvature and topology of manifolds. Prereq: 567-68 or consent of instructor. May be repeated with consent of department. Maximum 12 hrs.

669 Seminar in Topology (3) May be repeated with consent of department. Maximum 12 hrs.


679 Seminar in Numerical Mathematics (1-3) May be repeated with consent of department. Maximum 12 hrs.

681-82 Advanced Mathematical Ecology (3,3) Selected topics in theoretical and applied mathematical ecology: population, community, ecosystem ecology and applied topics such as demography, ecotoxicology, epidemiology, environmental changes, and resource management. Prereq: 581-82. May be repeated. (Same as Ecology and Evolutionary Biology 681-682.)

### Mechanical, Aerospace and Biomedical Engineering

#### (College of Engineering)

**MAJOR**

**DEGREES**

Aerospace Engineering ............. M.S., Ph.D.

Engineering Science ............... M.S., Ph.D.

Mechanical Engineering .......... M.S., Ph.D.

T. E. Shannon, Interim Head

**Professors:**

Antar, B. (UTSI), Ph.D. ............ Texas

Arimili, R. V., Ph.D. ............. VPI

Baker, A. J., Ph.D. .............. New York

Carley, T. G. (Emeritus), Ph.D. .... Illinois

Caruthers, J. E. (UTSI), Ph.D. ..... Georgia Tech

Collins, F. G. (UTSI), Ph.D. ....... California

Crawford, R. A. (Emeritus) (UTSI), Ph.D. ....... Tennessee

Dareing, D. W., P.E., Ph.D. .......... Illinois

Edmondson, A. J. (Emeritus), Ph.D. ....... Pennsylvania

Engels, R. C. (UTSI), Ph.D......... Texas A&M

Flandro, G. W. (UTSI), Ph.D. ....... Cal Tech

Forrester, J. H. (Emeritus), Ph.D. ..... Iowa State

Fortey, J. W. (Emeritus), Ph.D. ...... Toulouse (France)

Frankel, J. I., Ph.D. ........... VPI

Garrison, G. W. (UTSI), Ph.D. ...... NC State

Hodgson, J. W. (Emeritus), Ph.D. ... Georgia Tech

Jendrucko, R. J., Ph.D. .......... Virginia

Johnson, W. S., Ph.D. ............ Clemson

Keefer, D. R. (UTSI), Ph.D. ........... Florida

Keyhani, M., Ph.D. ................. Ohio State

Kim, K. H. (Emeritus), Ph.D. ....... NC State

Krane, R. J., Ph.D. ............ Oklahoma

Landes, J. D., PE, Ph.D. ............. Lehigh

Lee, C. W. (Emeritus), Ph.D. ....... Illinois IT

Liston, H., Jr., M.E.A. ...... George Washington

Lo, C. F. (UTSI), Ph.D. .......... Cornell

McCay, M. H. (UTSI), PE, Ph.D. .... Florida

McCay, T. D. (UTSI), PE, Ph.D. ....... Auburn

Maxwell, R. L. (Emeritus), PE, Ph.D. ....... M.S. .................. Case Western

Merkle, C. L., Ph.D. ............ Princeton

Milligan, M. W., PE, Ph.D. ....... Tennessee

Parang, M., PE, Ph.D. ........... Oklahoma

Parsons, J. R., PE, Ph.D. .......... NC State

Peters, C. E. (Emeritus) (UTSI), Ph.D. ....... Brussels

Ph, H. (Emeritus), PE, Ph.D. ....... Illinois IT

Pitts, D. R. (Emeritus) Ph.D. ...... Georgia Tech

Remenyik, C. J. (Emeritus), Ph.D. ....... Johns Hopkins

Schulz, R. J. (UTSI), Ph.D. ....... Tennessee

Scott, W. E. (Emeritus), Ph.D. .... Johns Hopkins

Shahrokhi, F. (UTSI), Ph.D. ....... Oklahoma

Shannon, T. E., PE, Ph.D. ....... Tennessee

Shobe, L. R. (Emeritus), PE, Ph.D. ....... Kansas State

Smith, G. V., PE, Ph.D. .......... Penn State

Snyder, W. T., Ph.D. ........... Northwestern

Soliman, O., PE, Ph.D. .......... Tennessee

Speckhart, F. H. (IBM Prof.), Ph.D. .... Georgia Tech

Stair, W. K. (Emeritus), M.S. ....... Tennessee

Steinhoff, J. S. (UTSI), Ph.D. ...... Chicago

Stoneking, J. E., PE, Ph.D. ....... Illinois

Vakili, A. D. (UTSI), Ph.D. ....... Tennessee

Venkateswaran, S. (UTSI), Ph.D. ....... Penn State

Wasserman, J., PE, Ph.D. .......... Cincinnati

Weitsman, Y. J. (Distinguished Prof.), Ph.D. ....... Rensselaer

Wilkerson, H. J. (Emeritus), PE, Ph.D. ....... Tennessee

Wilson, C. C. (Emeritus), Ph.D. ....... Purdue

Wu, J. M. (Emeritus) (UTSI), Ph.D. .... Cal Tech

Wu, J. Z. (UTSI), Ph.D. .......... Beijing Institute

Wu, Y. C. (Emeritus) (UTSI), Ph.D. ... Cal Tech

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

**Associate Professors:**

Boulet, J. A. M., Ph.D. .......... Stanford

Freeman, J. S., Ph.D. .......... Wisconsin

Hamel, W. R., Ph.D. .......... Tennessee

Hopkins, J. A. (UTSI), Ph.D. ....... Tennessee

Iannelli, G. S., Ph.D. .......... Tennessee

Kasra, M., Ph.D. .......... Ecole Polytechnique (Canada)

Kawiacki, G., Ph.D. .......... West Virginia

Lumsdaine, A., Ph.D. .......... Michigan

Lyne, J. E., M.D., Ph.D. .......... NC State

Madhukar, M.S., Ph.D. .......... Drexel

Moulden, T. H. (UTSI), Ph.D. ....... Tennessee

Nguyen, K., Ph.D. .......... Colorado

Pionke, C., PE, Ph.D. .......... Ga Tech

Yu, N., Ph.D. .......... California (San Diego)

**Assistant Professors:**

Bond, R. E., Ph.D. .......... West Virginia

English, A., Ph.D. .......... Harvard

Kress, R. L., PE, Ph.D. .......... Arizona

Zheng, M., Ph.D. .......... Calgary (Canada)
Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy are available with majors in Mechanical Engineering, Aerospace Engineering, and Engineering Science. Changing from one of these programs to another requires departmental approval. Each applicant is advised to take necessary courses before entering a program. A dual M.S.-MBA degree program with a concentration in product development and manufacturing is also available with a major in Mechanical Engineering or in Engineering Science.

In Mechanical Engineering, program concentrations include dynamics, control, and robotics; energy conversion and utilization; gas dynamics; heat transfer and fluid mechanics; machine design; power generation; product development and manufacturing (MS only); propulsion; space engineering; stress analysis; and thermodynamics.

In Aerospace Engineering, program concentrations include aeronautics; aerodynamics and performance; energy conversion and utilization; flight and aerospace mechanics; gas dynamics; heat transfer and fluid mechanics; propulsion; space engineering; structures and stress analysis; and thermodynamics.

In Engineering Science, program concentrations include applied artificial intelligence, biomedical engineering, computational mechanics, fluid mechanics, mechanics of composite materials, solid mechanics, industrial engineering (Ph.D. only), product development and manufacturing (MS only), optical engineering (UTSI only). In each of these concentrations, interdisciplinary programs are arranged to meet individual needs or interests. The flexibility and interdisciplinary aspect of the program concentrations are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering or can best be met by interdisciplinary study in engineering. The program's course offerings and research activities are intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics or in related interdisciplinary studies such as biomaterials.

In Mechanical Engineering or Aerospace Engineering, entrance into the Master of Science program is available to qualified graduates of recognized undergraduate curricula in mechanical or aerospace engineering and to qualified graduates of other curricula who satisfy the necessary prerequisites. A program application is required in addition to the Graduate Application for Admission. Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in engineering backgrounds. The general GRE is required of all international applicants for admission.

In Engineering Science, entrance into the graduate program is available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. A program application is required in addition to the Graduate Application for Admission. The names and addresses of four references must be included with the program application. The general GRE is required of all international applicants for admission.

