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, health planning/administration, and occupational/environmental health and safety. 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. Appropriate forms are available from the department's program in Public Health. Preferential consideration 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. No provisional students will be admitted. As a restricted program, non-degree admission requires departmental recommendation.

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. Field practice 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.

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.P.H. program in Public Health is available to residents of the states of Arkansas, Florida, Kentucky, Louisiana, Mississippi, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

COURSE REGISTRATION
Provisional graduate students are ineligible to enroll in 500-level public health courses. Non-degree students must obtain permission from department/professor to register for 500-level public health courses. Prerequisite coursework assigned as a condition of admission to the M.P.H. program must be completed promptly, with a grade of B or better, typically within the first semester or two of enrollment in graduate studies.

GRADUATE COURSES
400 Consumer Health (3) (Same as Health 400.)
410 Health in the Work Environment (3) Fundamental activities in field of industrial health aimed at reducing health problems for employees. Workplace health hazards and problems of concern to nurses, medical staff, management, engineers and others in industrial health and safety fields. Prereq: Consent of instructor. May not be taken for credit by occupational health concentration majors.

480 Special Topics (3) Prereq: Consent of instructor. May be repeated under different topic. Maximum 6 hrs.

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 (3-15) Prereq: Consent of instructor. May not be registered without instructor's approval. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E, N/C

505 Continuing Education in Public Health (1-3) Selected learning activities and experiences in specialized areas of public health utilizing workshop format. May be repeated. Maximum 9 hrs.

509 Graduate Seminar in Public Health (1) In-depth discussion of timely topics reflecting scope of public health as discipline and its interaction with many other academic and professional disciplines. Speakers both internal and external. May be repeated. Maximum 4 hrs. F, Sp


511 Fundamentals of Industrial Hygiene (3) Occupational health theory, practice and regulations; recognition, evaluation and control of workplace health hazards. Prereq: Consent of instructor. May not be repeated. F, Sp

512 Industrial Hygiene Controls (4) Activities in comprehensive practice of industrial hygiene controls; present day and emerging roles and techniques for effective control. Prereq: Consent of instructor. May not be repeated. F, Sp

513 Industrial Hygiene Instrumentation and Sampling (3) Instrumentation and methods for evaluating industrial hygiene and environmental health hazards in workplace settings. Students will be required to perform sampling, testing, and analysis on various types of environmental and occupational hazards. Prereq: Consent of instructor. May not be repeated. F, Sp

520 Health Policy and Administration (3) Administrative considerations of community-based health care programs and public health practice. Health policy formulation, planning, and implementation; organizational and operational involvement in health, legal responsibilities, and managerial concepts/techniques/process. Prereq: Consent of instructor. F, Sp

521 Organization Theory and Health Care Delivery (3) Administrative and Organization theory related to health facilities, organizations and management in community hospital. Case discussions and problem-solving exercises; managerial functions and skills.

523 Management in Extended Care Settings (3) Management concepts and theoretical foundations essential to supervision and administration of domiciliary health services programs. Management and operation of health care services programs. Prereq: Consent of instructor. F, Sp

525 Financial Management of Health Programs (3) Financial management principles and practices applied to health care programs. Fundamentals of budgeting, costing, financing, rate setting, financial reporting and control. Opportunities to apply skills. Prereq: Consent of instructor. F, 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. Prereq: Consent of instructor. F, Sp

540 Research Methods in Epidemiology (3) Basic measurement science of public health. Epidemiologic research techniques; application of discipline's research methods. Basic measures of risk, concepts of bias and causal reasoning. Study design options and analytic approaches. Prereq: Consent of instructor. F, Sp

542 Advanced Epidemiologic Methods (3) Co-Trainee Study Design, comparison studies; and general attention to calculation and formulation of professional literature, critical perspective of epidemiologic approaches to prob-
Recreation and Leisure Studies

Graduate study in a major in Recreation and Leisure Studies leads to the Master of Science (M.S.) degree. Preparation concentrations are available in therapeutic recreation, general recreation, and sport administration/management. The third concentration is an interdisciplinary program with the department of Human Performance and Sport Studies.