Each student must satisfactorily complete a program of study that has been approved by his/her advisory committee and complies with the requirements of the Graduate Council. In Engineering Science, the student's major professor may be selected from a department other than the Department of Mechanical and Aerospace Engineering and Engineering Science; however, at least one member of the student's graduate advisory committee must be on the faculty of the Department of Mechanical and Aerospace Engineering and Engineering Science.

THE MASTER'S PROGRAM

In Mechanical Engineering, Aerospace Engineering, and Engineering Science, two M.S. options are offered. Option I requires a thesis and is the normal program for graduate students. Option II does not require a thesis and provides graduate students, including co-op and other off-campus students, the opportunity to focus their programs in special areas through extended coursework.

Credit requirements for these two options in Mechanical Engineering and Aerospace Engineering are:

<table>
<thead>
<tr>
<th>Course Areas</th>
<th>Hours Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis credit</td>
<td>6</td>
</tr>
<tr>
<td>Coursework</td>
<td>24</td>
</tr>
<tr>
<td>Courses in program</td>
<td>12</td>
</tr>
<tr>
<td>(500-level or above)</td>
<td></td>
</tr>
<tr>
<td>Mathematics (400-level or above)</td>
<td>6</td>
</tr>
<tr>
<td>590 Selected Engineering Problems (max.)</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

Credit requirements for these two options in Engineering Science are:

<table>
<thead>
<tr>
<th>Course Areas</th>
<th>Hours Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis credit</td>
<td>6</td>
</tr>
<tr>
<td>Coursework</td>
<td>24</td>
</tr>
<tr>
<td>Engineering courses (Major concentration may include but is not restricted to course offered by the Department.)</td>
<td>12</td>
</tr>
<tr>
<td>Mathematics (400 level or above)</td>
<td>6</td>
</tr>
<tr>
<td>Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.)</td>
<td>6</td>
</tr>
<tr>
<td>590 Selected Engineering Problems (max.)</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

For all program options, other 500-level engineering coursework that are approved by the student's master's committee and the graduate programs committee may be substituted for the mathematics courses. All program options require participation in the departmental graduate seminars program, attending a final examination on all work submitted for the degree. The final examinations in Option II will cover all coursework. The thesis option, Option I, requires submission and defense of a written thesis that demonstrates the ability to conduct and report an independent investigation.

DUAL M.S.-MBA PROGRAM

The College of Business Administration and the College of Engineering offer an integrated program leading to the conferment of the Master of Business Administration degree with a major in Business Administration (concentration in operations management) and the Master of Science degree with a major in Engineering Science or Mechanical Engineering (concentration in product development and manufacturing). The Engineering Science program is intended to provide other engineering majors an opportunity to participate in this program with a flexible coursework plan based on their undergraduate degree.

The establishment of the dual program addresses the critical need for personnel trained in both engineering and management who can integrate an increasingly complex body of knowledge for rapid introduction of new products to the marketplace. The objective of the dual degree program is to prepare graduates to take a leading management role in companies that must react quickly to a dynamic market where forces of competition require rapid changes in design and manufacturing and a short product development cycle.

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 Office of Graduate Admissions for the Master of Business Administration degree program and the Master of Science degree program with a major in Engineering Science or Mechanical Engineering, and by the Dual Program Committee.

Students will initially apply for the MBA program, indicating on their application the intent to pursue the dual M.S.-MBA program and the appropriate engineering major (refer to the MBA program for separate instructions). Students accepted for both the MBA and the M.S. with a major in Engineering Science or Mechanical Engineering programs will be assigned to Dual Program Committee advisors, who will be responsible for course approval and supervision of the students' progress through the dual program.

Applications by U.S. citizens and permanent residents received after the MBA application deadline of March 1 will be considered as space allows. Additional information is required and different application dates are established by the Office of Graduate Admissions for international students.

Curriculum

All engineering students enrolled in the program must complete common coursework designed to provide them with an integrated, multidisciplinary teamwork experience. The MBA curriculum in product development and manufacturing consists of 3 hours of common coursework in the College of Business Administration and 15 hours of common coursework in the College of
Engineering, Engineering common coursework includes a culminating 3-hour integrated project course requiring a comprehensive report, and a final examination as required by the Dual Program Committee, to be taken during the first session of summer following the second year.

During the second year dual degree candidates will take courses in their engineering major. The coursework for each option is designed to provide students with a concentration in their major and advanced skills to accomplish their team work assignments.

Curriculum for Dual M.S.-MBA Degree – Major in Mechanical Engineering

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<thead>
<tr>
<th>August - First Year</th>
<th>FALL - First Year</th>
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<tbody>
<tr>
<td>BA 511 MBA Core I</td>
<td>BA 512 MBA Core II</td>
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<tr>
<td>ME 504 Product Development Process 1</td>
<td>ME 504 Product Development Process 1</td>
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<th>Spring</th>
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<tr>
<td>BA 513 MBA Core III</td>
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<td>ME 506 Product Selection and Evaluation</td>
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<td>ME 508 Integrated Product, Process, and Manufacturing System Design</td>
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<td>Internship</td>
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<td>BA 514 Integrated Business Simulation 3</td>
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<td>ME 509 Project Management 1</td>
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<th>Fall - Second Year</th>
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<tr>
<td>IE 511 Business Planning and Commercialization</td>
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<td>ME 509 Project Management 1</td>
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<td>ME 509 Project Management 1</td>
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The dual degree candidate must satisfy the curriculum and graduation requirements of the engineering major being pursued and the College of Business Administration. Students withdrawing from the dual degree program before completing both degrees will not receive credit toward graduation in either degree program for courses taken in the other degree program, except as such courses qualify for credit without regard to the dual degree program. The M.S. and the MBA degrees will be awarded upon successful completion of the requirements of the dual program.

Approval Dual Credit

A maximum of 15 semester hours of the common program courses completed in the College of Engineering may be counted toward the MBA degree program.

THE DOCTORAL PROGRAM

All students must complete a minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the master's thesis. These shall include a minimum of 24 semester hours in Doctoral Research and Dissertation and a minimum of 48 semester hours in other courses.

In Mechanical Engineering or Aerospace Engineering, the courses must include:

1. A minimum of 12 semester hours of graduate credit in mathematics in courses numbered 400 or above with a minimum of 6 semester hours numbered 500 or above.
2. A minimum of 24 semester hours in the department in courses numbered 500 and above, with at least 12 of these semester hours in the major. A minimum of 9 semester hours of courses is required at the 600 level. These are exclusive of thesis, problems, or dissertation credit. The student's advisory committee can approve a student's petition to replace one 600-level course with one or more 500-level course(s) that are more appropriate.

In Engineering Science, the courses must include:

1. A minimum of 24 semester hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 500 and above, with at least 9 semester hours of 600-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.
2. A minimum of 12 semester hours in mathematics or computer science in courses numbered 400 and above, exclusive of a first course in ordinary differential equations.

The additional requirements for all students include:

1. Registration and participation in the graduate seminar in the major program.
2. Meet all departmental examination requirements, which include passing a written and oral comprehensive examination.
3. Presentation of a dissertation proposal to the student's advisory committee and approval of that proposal by that committee.

CERTIFICATE IN MAINTENANCE AND RELIABILITY ENGINEERING

The College of Engineering offers a certificate program in maintenance and reliability engineering. The program is designed primarily for part-time students in that several of the courses are available through distance education. The 12-credit certificate is earned by completing 483 and 484, which are cross-listed among all participating departments in the College of Engineering, plus two elective courses selected from a list of courses provided by the participating departments. Currently, the available elective courses are Industrial Engineering 516 and 591, Mechanical Engineering 554 and 589, and Nuclear Engineering 579 and 585. The selection of elective courses is determined through an advising conference with each individual student, and is based on the student's personal interests, academic background, and work experience. Applicants must meet the minimum criteria established by the Graduate Council.

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 on an in-state tuition basis. The M.S. program in Aerospace Engineering is available to residents of the states of Kentucky or South Carolina. The Ph.D. program in Aerospace Engineering is available to residents of the states of Arkansas or Kentucky. Additional information may be obtained from the Administrative Services Assistant in the Office of Graduate Admissions.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Students majoring in Mechanical Engineering or Aerospace Engineering may not normally use more than one 400-level engineering course to meet their advanced degree requirements. Undergraduate courses that are required for the bachelor's degree in Mechanical Engineering may not be taken for graduate credit by graduate students in Mechanical Engineering. Undergraduate courses that are required for the bachelor's degree in Aerospace Engineering may not be taken for graduate credit by graduate students in Aerospace Engineering. For students majoring in Engineering Science, 400-level courses in
Aerospace Engineering

NOTE: Not all the courses listed below are available at both the UT and the UT/TSI campuses.