The M.S., with thesis and non-thesis options, requires completion of 32 semester hours.

The following retention policy applies to graduate students seeking the M.S. with a concentration in sport administration/management:

1. Graduate students are required to maintain an overall 3.0 GPA.
2. Any student who falls below this standard will be advised in writing by the department head of the need to discuss the matter with his/her advisor.
3. If a student's overall GPA remains below 3.0 for a second semester, the student will have his/her degree status revoked.

GRADUATE COURSES

410 Maintenance and Management of Recreation and Sports Related Facilities (3) Principles for operationalization of modern facility maintenance systems and management strategies. Cost tracking, inventory systems, specialized maintenance techniques, safety guidelines, maintenance management systems and security. Prereq: 110, 310 or consent of instructor. F

430 Organization and Administration of Leisure Services (3) Principles of administration applied to provision of leisure services offered by public, private, and/or commercial enterprises. Organizational structures, personnel management, evaluation, legal authority, introduction to budgeting and fiscal procedures. Prereq: 310 or consent of instructor. F

440 Dimensions of Private and Commercial Recreation Businesses (3) Nature and function of recreation in private and commercial enterprises. Survey of development and management of commercial goods and services offered in leisure market. Factors influencing participation, management considerations, and research in commercial recreation and tourism. Prereq: 110, junior standing, or consent of instructor. Sp

450 Specialized Study in Leisure Education (1-6) Special interest in leisure areas; developing positive attitudes toward leisure. Demonstrates how leisure contributes to one's mental and physical health. May be repeated. S/NC only. E

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

502 Registration for Use of Facilities (3-15) Required of all graduate students. May be repeated. S/NC only. E


515 Philosophical and Conceptual Foundations of Leisure (3) Philosophy of leisure and recreation; nature of philosophy, concepts of leisure, recreation, play, work, and other. History of field, and relationships of ideas to contemporary society and to professional practice. Prereq: Consent of instructor. F

520 Program Design and Evaluation in Therapeutic Recreation (3) History, philosophy, nature, purpose, special populations served; program planning; factors involved in development of therapeutic recreation. Basic overview of aspects of leisure delivery systems. Prereq: Consent of instructor. F

521 Leisure Counseling and Facilitation Techniques (3) Investigation of theories and techniques of leisure counseling; introduction to and practice of various leisure facilitative techniques; use of increased personal leisure awareness as desired but concurrent goal. Prereq: 520 or consent of instructor. Sp

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

540 Fiscal Policies for Recreation and Sports Related Organizations and Facilities (3) Application of fiscal policies and procedures to operation of recreation and sports related organizations and facilities. Finance, revenue generation, management, accounting, and control. Public relations, cooperative ventures, and microcomputer applications. Prereq: 430 or consent of instructor. Sp

590 Practicum in Leisure & Recreation (1-6) Required of all graduate students. 100 clock hours during semester with agency for 2 hrs credit. Two major phases: work experience and written paper. E

591 Directed Study in Leisure & Recreation (1-6) Detailed study of theme, issue, or concept. Designed to meet needs of individual students. May be repeated. Maximum 6 hrs. E

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

Safety

Graduate programs are available leading to the Master of Science with a major in Safety Education and Service (thesis and non-thesis options) and to the Specialist in Education with a major in Safety Education and Service. The M.S. with thesis options, requires completion of 30 semester hours.

The Specialist in Education (Ed.S.) requires 30 semester hours beyond the M.S. An internship and research of a significant safety problem are included as professional development activities.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. and Ed.S. programs in Safety Education and Service are available to residents of the states of Alabama, Arkansas, Florida, or South Carolina. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

441 Driver and Traffic Safety Education (4) Preparation of traffic safety instructors for school, colleges, industry, and commercial agencies. Students required to teach at least two semesters for valid driver's license required. 3 hrs and 2 labs. F, Sp

442 Advanced Driver & Traffic Safety Education (3) Development of competence in teaching of driver education through use of simulation, multimedia, and multi-car driving range. Teaching skills and supervision, 2 hrs and 2 labs. F, Sp