GRADUATE COURSES

422 Aerodynamics (3) Theory and design of aerodynamic bodies for desired characteristics. Potential flow theory, viscous effects, compressibility effects. Subsonic boundary layer and supersonic airdyn. Prereq: 351 Compressible Flow, 370 Airplane Performance. F

424 Astronautics (3) Orbital mechanics, propulsion, atmospheric reentry of space vehicles; reentry thermal protection materials, human factors in space flight, space environment and current topics. Prereq: 351 Compressible Flow. Coreq: Mechanical Engineering 344 Heat Transfer. F

425 Propulsion (3) Principles of propulsion devices; turbo-jet, ram jet and rocket engines. Prereq: 351. F

426 Introduction to Aerospace Design (2) Design process, synthesis, safety, reliability, patents, product liability, economic analysis, optimization, design standards, design studies. Individual design reports. Prereq: 351, 370, 363. Coreq: Mechanical Engineering 344. F

429 Aerospace System Design (4) Synthesis and design of complete aerospace system. Participation in design team efforts: formal presentations and design report. Prereq: 422, 425, 428. Sp


494-95 Selected Topics in Aerospace Engineering (1-4,1-4) Problems and topics related to development and practice in aerospace engineering. Prereq: Consent of instructor. E

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

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

511 Inviscid Flow (3) Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping. Prereq: 422 or 541, Mathematics 425 or equivalent. F

512 Viscous Flow (3) Derivation of fundamental equations of compressible viscous flow; boundary conditions for viscous flow; exact solutions for Newtonian viscous flow (Navier-Stokes) equations for special cases; similarity solutions. Thermal boundary layers, stability of laminar flows, transition to turbulence, 2-D turbulent boundary layer equations. Incompressible-turbulent mean flow, and compressible boundary layer flow. Prereq: Consent of instructor. E

513 Experimental Methods in Fluid Mechanics (3) Experimental techniques with laboratory experiments; representative experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, water table experiments, supersonic flow experiments, boundary layer measurements, laser-optical measurements. Prereq: 423 Viscid Flow or 541. F

515-16 Air Vehicle Aerodynamics and Performance (3,3) Application of aerodynamic principles to air vehicles to provide estimates of performance, stability, and control characteristics for subsonic to hypersonic speeds. Various launch platforms, control design, stability and control, propulsion systems, vehicle performance characteristics, and trajectory optimization. Prereq: 422; 515 for S.

521-22 Aerodynamics of Compressible Fluids (3,3) One- and two-dimensional external flow; wavevess; small perturbation theory; slender body theory; similarity rules; method of characteristics. Prereq: 422 for 521; 521 for 522. F

525 Hypersonic Flow (3) Slender body flow; similarity; Newtonian theory; blunt body flow; viscous interactions; free molecule and rarefied gas flow. Prereq: 512. F

527-28 Aerospace Ground Test Facilities (3,3) Atmospheric models and similarity considerations; aerodynamic test facilities; continuous and dynamic wind tunnels and ballistic range; propulsion test facilities or air breathing and rocket engines; space environment and space vehicle test facilities. Prereq: 521, 541 and Mechanical Engineering 522. F

529 Rarefied Gasdynamics (3) Binary elastic collisions; kinetic theory; flow regimes; Boltzmann and model equations, transfer equation, gas-surface interactions; slip between a free molecule, slip and transition flow; Monte Carlo simulation; experimental techniques; introduction to hypersonic real gas flows. Prereq: 522, Mechanical Engineering 522. F

531 Magnetohydrodynamics (3) Electromagnetic field theory; chemical kinetics; thermodynamic and thermophysical properties of gas plasmas; governing equations and applications. Prereq: 422 and Mathematics 471. F

532 Introduction to Turbulence (3) Macroscopic effects and treatment, correlation functions, energy spectra, diffusion; application of turbulent jets and pipe flow. Prereq: 511-12. F

533 Dynamics (3) (Same as Mechanical Engineering 533 and Engineering Science 533.)

534 Atmospheric Entry (3) Reentry trajectories; lift and drag; entry and reentry; vehicle motion and stability during reentry; aerodynamic heating and heat protection systems. Prereq: 522. Recommended prereq: 512. F

535 Mechanical Vibrations (3) (Same as Mechanical Engineering 534 and Engineering Science 534.)

539 Continuum Mechanics (3) (Same as Engineering Science 539 and Mechanical Engineering 539)

541 Fluid Mechanics I (3) (Same as Mechanical Engineering 541 and Engineering Science 541.)

542 Fluid Mechanics II (3) (Same as Mechanical Engineering 542 and Engineering Science 542.)

544 Transonic Flow (3) Nature of flow at transonic speeds; small disturbance theory; shock wave properties; shock-free flows; strong viscous interaction phenomena; similarity solutions. Prereq: 522. F

551 Aerospace Mechanics (3) Principles of mechanics applicable to aerospace vehicles, equations of motion, multibody problems and trajectory analysis. Prereq: Mathematics 471. F

552-53 Advanced Strength of Materials (3,3) (Same as Mechanical Engineering 553-36 and Engineering Science 521-22.)

554 Aerospace Vehicle Stability and Control (3) Static and dynamic longitudinal directional and lateral stability and control. Coupled modes. Motion with free and fixed flight control surfaces. Automatic control systems. Prereq: 423, 551. F

556 Vertical or Short Take Off and Landing Aircraft (3) Performance, stability, control of rotary wing, tilt wing, vectored lift and jet vertical riser type aircraft. Vertical and transition flight modes. High lift airfoils, Automatic controls. Simulation facility types and flight testing. Prereq: 555. F


561 Fundamentals of Aeroacoustics (3) Generation, propagation and absorption of sound in static and moving media. Prereq: Consent of instructor.

564 Spacecraft Attitude Dynamics and Control (3) Rotational attitude to governing equations. Gyroscopic instruments; passive and active attitude control devices. Linear control theory and attitude stabilization. Prereq: 551, Mathematics 471. F

571 Finite Elements for Engineering Applications (3) (Same as Engineering Science 551 and Mechanical Engineering 561.)

572 Computational Fluid Dynamics (3) (Same as Engineering Science 552 and Mechanical Engineering 562.)

573 Computational Solid Mechanics (3) (Same as Engineering Science 553 and Mechanical Engineering 563.)

574 Space Engineering: Satellite Technology (3) Satellites and rockets (orbit, launch vehicles and launching), spacecraft structure, power systems, attitude control system, telemetry/tracking/command and data communications, spacecraft testing, reliability, and application of satellites (communication, weather, Earth observation, and future applications). Prereq: 425, Mathematics 471, 404. F

590 Selected Engineering Problems (2-6) Enrollment limited to students in programs program. Prereq: Consent of advisor. May be repeated. Maximum 6 hrs. S/NC only.

595 Seminar (1) All phases of aerospace engineering, reports on current research at UT and UT/TSI. May be repeated. S/NC only.

599 Special Topics in Aerospace Engineering (1-3) May be repeated. Maximum 6 hrs.

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

631 Magnetohydrodynamics I (3) Electromagnetic field equations, motions of single charged particle, Boltzmann equation, conduction and diffusion in ionized gases, continuum magnetohydrodynamic equations. Prereq or coreq: 512. Prereq: Mathematics 561 or equivalent.

632 Magnetohydrodynamics II (3) Alfvéen and shock waves, statistical solution to governing equations. Continuum magnetohydrodynamic equations; non-equilibrium kinetic theory, flow with translational non-equilibrium. Prereq: 522, Mechanical Engineering 522. F

645 Theory of Turbulence (3) (Same as Engineering Science 542 and Mechanical Engineering 542.)

651-62 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science 651-52 and Mechanical Engineering 651-52.)

663-64 Advanced Topics in Computational Solid Mechanics (3,3) (Same as Engineering Science 653-54 and Mechanical Engineering 653-54.)


690 Advanced Topics in Aerospace Engineering (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
Biomedical Engineering

GRADUATE COURSES


430 Biomedical Engineering Laboratory (3) Experience with unique problems associated with making measurements and interpreting data in living systems; experiments: mechanical testing of biological materials, imaging and physiological measurements. Prereq: 310 Biomechanics, 346 Design of Experiments or consent of instructor.

435 Bioinstrumentation (3) Nature of biomedical signals, transducers, signal processing, noise, telemetry and display devices. Prereq: 300 Engineering Physics, Electrical and Computer Engineering 301 Circuits and Electro Mechanical Components.