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

452 General Safety (3) Principles, practices, and procedures in general safety. Safety problems in school, traffic, recreation, industry, home and other public areas. E

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

502 Registration for Use of Facilities (3-15) Required of all graduate students. May be repeated. S/NC only. E

532 Behavioral Problems in Safety Education & Accident Prevention (3) Problems of behavior, causes of accidents, and application of principles of psychology in development of safe behavior in all segments of environment. F

Health, Leisure and Safety
533 Problems and Research in Accident Prevention
(3) Safety problems found in wide variety of accidents that occur in community; findings of current research in behavioral sciences as related to variation incidence of accidents. F

534 Organization, Administration and Supervision of Safety Programs (3) National, state and local level programs; administrative, instructional, and supervisory aspects. Implementation of relevant programs. Sp

535 Emergency Management (3) Civil and defense problems: tornadoes, fires, floods, mass civil disorders, and nuclear and personnel attack by alien countries. Sp

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

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

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 Liberal Arts)

MAJOR DEGREES

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

Russell Buhite, Head

Professors:
Bergeron, Paul H., Ph.D. .......... Vanderbilt
Buhite, Russell, Ph.D. .......... Michigan State
Chmielewski, Edward V., Ph.D. .......... Harvard
Cobb, James C., Ph.D. .......... Georgia
Haas, Arthur G., Ph.D. .......... Chicago Hao, Wen-Ping, Ph.D. .......... Harvard
Jackson, Charles O., Ph.D. .......... Emory Klein, Milton M. (Emeritus) (Distinguished Prof.), Ph.D. .......... Columbia
McDonald, Michael J., Ph.D. .......... Pennsylvania Wheeler, W. Bruce, Ph.D. .......... Virginia

Associate Professors:


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 and also offers a non-thesis public history concentration. The doctoral program has concentrations in American and European history with special focuses in the areas identified under group II doctoral fields.

Details of 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 and subject).

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 elsewhere 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 non-thesis option is examined by a two-hour written examination taken 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 secondary field.

M.A. Fields
United States (colonial to present) 
Premodern Europe
Modern Europe
Asia
Latin America

Concentration in Public History
The public history program is a 37 hour non-thesis program that trains students in the field of American history and an aspect of public history such as historical editing and management of historical collections, presentation of historical subjects through non-traditional formats and preservation of historical sites.

The program consists of 19 hours within the history department (including 510, one research seminar, three readings courses, and 599) and an additional 18 hours (primarily outside the history department) selected by the student and the supervising professor from an approved list. Students must maintain a 3.0 grade-point average in history courses taken and in courses taken outside the department and earn a B or higher in 599. Public history students take the same M.A. examination in American history as the non-thesis M.A. students.

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 and subject).

Residence and Coursework
Before being admitted to doctoral candidacy, a student must:
1. Complete History 510 at UT Knoxville.
2. Complete a minimum of 6 related hours outside the department.
3. Spend two consecutive semesters in residence.
4. Complete 9 hours in each of two Group I doctoral fields. (The courses in the non-examined field must be graded A-F. There is no minimum hours requirement for a Group II field. Courses taken to fulfill M.A. requirements may be counted toward this requirement.)
5. Fulfill the foreign language requirement.
6. Complete two 600-level research seminars. (One must be completed at UT Knoxville. Students who completed a Master's thesis need complete only one research seminar but it must be completed at UT Knoxville.)
7. Maintain a 3.0 overall grade-point average in graduate work completed.
8. Complete 21 hours of graduate coursework graded A-F at UT Knoxville beyond that required for the M.A.
9. 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.

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 to be taken during the same semester. Each part consists of a 4-hour written examination within one week by a
2-hour oral examination. A grade of pass or fail is awarded at the conclusion of the oral examination. A student who fails the comprehensive examination (or any part) must repeat it no later than the following semester. A student who fails the same examination twice or who does not take the examination when required will be dropped from the graduate program. Upon completion of the residence, coursework, research, and language requirements and passing the comprehensive examination, 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: Political (U.S.), Social Economic, Military/International Relations, Regional/Local (U.S.), National/Regional (Non-U.S.).