494-95 Special Project in Biomedical Engineering (1-3,1-3) Problems related to recent developments and practice. May be repeated. Maximum 6 hrs. Prereq: Junior or senior standing, consent of instructor.

571 Biomechanics of Hard and Soft Tissue (3) (Same as Engineering Science 571.)

572 Biomedical Fluid Mechanics (3) (Same as Engineering Science 572.)

528 Ceramic Matrix Composites: Material and Mechanics (3) Micromechanics and microstructural design; fabrication of ceramic matrix composites; interface characterization and mechanics; electron microscope examination; nondestructive evaluation; fracture; fatigue; applications. Prereq: Consent of instructor. (Same as Materials Science and Engineering 528.)

529 Fatigue of Engineering Materials (3) Fatigue life prediction, crack initiation, crack propagation. Variable amplitude loading, multi-axial loading, environmental fatigue, creep fatigue, metallurgical and microstructural variables, fractography, non-metals. Prereq: Consent of instructor. (Same as Materials Science and Engineering 529.)

533 Dynamics (3) (Same as Mechanical Engineering 533 and Aerospace Engineering 535.)

534 Mechanical Vibrations (3) (Same as Mechanical Engineering 534 and Aerospace Engineering 535.)

539 Continuum Mechanics (3) Cartesian tensors, transformation laws, basic continuum mechanics concepts; stress, strain, deformation, constitutive equations. Conservation laws for mass, momentum, energy. Applications in solid and fluid mechanics. (Same as Aerospace Engineering 539 and Mechanical Engineering 539.)

541 Fluid Mechanics I (3) (Same as Mechanical Engineering 541 and Aerospace Engineering 541.)

542 Fluid Mechanics II (3) (Same as Mechanical Engineering 542 and Aerospace Engineering 542.)

551 Finite Elements for Engineering Applications (3) Computer procedures for differential equation statements in engineering and sciences. Approximation, boundary conditions, finite element method; finite element implementations; comparison to legacy finite difference methods, Applications in 1, 2, and 3 dimensions, non-linearly, unsteady problems, coupled equation systems. Examples from diverse technical fields; fluid mechanics, heat/mass transfer, elasticity, electromagnetics, reacting systems. Computer projects. Prereq: Consent of instructor. (Same as Civil Engineering 551.)

552 Computational Fluid Dynamics (3) Modern discrete approximation procedures for incompressible flows: Navier-Stokes equations, turbulence, heat transfer, Boussinesq form. Fundamentals of weak form methods, error extremization, trial and test function spaces, stability, Discrete implementations, finite element, finite volume; numerical linear algebra. Developments for steady boundary layers, unsteady flows using vorticity-stream function, pressure projection and pseudo-compressibility constructions. Comparisons to legacy methods, SIMPLE, PISO; theoretical error estimates, efficiency. Computer projects. Prereq: Bachelor's degree in engineering or natural science. (Same as Aerospace Engineering 561 and Mechanical Engineering 571.)

555 Mechanical Systems (3) Applications in structural mechanics and linear elasticity. Two and three-dimensional formulations; isoparametric elements, numerical quadrature. Equation solving, matrix iteration techniques. Applications in beams, plates and shells; use of representative computer programs in PC and networked Unix-CAD solids modeler. Prereq: 321 Mechanics of Materials I or equivalent. (Same as Aerospace Engineering 556 and Mechanical Engineering 572.)

553 Computational Solid Mechanics (3) Finite element techniques in structural mechanics and linear elasticity. Two and three-dimensional formulations; isoparametric elements, numerical quadrature. Equation solving, matrix iteration techniques. Applications in beams, plates and shells; use of representative computer programs in PC and networked Unix-CAD solids modeler. Prereq: 321 Mechanics of Materials I or equivalent. (Same as Aerospace Engineering 556 and Mechanical Engineering 572.)

564 Laser Processing of Materials (3) Physics and engineering of laser processing of metals and composites. Physics: lasers, optics, plasma, heat transfer, phase transformations, solidification and fluid flow processes; welding, physical metallurgy, of welding, theories of segregation and porosity formation, drilling, cutting, machining, brazing, soldering, glazing, alloying. Ying as a tool for atomic, plasma character and diagnostics and applications to process utilization.

566 Optical Engineering I (4) Wave optics; scalar diffraction theory; introduction to Fourier optics; ray or geometrical optics; lens design; paraxial design methods; introduction to aberrations.

568 Optical Engineering II (4) Statistical optics; spontaneous and induced emission; black and gray body radiation; incoherent, partial and totally coherent radiation; mutual coherence function; detectors; radiometry. Prereq: 566.

571 Biomechanics of Hard and Soft Tissue (3) Introduction to terminology, physiology, and analytical methods for mechanics of living tissue. Continuum mechanics analysis of hard and soft tissue, biological fluid flows. Flow properties of blood, rheology of blood in micro vessels; bioviscoelasticity of fluids and solids, mechanical properties of blood vessels; skeletal and smooth muscle cells. Analysis of pathologies: bowel, heart and cartilage. Research paper. (Same as Biomedical Engineering 571.)

572 Biomedical Fluid Mechanics (3) Application of fluid mechanics theory to fluid flows in living systems, solutions to differential equations of motion for blood flow in arteries, veins and the microcirculation. Measurement of flow properties of blood and other biologic fluids. Analysis of pathological blood flow through arteriosles. Study of flow through artificial heart valves and in extracorporeal devices. Prereq: 541. (Same as Biomedical Engineering 572.)

576 Expert Systems in Engineering (3) (Same as Nuclear Engineering 576 and Mechanical Engineering 576.)

577 Neural Networks in Engineering (3) (Same as Nuclear Engineering 577 and Mechanical Engineering 577.)

578 Fuzzy Systems in Engineering (3) (Same as Nuclear Engineering 578.)

581 Special Topics in Engineering Mechanics (3) Mechanics problems related to bioengineering. Prereq: Consent of instructor. May be repeated with consent of department.

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

590 Selected Engineering Problems (2-6) Enrollment limited to students in programs program. Prereq: Consent of advisor. May be repeated. Maximum 6 hrs. S/NC only.

595 Seminar (1) All phases of engineering science, reports on current research at UTK and UTSMI. May be repeated. S/NC only.

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

624 Viscoelasticity (3) Viscoelastic constitutive relations; isothermal boundary value problems; wave propagation in viscoelastic materials; stability problems; determination of viscoelastic properties. Prereq: 523, and 539 or Materials Science and Engineering 541.


633 Advanced Vibrations (3) Free and forced vibration, dynamic testing, vibration analysis; fracture in nonmetals. Current research topics in fracture mechanics. Prereq: 527.

634 Advanced Topics in Fluid Mechanics and Convective Heat Transfer (3) Convective momentum, heat and mass transfer; boundary layer analysis, stability, transition, turbulence, closure models; Navier-Stokes Equations, convection, pressure procedures: time- and ensemble-averaging, large scale structures; high speed flow, reacting, nonreacting, excitation, ionization. Approximations in propulsion, lasers, aerodynamics. Prereq: 542.

645 Theory of Turbulence (3) Mathematical descriptions of turbulence; isotropic behavior, small and large eddies, modeling for turbulence, diffusion by continuous movement; applications to turbulent jets, wakes, pipe flow, and boundary layers. Prereq: 542. (Same as Aerospace Engineering 645.)

651-52 Advanced Topics in Computational Fluid Dynamics (3,3) Models and computer programs for non-linear Navier-Stokes systems. Algorithm constructions; finite element, finite volume; accuracy, convergence, stability, smooth and non-smooth solutions; shocks, artificial dissipation mechanisms. Two- and three-dimensional, compressible viscous and inviscid
Mechatronic Components. F, Sp

Analysis and design of feedback control systems

Mechanical Engineering

NOTE: Not all the courses listed below are available at both the UT and the UTSC campuses.

GRADUATE COURSES

449 Mechanical Engineering Laboratory (3) De- designing, constructing and reporting results of experi-


451 Systems and Controls (3) Analytical models of

physical systems; comprised of combinations of

mechanical, fluid, electrical, and thermal systems.

Analysis and design of feedback control systems

using transient and frequency response techniques,

stability analysis, control systems. Prereq: 345

Instrumentation and Measurement, Electrical and

Computer Engineering 301 Circuits and Electro

Mechanical Components.

452 Computational Mechanics (3) Integration of

fundamental physical laws, mathematical methods

and computational techniques necessary to develop

engineering analysis and design capabilities. Finite


455 Introduction to Design (2) Engineering econ-
y

omy, optimization, design for automation, reliability,

patents and product liability; design of mechanical

engineering solid mechanics system. Participation in
team design effort; design report. Prereq: Dynamics

and Vibrations of Machines.

456 Introduction to Thermal Design (2) Engineering
economy, optimization, design for automation, reliabil-

ity, patentability; design of mechanical engineering

thermal-fluid system. Participation in team design

effort; design report. Prereq: 332, 344. F

466 Machine Design II (3) Application of strength and

properties of materials, design factors, theories of

tailor to design of machine elements. Mini design

experiences, Prereq: Materials Science and Engineer-

ing 201, Engineering Science and Mechanics 221, F, Sp

469 Machine Design (4) Design of complete machine;
documentation, complete specifications, design cal-

culations, working drawings, and cost analysis. Written

and oral report. Prereq: 455, 466. Sp

471 Refrigeration and Air Conditioning (3) Vapor

compression and absorption cycles; heat pump sys-
tems; psychrometric processes; air washers; cooling

towers; solar radiation; building heat transmission.

Prereq: 332, 344.

475 Thermal Engineering (3) Thermal systems,
turbomachinery, heat exchangers, combustion and

system analysis and design, second law and economic

analysis. Prereq: 332, 344. F, Sp

479 Thermal Engineering Design (4) Design of

complete thermofluid system, economic, technical

and optimization aspects. Participation in team design

effort, formal presentations and design report. Prereq:

456, 475. Sp

483 Introduction to Reliability Engineering (3)

(Same as Nuclear Engineering 483, Chemical Engi-

neering 484, and Industrial Engineering 484.)

484 Introduction to Maintenance Engineering (3)

(Same as Nuclear Engineering 484, Chemical Engi-

neering 484, Industrial Engineering 484, and Materials

Science and Engineering 485.)

494-95 Selected Topics in Mechanical Engineering

(1-1, 1-4) Problems and topics related to developments and

practice in mechanical engineering. Prereq: Consent

of instructor. E

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

502 Registration for Use of Facilities (1-15) Re-

quired for the student not otherwise registered during

any semester in any facilities, and/or/faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

504 Product Development Process (1) Basic ele-

ments in product development process and project

management. Business and engineering interrelations
to development and commercial manufacturing of new

products. Multidisciplinary teams to explore possible

new product opportunities. Prereq: Consent of instruc-
tor. (Same as Industrial Engineering 504.)

505 Mechatronics (3) Application of microcomputers
to control electromechanical devices. Application and

theory of feedback control, computer-aided lan-
guage programming, microcontroller architecture, step-
dng and DC motors, photoelectric devices, A/D, D/A,
integrated circuits. Prereq: Electronics and Computer

Circuits and consent of instructor.

506 Product Selection and Evaluation (2) Develop-

ment of operational requirements and features for new

product having potential for business venture. Market

potential, design feasibility and manufacturing require-

ments. Design alternatives created and evaluated against

set of performance requirements determined from

market analysis. Prototype of selected product made

and tested against required operating conditions. Design changes implemented to meet customer’s needs. Fabrication
drawings and manufacturing plans finalized for introduction of product. Prereq: Consent of instructor. Prereq: 335, 344. F

507 Application of Linear Algebra in Engineering

Systems (3) (Same as Chemical Engineering 507,
Electrical and Computer Engineering 507, and Materials Science and Engineering 507.)

508 Integrated Product, Process and Manufactur-

ing System Design (3) (Same as Industrial Engineer-

ing 508.)

509 Project Management (1) (Same as Industrial Engineer-

ing 509.)

510 Prototype Development and Evaluation (3)

Prototype of selected product made and tested against

required operating conditions. Design changes imple-

mented to meet customer’s needs. Fabrication draw-
ings and manufacturing plans finalized for introduction

of product. Prereq: Consent of instructor. Prereq: 335, 344. F

511 Heat Transfer I (3) Properties of radiating sur-

faces. Diffuse, specular and directional interchange

for gray and nongray surfaces. Interaction with other

heat transfer modes. Analysis of steady-state and

time-dependent with other heat transfer modes. Anal-

ysis of steady-state and time-dependent heat conduc-

tion in analytical methods. Prereq: Undergraduate

heat transfer.

512 Heat Transfer II (3) Analysis of steady-state and

time-dependent heat conduction by numerical meth-

ods. Analysis of laminar and turbulent convection heat

transfer in internal flows, forced and

buoyancy driven flows. Prereq: 541.

514 Phase Change Heat Transfer (3) Mechanisms and

modeling of nucleate, transition and film boiling

processes; critical heat flux; forced convection boiling

and post dry-out heat transfer; condensation pro-
cesses; heterogeneous nucleation; dropwise and

filmwise condensation; flow condensation; liquid-solid

heat exchange processes; boundary-layer fronts; math-

ematical modeling. Prereq: 344, 511.

515 Numerical Heat and Mass Transfer (3) Discrete

modeling of Navier-Stokes equations and energy

equation via control volume methods. Difference

method and finite element methods. Iterative solv-

e solution algorithms for pressure-linked equations

modeling forced and buoyancy driven flows. Com-

puter project. Prereq: Undergraduate fluid mechanics and

heat transfer.

521-22 Thermodynamics I and II (3, 3) Macroscopic

thermodynamics, including First and Second Law

analyses, availability, phase and chemical equilibrium

(Thermodynamics I: At the UT campus or Thermodynamics II: At the UTSC campus."

Prereq: 522, 541, or consent of instructor.

523 Special Topics in Thermodynamics (3) Ap-

plication of thermodynamics to topics of current

interest in mechanical engineering. Prereq: Consent

of instructor.

525 Combustion and Chemically Reacting Flows

(3) Fundamental approaches to buoyant and

turbulent flows; fundamental approaches to buoyant

and turbulent flows; ignition and extinction of premixed

reactants; spray combustion models; fluidized bed

combustion; combustion reacting boun-

ary layers; laser diagnostics; shock and rocket motor

combustors; furnaces; introduction to supersonic com-

bustion and hypersonic flows. Prereq: 525.

533 Dynamics (3) Kinematics and dynamics of par-

ticles in three dimensions. Rotating coordinate sys-
tems, Hamilton’s principle. Lagrange’s equations of

motion. Kinematics and dynamics of rigid bodies.

Prereq: Mathematics 431 or Engineering Analysis,

undergraduate vibrations course. (Same as Aerospace

Engineering 533 and Engineering Science 533.)

534 Mechanical Vibrations (3) Vibrations of linear,
discrete, undamped and damped systems. Lagrange’s e-

quations for holonomic systems. Modal analysis.

Laplace transform. Introduction to mechanical tran-
sients. Prereq: Undergraduate vibrations course. (Same as Aerospace Engineering 535 and Engineering Sci-
ence 534.)

535-36 Advanced Strength of Materials (3,3) Three-
dimensional transformations for stress and strain.

elementary theory of elasticity, unsymmetrical bend-
ing, beams on elastic foundation, energy methods,
shear center, beam-columns, thick-walled pressure
vessels, elementary theory of plates. Prereq: Mechan-
ics of Materials II or Mechanical Engineering 466.
Mathematics 431 or Engineering Analysis. (Same as
Aerospace Engineering 532-53 and Engineering Sci-
ence 521-22.)

539 Continuum Mechanics (3) (Same as Engineering
Science 539 and Aerospace Engineering 539.)

541 Fluid Mechanics I (3) Derivation of equations
governing flow of incompressible and viscous fluids
(conservation of mass, Newton’s second law, conservation
of energy). Equations of state and constitutive relations.

Euler and Navier-Stokes forms and nondimensionalization. Exact solutions and introduc-
tion to potential and quasi-flow solutions. Prereq: Fluid mechanics. (Same as Aerospace Engineering 541 and Engineering Science 541.)

542 Fluid Mechanics II (3) Equations of viscous fluid
flows. Basic concepts and equations of turbulent flow.

Separate, stabilizing, and transition. Laminar and turbu-

lent boundary-layer flows. Exact, approximate, and

numerical solutions. Prereq: 541. (Same as Aerospace Engineering 542 and Engineering Science 542.)
551-52 Mechanical Engineering Design (3,3) Design of mechanical engineering devices and systems. Prereq: Consent of instructor.

555 Design Tools (5) Project driven. Skills for using relevant software design tools to perform assigned design tasks. Consideration of project deadlines and timing of subject material modified to meet specific needs of each project. Prereq: Consent of instructor.