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

510 Foundations to Graduate Study in History (3) Prerequisites: and methods of historians. Required of all candidates for doctoral degree. May be repeated.

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 5 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- and 20th-Century United States (3) Reading seminar: secondary sources on 19th- and 20th-century United States. 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.

554 Topics in Comparative Social and Economic History (3) Reading seminar: secondary sources on multinational topics, comparatively structured. Focus varies. 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.

559 Topics in Latin American History (3) Reading seminar: secondary sources on Latin America. Focus varies. May be repeated. Maximum 15 hrs.

560 Topics in U.S. Religious History (3) (Same as Religious Studies 560) Focus varies. May be repeated. Maximum 15 hrs.

566 Topics in U.S. Religious History (3) (Same as Religious Studies 566) Focus varies. May be repeated. Maximum 15 hrs.

571 Topics in Applied History (3) Seminar to develop practical skills applicable to museology, historical preservation, material culture, historical agencies, historical editing, and other areas of applied history. Focus varies. May be repeated. Maximum 15 hrs.

580 Topics in History (3) Reading seminar: secondary sources for new topics. Focus varies. May be repeated. Maximum 15 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

599 Historic Preservation Internship (3) 180-hour experience with regional historical agency, project site, or near completion of graduate program. Written analysis of relationship between academic program and applied project.

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

621 Directed Readings (3) Directed readings to prepare candidate for doctoral comprehensive examination. May be repeated. Maximum 1 per doctoral field. S/NC only.


632 Seminar in Modern European History (3) Research seminar in primary sources culminating in scholarly paper in modern European history. Focus varies. May be repeated. Maximum 15 hrs.

641 Seminar in Early American History (3) Research seminar in primary sources culminating in scholarly paper in American history. Focus varies. May be repeated. Maximum 15 hrs.


651 Seminar in Military and Foreign Relations History (3) Research seminar in primary sources culminating in scholarly paper in military or foreign relations history. Focus varies. Not restricted by national grouping. May be repeated. Maximum 15 hrs.


658 Seminar in United States Regional and Local History (3) Research seminar in primary sources culminating in scholarly paper in local history. Focus varies. May be repeated. Maximum 15 hrs.


580 Seminar in History (3) Research seminar in primary sources culminating in scholarly paper in aspect of history not covered in another 600-level research seminar. Focus varies. May be repeated. Maximum 15 hrs.

**Home Economics**

(Graduate of College of Human Ecology)

**MAJOR DEGREE**

Home Economics: 

M.S.

The Master of Science with a major in Home Economics is a college-wide, multidisciplinary program. This degree provides a flexible graduate program for students wishing to pursue in-depth study across subject areas of home economics/human ecology. Teachers, extension personnel, family life educators and other professionals interested in broad-based areas will find that a diversity of subject matter combinations can be tailored to meet individual needs.

**ADMISSION REQUIREMENTS**

A completed file for review includes the Graduate School application file, College of Human Ecology application, Graduate Record Examination (GRE) scores for the general section or Miller's Analogical Test (MAT) score, and three Graduate School Graduate/Approved Forms completed by individuals who can attest to the potential for graduate education. Forms may be obtained from the Dean's Office, College of Human Ecology. The M.S. in Home Economics requires an undergraduate degree in Home Economics.

**THE MASTER'S PROGRAM**

The M.S. in Home Economics is designed to meet graduate study needs of professionals who work in programs encompassing all areas of home economics. Thesis (33 hours) and non-thesis (36 hours) options are offered. The program includes 6 hours in statistics and/or research methodology, 9 hours in program planning, implementation, and evaluation (may be selected from agricultural extension, home economics education, or other courses approved by committee), 3 hours in the integrative nature of home economics (HE 510), and 9 (thesis option) or 12 (non-thesis option) hours in the College of Home Economics. At least one course is to be from each department in the college. The thesis option requires 6 hours of Thesis 500, and the non-thesis option requires a creative project (3 hours) and 3 hours of approved electives. An oral/written comprehen-
sive examination will be administered at the end of the program.