561 Finite Elements for Engineering Applications (3) (Same as Engineering Science 551 and Aerospace Engineering 557.)

562 Computational Fluid Dynamics (3) (Same as Engineering Science 552 and Aerospace Engineering 557.)

563 Computational Solid Mechanics (3) (Same as Engineering Science 553 and Aerospace Engineering 573.)

576 Expert Systems in Engineering (3) (Same as Nuclear Engineering 576 and Engineering Science 576.)

577 Neural Networks in Engineering (3) (Same as Nuclear Engineering 577 and Engineering Science 577.)

581 Rocket Propulsion I (3) Rocket propulsion fundamentals; thermodynamics of nonreacting and chemically reacting ideal gases, rocket nozzle design; ideal rocket engine performance; rocket heat transfer; chemistry of propellants; liquid rocket engine systems; ground testing; introduction to solid propellant rockets. Prereq: Consent of instructor.

582 Rocket Propulsion II (3) Solid propellant rocket performance, homogeneous and heterogeneous propellant chemistry and combustion system performance, thermal decomposition and gas phase reaction models; effect of chamber pressure and additives on solid propellant burn rates, erosive burning; analysis of two-phase solid rocket exhaust flow. Introduction to nuclear and electric propulsion; electrical resistance and electric field (ion) engine performance, magnetohydrodynamic thrusters, traveling wave thrusters, exotic propulsion systems. Prereq: Consent of instructor.

584-85 Turbomachinery Systems I, II (3,3) Ideal cycle analysis of turbine engines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flow through theory, turbine engine component matching, transient operation, surge and rotating stall, engine control systems, structural considerations. Prereq: First year graduate standing and consent of instructor.

586 Mechanics and Control of Robotic Manipulators (3) Fundamentals of robotic manipulation: kinematics and dynamics of manipulators, control system designs, trajectory planning, advanced force and impedance control strategies. Prereq: 451, 533, or equivalent.


588 Introduction to Hybrid Electric Vehicles (3) Series, parallel, and dual configurations. Sizing and analysis of typical HEV components: motors, auxiliary power sources, on-board energy storage, and fuels. Steady-state HEV power trains and power management schemes. Power train design using various computer simulation tools. Prereq: Consent of instructor.

589 Hybrid Electric Vehicle Control Systems Design and Analysis (3) Dynamic modeling, simulation and analysis of complete hybrid electric vehicle systems. Linear control design techniques and discrete logic design applied to HEV power trains and operating mode controls. Digital and real-time control and hardware issues of automotive systems. Design and human factors engineering issues of vehicle controls and displays. Prereq: 588 or consent of instructor.

590 Selected Engineering Problems (2-6) Enrollment limited to students in programs program. Prereq: Consent of advisor. May be repeated. S/NC only.

594 Culminating Integrated Project Report (3) Final phase of product development process. Multidisciplinary teams submit and defend comprehensive project report. Report includes all engineering and business considerations needed to convince potential investors to fund proposed business venture. Prereq: Consent of instructor. (Same as Industrial Engineering 594.)

595 Seminar (1-3) All phases of mechanical engineering reports on current research at UTK and UTSA. May be repeated. S/NC only.

599 Special Topics in Mechanical Engineering (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

610 Advanced Topics in Fluid Mechanics and Heat Transfer (3) Advanced theory and application of fluid mechanics and heat transfer; natural convection, multi-phase flow, high speed reacting and nonreacting flows, advanced boundary layer techniques, combustion, perturbation and variational methods of analysis, heat exchanger theory and design. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

613 Advanced Radiation Heat Transfer (3) Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with conduction and convection heat transfer. Prereq: 511, 512.


642 Advanced Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of pure substances, metastable states. Non-equilibrium thermodynamics. Prereq: Consent of instructor.

651-52 Advanced Topics in Computational Fluid Dynamics (3,3) (Same as Engineering Science 651-52 and Aerospace Engineering 661-62.)

653-54 Advanced Topics in Computational Solid Mechanics (3,3) (Same as Engineering Science 653-54 and Aerospace Engineering 663-64.)


671 Advanced Topics in Applied Artificial Intelligence (3) (Same as Nuclear Engineering 671 and Engineering Science 671.)

686 Telerobotic Systems (3) Analysis of modern telerobotic concepts; review of current research and literature in telerobotics; design of telerobotic systems, robotic systems, and telerobotic systems: human-machine interfaces, control system architectures, data communications, and sensing, virtual reality-based, and internet-based systems concepts. Prereq: 586 or consent of instructor.


Medical Biology

See College of Veterinary Medicine and Comparative and Experimental Medicine

Microbiology

(College of Arts and Sciences and College of Veterinary Medicine)

MAJOR

Microbiology ......................... M.S., Ph.D.
Veterinary Medicine ................... D.V.M.

DEGREES

Robert Moore, Head

Professors:
Beck, Raymond W. (Emeritus), Ph.D. ......................... Wisconsin
Becker, Jeffrey M., Ph.D. ......................... Cincinnati
Brian, D. A., Ph.D., D.V.M. ......................... Michigan State
Montie, T. C. (Emeritus), Ph.D. ......................... Maryland
Moore, R. N., Ph.D. ......................... Texas
Riggby, W. Stuart, Ph.D. ......................... Yale
Rouse, B. T., Ph.D. ......................... Guelph
Savage, Dwayne C. (Emeritus), Ph.D. ......................... California
Sayler, Gary S., Ph.D. ......................... Idaho
Stacey, G., Ph.D. ......................... Texas
White, D. C. (Distinguished Scientist), Ph.D. ......................... Rockefeller
Woodward, J. M. (Emeritus), Ph.D. ......................... Kansas

Associate Professors:
Hacker, David, Ph.D. ......................... Michigan State
Small, Pamela, Ph.D. ......................... Stanford

Assistant Professors:
Urbach, Ena, Ph.D. ......................... MT
Wilhelm, Steve, Ph.D. ......................... Western Ontario

The Department of Microbiology offers both the M.S. and Ph.D. Students have the option of selecting from a variety of graduate research programs. For a departmental brochure, contact the department head.

ADMISSION REQUIREMENTS

Students are expected to have completed an undergraduate program with a 3.0 or better GPA on a 4.0 system. Included in the undergraduate course credits should be (1) a full year of general biological science, (2) one year of calculus, (3) two years of chemistry, including one year of organic, (4) one year of physics, and (5) an introductory course in microbiology. In many cases, deficiencies in requirements may be removed by taking appropriate courses during the first year of graduate study. The department also requires the general portion of the Graduate Record Examination. A satisfactory score on each part is 550 or higher with rare exceptions. Three letters of recommendation should be submitted by current or former faculty members.

Each new graduate student meets with an advisory committee chaired by the departmental Director of Graduate Studies to plan a program of study for the first one or two semesters until a research advisor is selected. All first-year students participate in a laboratory rotation program during the first semester of study. This program allows the student to adjust smoothly to the research programs of the department, to develop a background of research procedures and concepts, and to facilitate the selection of a research professor. Usually the student selects a research professor toward the end of the laboratory rotation period. The major professor assists in the selection of and carrying out of a suitable research program in the naming of a thesis or dissertation committee.
THE MASTER’S PROGRAM

The program leading to the M.S. is designed to provide the student with broad basic knowledge, to permit the acquisition of technical competence in the fundamentals of research, and to encourage creative and independent thinking. Two to three calendar years are usually needed for the course of study that has the following requirements:

1. 30 hours including 6 thesis credits;
2. A 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F system;
3. A 3.0 GPA in courses taken in the department;
4. A complete course sequence in biochemistry or molecular biology;
5. A presentation of a research thesis and its oral defense.

THE DOCTORAL PROGRAM

The program leading to the Ph.D. is designed to develop the student’s ability to pursue independent and original research in microbiology and allied fields, to teach both oral and written communication of the results of research to the scientific community, and to train effective teachers. Students may enter the program after receiving either a bachelor’s or master’s degree. Students who enter with a bachelor’s degree usually receive the Ph.D. after four or five years; those with the master’s degree usually take three or four years to complete the degree.

Departmental requirements are:

1. A 3.0 GPA in all courses taken for graduate credit after 12 hours of credit have been earned in courses graded on the A-F scale;
2. A 3.0 GPA in courses taken in the department;
3. A satisfactory performance in at least one semester as a teaching assistant;
4. A one-semester course in physical chemistry;
5. A course in statistics;
6. Two of biochemistry or molecular biology;
7. A satisfactory performance in a comprehensive examination that must be taken before the end of the fifth semester in the program and passed before admission to candidacy; and
8. The presentation of a research dissertation and its oral defense.