ACADEMIC COMMON MARKET

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

Home Economics Education

(College of Human Ecology)

Students pursuing graduate study in home economics education or extension are encouraged to enroll in the multidisciplinary Master's degree in Home Economics. Home Economics Education courses may be selected to meet requirements of that program. Home economics teachers may choose courses within this area for updating and certification renewal. Graduate coursework in Home Economics Education may also be selected for development of a concentration or minor within other areas of specialization.

GRADUATE COURSES

510 Curriculum in Home Economics (3) Development of home economics educational materials and instruction. Prereq: 420 or equivalent or consent of instructor. F,A

515 Evaluation in Home Economics Education (3) Assessment of programs and pupil progress; techniques, methods and purposes. Prereq: 420 or equivalent, F,Sp,A

520 Supervision of Home Economics in the Public Schools (3) Program planning, organization and administration of vocational home economics education. Supervision of pre-service and in-service home economics professionals. Prereq: Classroom teaching experience. Sp

525 Home Economics Adult Education (3) Development and administration of community-based home economics programs for adults. Prereq: Consent of instructor. Sp

530 College Teaching in Home Economics (3) Instructional effectiveness, techniques, organization, and evaluation. Prereq: Consent of instructor. F,A

563 Family Life Education Programs (3) (Same as Child & Family Studies 563.)

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

Human Ecology

(College of Human Ecology)

MAJOR

Human Ecology ........................................ Ph.D.

Graduate study leading to the Doctor of Philosophy with a major in Human Ecology is available in the Departments of Child and Family Studies, Nutrition, and Textiles. Retailing, and Interior Design. Concentration areas are child development, family studies, nutrition science, textile science, and consumer environments. A major challenge of the doctoral program in Human Ecology is to draw upon the basic research generated from the natural sciences, social sciences, humanities, and the arts, and to provide a holistic perspective that contributes to the improvements of individual and family well being. For example, the physiological chemist may study metabolic-dietary interrelationships and psychologists may study child behavior. But, it is within human ecology that the nutrient needs of the growing child are considered along with the factors that affect the child's acceptance of different foods. Within the College of Human Ecology, research from one discipline is enhanced by encompassing and utilizing the findings of research from other disciplines.

ADMISSION REQUIREMENTS

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

THE DOCTORAL PROGRAM

The doctorate 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 School sets minimum requirements for the doctoral degree. Additionally, the college has requirements that include:

1. Selection of a concentration and fulfillment of the requirements as directed by the major professor and approved committee.

2. Minimum of 78 semester hours in courses beyond the baccalaureate degree (exclusive of dissertation), including College Professional Seminar in Human Ecology 610; minimum of 9 semester hours of 600-level coursework (not including dissertation); and 24 semester hours of dissertation.

3. Successful completion of written/oral comprehensive examinations as provided by each department's procedures and the student's doctoral committee.

4. Original research project, which culminates in a dissertation.


The doctoral committee shall determine whether a reading knowledge of a foreign language is required.

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

CONCENTRATION IN CONSUMER ENVIRONMENTS

The consumer environments concentration is designed to be most appropriate for students with interests in retail and consumer sciences, foodservice and lodging administration or interior design.

Requirements are a minimum of 90 hours including:

1. HEED 530
2. HE 610
3. HRA 532, ID 570 and RCS 550
4. HRA 537 or RCS 590 or ID 590 (2 hours)
5. Minimum 8 hours of statistics and research methods.
7. Twenty-four hours of dissertation.
8. Electives for 34 hours approved by the committee. (Students must take at least 18 hours in one of three specialty areas: food-service and lodging administration, retail and consumer sciences or interior design; including a minimum of 9 hours required at the 600 level.)

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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

501 Microcomputer Research Applications in Human Ecology (3) Advanced microcomputer concepts and applications for research. Overview of statistical analysis software, computer graphics, computer-assisted design and national data base searches.