GRADUATE COURSES

410 Bacterial Physiology (3) Modern concepts of function and structure of bacterial cell. Prereq: Introduction to Microbiology. Sp

411 Bacterial Genetics (3) Transmission and expression of genetic information by bacteria. Prereq: Introduction to Microbiology. Sp

420 Medical Microbiology (3) Disease-producing microorganisms, including bacteria, rickettsia, chlamydia and fungi. Prereq: Introduction to Microbiology. Sp

429 Medical Microbiology Laboratory (2) Laboratory exercises in medically important areas of microbiology: microorganisms, pathogenesis and immunology. Prereq: Introduction to Microbiology Lab. Coreq: 420. Sp

430 Immunology (3) Principles of inflammation and immunity; immunoglobulin structure and theories of formation and diversity; complement, hypersensitivities, cell cooperation and recognition in immune mechanisms; soluble factors. Prereq: General Genetics. F


470 Microbial Ecology (3) Physiological diversity and taxonomy of microorganisms from natural environments. Functional role of microorganisms in natural and simulated ecosystems. Prereq: 310. F

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

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

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

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

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

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

595 General Seminar (1) Lectures and seminars by invited speakers, faculty, and graduate students. May be repeated. Maximum 18 hrs. S/NC only. E

596 Laboratory Rotation (1) Familiarization with research areas in department through series of rotations in laboratories of individual faculty members. May be repeated. Maximum 3 hrs. S/NC only. E

600 Doctoral Research and Dissertation (3-15) Prereq: 596 laboratory rotation. May be repeated. Maximum 18 hrs. S/NC only. E

601 Journal Club in Microbial Physiology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

602 Journal Club in Microbial Pathogenesis (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

603 Journal Club in Immunology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

604 Journal Club in Virology (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

605 Journal Club in Microbial Genetics (1) Readings and discussions based on current literature. May be repeated. Maximum 18 hrs. S/NC only. E

610 Topics in Microbial Physiology (1-3) Prereq: 410 or consent of instructor. May be repeated. Maximum 12 hrs.

620 Topics in Microbial Pathogenesis (1-3) Prereq: 420, 430 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Topics in Immunology (1-3) Prereq: 430 or consent of instructor. May be repeated. Maximum 12 hrs.

640 Topics in Virology (1-3) Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hrs.

650 Topics in Microbial and Molecular Genetics (1-3) Prereq: 411 or consent of instructor. May be repeated. Maximum 12 hrs.

670 Advanced Topics in Environmental Microbiology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

Microbiology-Veterinary Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Modern Foreign Languages and Literatures

(College of Arts and Sciences)

MAJORS

French ............................................................ M.A.
German .......................................................... M.A.
Spanish .......................................................... M.A.
Modern Foreign Languages ................................ Ph.D.

Carolyn R. Hodges, Head

Professors:
Barrette, Paul E., Ph.D. ............... California
Brady, Patrick (Shumway Chair of Excellence), D.U.P. ......... Sorbonne
Campion, Edmund J., Ph.D. .......... Yale
Cobb, Carl W. (Emeritus), Ph.D. .... Tulane
Creeg, Bryant, Ph.D. ................. California
DiMaria, Salvatore, Ph.D. ........... Wisconsin
Elliott, Jacqueline C. (Emerita), M.A. ... Illinois
Fallen, James E. (Emeritus), Ph.D. .... Pennsylvania
Fiene, Donald M. (Emeritus), Ph.D. .... Indiana
Handelsman, Michael H. (Liaison), Ph.D. ................. Florida
Heflin, William H. (Emeritus), Ph.D. .......... Florida State
Hodges, Carolyn R., Ph.D. .......... Chicago
Irving, Thomas B. (Emeritus), Ph.D. .... Princeton
Kratz, Henry (Emeritus), Ph.D. .... Ohio State
Levy, Karen D., Ph.D. ............... Kentucky
Mauroin, Ferdinando D. (Emeritus), Ph.D. .......... Columbia
Mellor, C. J., Ph.D. ............... Northwestern
Pinsky, Clara (Emerita), Ph.D. .......... California
Ritzenhoff, Ursula C. (Emerita), Ph.D. .......... Illinois
Romeiser, Margaret Ph.D. .......... Texas
Silva-Filho, Euridice, Ph.D. .......... North Carolina

Associate Professors:
Beauvois, Margaret, Ph.D. .......... Texas
Blackwell, Stephen H., Ph.D. ........... Indiana
Brazio-Skov, Flavia, Ph.D. .......... Washington
Essif, Les, Ph.D. ................. Brown
Hoeving, Peter, Ph.D. ................. Wisconsin
Holmlund, Christine, Ph.D. .......... Wisconsin
Kaplan, Gregory, Ph.D. .......... Pennsylvania
LaCure, Jon, Ph.D. ............... Indiana
Lee, David E. (Liaison), Ph.D. ........ Stanford
Nakuma, Constancio, Ph.D. .......... Sorbonne
Oehresberg, Stefanie, Ph.D. .......... McGill
Pervukhina, Natalia K., Ph.D. ....... Bryn Mawr
Silva-Filho, Eudice, Ph.D. .... North Carolina

Assistant Professors:
Ayo, Alvaro A., Ph.D. ............... Arizona
Berwald, Olaf, Ph.D. ............... North Carolina
The Department of Modern Foreign Languages and Literatures offers graduate programs leading to the Master of Arts degree with majors in French, German and Spanish, and the Doctor of Philosophy degree with a major in Modern Foreign Languages. Inquiries should be addressed to the head of the department.

THE MASTER’S PROGRAMS

French
Thesis Option:
1. Completion of a minimum of 24 semester hours in coursework plus at least 6 hours in course 500 Thesis. French 501 is required. A maximum of 6 hours may be taken at the 400 level, the rest at the 500 level, and under certain conditions the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours (including 6 hours of thesis) must be taken in the major, 6 in the minor.
2. A thesis, with a minimum of 6 semester hours in course 500.
3. A written examination covering the coursework and selected items from a master reading list.
4. A final oral examination covering the thesis.
Non-Thesis Option:
1. Completion of at least 30 semester hours, with a maximum of 9 at the 400 level, the rest at the 500 level, including French 501. Under certain conditions, the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours must be taken in the major, 6 in the minor.
2. Theses and papers that have been accepted by the student’s advisory committee.
3. A written examination covering the coursework and selected items from a master reading list.
4. A final oral examination to discuss the papers.

German
Thesis Option: The minimum requirements are 24 semester hours of coursework and 6 hours of Thesis 500. German 510 and 519-20 are required, as are three courses on German literature or culture, one of which may be at the 400 level. In addition, students must take three further courses, only one of which may be chosen from 411-12 or 485. All graduate teaching assistants should take 512, and other candidates may take 512 or any other 500-level course. A maximum of three 400-level courses may be counted toward the 30 semester hours of coursework. A common written exam over the designated reading list is required, as is a standardized language exam, such as the Zentrale Mittelstufenprüfung. Each non-thesis M.A. candidate will have a committee of three faculty members in German to whom the student will submit a dossier consisting of the seminar paper and one paper previously submitted in a graduate course. The length and type of the papers is described in greater detail in the Manual for Graduate Students in German.
Non-Thesis Option:
1. Completion of at least 30 semester hours, with a maximum of 9 at the 400 level, the rest at the 500 level, including German 501. Under certain conditions, the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours (including 6 hours of thesis) must be taken in the major, 6 in the minor.
2. Three term papers that have been accepted by the student’s advisory committee.
3. A written examination covering the coursework and selected items from a master reading list.
4. A final oral examination covering the thesis.

Spanish
Thesis Option:
1. Completion of a minimum of 24 semester hours in coursework plus at least 6 hours in course 500 Thesis. Spanish 550 is required. A maximum of 6 hours may be taken at the 400 level, the rest at the 500 level, and under certain conditions the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours (including 6 hours of thesis) must be taken in the major, 6 in the minor.
2. A thesis, with a minimum of 6 semester hours in course 500.
3. A written examination covering the coursework and selected items from a master reading list.
4. A final oral examination covering the thesis.
Non-Thesis Option:
1. Completion of at least 30 semester hours, with a maximum of 6 at the 400 level, the rest at the 500 level, including Spanish 501. Under certain conditions, the student may take 600-level seminars. If the student chooses to have a minor (such as Italian or Portuguese), at least 24 hours must be taken in the major, 6 in the minor.
2. Three term papers that have been accepted by the student’s advisory committee.
3. A written examination covering the coursework and selected items from a master reading list.

THE DOCTORAL PROGRAM

The Ph.D. in Modern Foreign Languages requires advanced training in a major language and either a second language or applied linguistics.

Admission Requirements
Applicants must have completed a B.A. in either French, German or Spanish to be accepted into this program. Both graduates of institutions in the United States and those with undergraduate degrees from institutions outside the United States must have a grade point average of at least 3.0. Consideration will also be given to applicants who do not have an undergraduate degree in one of the three foreign languages but do have the equivalent of an undergraduate major in one of them.

Degree Requirements
Candidates must complete a minimum of 63 semester hours of coursework beyond the bachelor’s degree in addition to 24 hours of doctoral research and dissertation.

For candidates with French or Spanish as a first concentration, two tracks are available:
The coursework for Track I must be distributed as follows: at least 39 hours in the first concentration; at least 18 hours in the second concentration; and at least 6 hours in a cognate field or in either the first or second concentration as approved by the student’s graduate committee.
The coursework for Track II must be distributed as follows: at least 45 hours in the first concentration; at least 12 hours in the second concentration; and at least 6 hours in a cognate field or in either the first or second concentration as approved by the student’s graduate committee. Because Track II students will have taken 12 graduate hours instead of 18 hours in the second concentration, they will normally not be eligible to teach that field at institutions which follow SACS guidelines for college foreign language teaching.
The coursework for all concentrations must be distributed as follows:

1. First Concentration: German. A minimum of 39 hours of German courses beyond the bachelor’s degree, distributed as follows:
   - 400 level: A maximum of 6 hours of 400-level classes taken for the M.A. may be applied.
   - 500 level: A minimum of 21 hours must be taken. These must include German 512, 519, 520, and 560. Thesis hours are excluded. If 512 is used as part of a second concentration in applied linguistics, another course must be substituted in the first concentration.
   - 600 level: A minimum of 12 hours must be taken, exclusive of dissertation hours.
First Concentration: French or Spanish. A minimum of either 39 (Track I) or 45 (Track II) hours of French or Spanish courses beyond the bachelor’s degree, distributed as follows:

   - 400 level: A minimum of 12 hours must be taken, exclusive of dissertation hours.
   - 500 level: A minimum of 21 (Track I) or 27 (Track II) hours must be taken. These must include French 512, 519, 584 or Spanish 512 and 550. Thesis hours are excluded. If 512 is used as part of a second concentration in applied linguistics, another course must be substituted in the first concentration.
   - 600 level: A minimum of 12 hours must be taken, exclusive of dissertation hours.

2. Second Concentration: a minimum of 18 (German or Track I) or 12 (Track II) hours beyond the bachelor’s degree, taken in the field of applied linguistics or in a second language, either French, German, Italian, Portuguese (Track II only), Russian or Spanish. For Track I and German, 12 of these hours must be at the 500 level or above. For Track II, 3 of these hours must be at the 500 level or above.
French students choosing applied linguistics must take French 421 or 429; 425; 512; and 9 (Track I) or 3 (Track II) hours of appropriate electives in English or French.
German students choosing applied linguistics...
Asian Languages

GRADUATE COURSES

431 Readings in Chinese Literature (3) Prerequisite: Mastery of intermediate-level Chinese or consent of instructor. May be repeated. Maximum 9 hrs.

451 Readings in Japanese Literature (3) Prerequisite: Mastery of intermediate-level Japanese or consent of instructor. May be repeated. Maximum 9 hrs.

French

GRADUATE COURSES

410 Medieval French Literature (3) Major representative works of medieval French literature. Texts in modern French. Prerequisite: 300-level literature course.

411 French Literature of the 16th Century (3) Highlights of 16th-century French literature. Excerpts from Rabelais and Montaigne; readings of poems from writers from Lyon and members of the Pléiade. Prerequisite: 300-level literature course.

412 French Literature of the 17th Century (3) Masterpieces of 17th-century French literature. Prerequisite: 300-level literature course.

413 French Literature of the 18th Century (3) Major works of enlightenment. Prerequisite: 300-level literature course.

414 French Literature of the 19th Century (3,3) French Romanticism and its counter movements: Realism, Parnassianism and Naturalism. Prerequisite: 300-level literature course.

415 French Literature of the 20th Century (3) Survey of 20th-century French literature. Prerequisite: 300-level literature course.

420 French Cinema (3) French cinema from earliest days through New Wave directors. Prerequisite: 300-level literature course. May apply toward major. (Same as Cinema Studies 420)

421 Phonetics (3) Foundation in science of phonetics. Practical exercises and individual performance. Graduate credit not offered to students majoring in Romance language. Prerequisite: Intermediate Composition and Conversation or French for Business. Prerequisite may be excused by department.

422 Advanced Grammar (3) Improving one's written French by studying basic and more refined structures of French language. Writing creative free-style compositions. Prerequisite: Intermediate Composition as conversation or French for Business

423-24 Advanced Conversation (1,1) Informal conversation with native speaker on contemporary topics. Emphasis on oral expression. Prerequisite: Intermediate Composition and Conversation or French for Business. 2 hrs. weekly.

425 Introduction to Descriptive Linguistics (3) Theory and practice of techniques of linguistic analysis in subfields of phonetics, phonology, morphology, syntax, semantics, pragmatics and historical linguistics; discussion of relevance to teaching and learning of foreign languages and to study of literary texts. Recommended prerequisite: Language, Linguistics and Society. (Same as German 425, Linguistics 425, and Spanish 425.)

426 Methods of Historical Linguistics (3) (Same as German 426, Spanish 426 and Linguistics 426.)

429 Romance Linguistics (3) Development of Classical Latin through Vulgar Latin into major Romance languages. (Same as Spanish 429 and Linguistics 429.)

430 Theatrical French (4) Comprehensive introduction to the theatrical production and performance in French. Collaboration in creative staging of a French play and participation in public performance. Prerequisite: 300-level literature course.

431 Highlights of French Civilization (3) Survey of French civilization from the Gauls to World War II. Historical events, daily life, all forms of arts. Prerequisite: 300-level literature course.

432 Contemporary French Culture (3) Current French cultural issues placed in historical perspective with comparative emphasis. Taught in English; readings in French for majors.

434 Literature of Quebec (3) Survey of literature of Quebec as well as French literature connected with North America. Readings include explorer and missionary works, such as Voyages of Champlain and Journals of Jesuits, and literature of contemporary Quebec. Prerequisite: 300-level literature course.

445 Advanced French for Business (3) Advanced contemporary French language and culture as relate to business transactions. Comparative approach to explore differences and similarities between francophone business culture(s) and those of North America and Japan. Building knowledge of business terminology while being sensitized to cultural differences and dangers of simplistic stereotyping. Prerequisite: French for Business or consent of instructor.

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

501 Techniques in Literary Analysis (3) Required for M.A. program. Close stylistic analysis of texts representative of different eras and of different genres. Development and improvement of student's written French.

502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or is required to devote time to research before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E

510 The French Language (3) French as spoken and written from Medieval period to present.

512 Teaching a Foreign Language (3) Practical approaches to methods for teaching and evaluating basic language skills and foreign language skills, and cultural aspects through seminars, demonstrations, peer teaching, and observation of foreign language classes. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships, except those whose previous training or experience warrants their being excused by department.

515 Technology Enhanced Language Learning (3) Introduction to TELL. Overview of existing software programs, and professional literature on topic. Hands-on development of instructional Web site for teaching a foreign language, culture, or literature.

519 Bibliography and Methods of Research (3) Critical research tools and scholarly contributions in French literature and language. Practical exercises on compiling of scholarly data using computer-based and non-computer sources.

520 French and Francophone Film (3) French and Francophone culture through film.

530 French and Francophone Theater (3) Changing approaches to French and Francophone theater.

540 French Literature and Culture I (3) Literary and cultural heritage of French Middle Ages.

550 French Literature and Culture II (3) Literary and cultural heritage of 16th- and 17th-century France.

560 French Literature and Culture III (3) Literary and cultural heritage of 18th- and 19th-century France.

570 French and Francophone Literature and Culture I (3) Literary and cultural heritage of France and other francophone countries in first part of 20th century.

573 French and Francophone Literature and Culture II (3) Literary and cultural heritage of France and other francophone countries from late 20th century to present.


584 Modern Theory and Criticism (3) Survey of contemporary critical theory, including psychoanalysis, Marxism, structuralism and more.