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degrees 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

515 Issues and Trends in Human Ecology (1-3) Research and theory related to current issues. Prereq: Consent of instructor. E

520 Directed Study in Human Ecology (1-3) Integrative topics. Prereq: At least 9 hrs. 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 Economics (1-6) Field based experiences. Prereq: Consent of instructor. 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 UTK. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs. (Same as Educational and Counseling Psychology 585, Nursing 585, Physical Education 585, Public Health 585, Psychology 585, Social Work 585, and Sociology 585.) S/NC only.

510 Professional Seminar in Human Ecology (3) Review of various approaches taken by different disciplines to study of ecology; ecological applications in human ecology; temporal, spatial properties of human ecosystems; model building/systems thinking and futures thinking in human ecology. Sp
Human Performance and Sport Studies

(College of Education)

MAJORS

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

Joan Paul, Head

Professors:

Capen, Edward K. (Emeritus), Ph.D. Iowa
Howley, Edward T., Ph.D. Wisconsin
Kozar, Andrew J., Ph.D. Michigan
Lay, Nancy E., Ph.D. Florida State
Liemohn, W. P., Ph.D. Iowa
Paul, Joan, Ed.D. Alabama
Phillips, Madge M. (Emeritus), Ph.D. Iowa
Watson, Helen B. (Emeritus), Ph.D. Michigan
Wrisberg, C. A., Ph.D. Michigan

Associate Professors:

Beitel, Patricia A., Ed.D. North Carolina (Greensboro)
Bond, Vernon, Jr., Ed.D. Tennessee
Croskey, R. J., M.F.A. Southern Methodist
DeSensi, J. T., Ed.D. North Carolina (Greensboro)
Jones, Ralph E., Ph.D. Toledo
Morgan, W. J., Ph.D. Minnesota
Namey, Thomas, M.D. Washington (St. Louis)

Adjunct Faculty:

Acker, J. E., M.D. Tennessee
Buckles, Tina M., Ph.D. Tennessee
O'Connell, D. G., Ph.D. Toledo

THE MASTER'S PROGRAM

The Department offers the Master of Science with a major in Human Performance and Sport Studies with the following concentrations:

Exercise science (adapted physical education, exercise physiology/fitness)
Motor behavior
Pedagogy in physical education
Sociocultural foundations (history, philosophy, sociology)
Sport administration/management (an interdisciplinary concentration with Health, Leisure and Safety)

The Master of Science program permits the student to select a thesis or non-thesis option. The thesis option requires a minimum of 30 hours. The non-thesis option requires 32 hours, including a project. All M.S. students must complete a course in research design or statistics and register for two credits of Physical Education 601.

THE DOCTORAL PROGRAM

The Doctor of Education with a major in Human Performance and Sport Studies is available with the following concentrations:

Exercise science (adapted physical education, exercise physiology/fitness)
Motor behavior
Sociocultural foundations (history, philosophy, sociology)

The Doctor of Philosophy with a major in Education includes the concentrations and specializations listed under Education.

ADMISSION REQUIREMENTS

Applicants are required to complete the departmental application which will be sent to all persons upon their initial inquiry about the Doctoral Program. Specific questions about these programs should be directed to the head of the Department of Human Performance and Sport Studies.

The following retention policy applies to all graduate students seeking a degree in the Department of Human Performance and Sport Studies:

1. Graduate students are required to maintain an overall 3.0 GPA.
2. Any student who falls below this standard will be advised in writing by the department head of the need to discuss the matter with his/her advisor.

If a student's overall GPA remains below 3.0 for a second semester, the student will have his/her degree status revoked.

GRADUATE ASSISTANTSHIPS

A limited number of graduate assistantships are available for qualified women and men who are graduates of accredited colleges or universities. These assistantships are open to students in the Master's and doctoral programs. Students interested in these opportunities should file their applications before February. Letters should be addressed to Graduate Assistantships Coordinator, Department of Human Performance and Sport Studies, The University of Tennessee, Knoxville, TN 37996-2700.

Human Performance and Sport Studies

GRADUATE COURSES

405 Sociology of Sport (3) (Same as Sociology 405).
411 Adapted Physical Education (3) Developmental disabilities, other physical/mental handicaps and variant/invariant characteristics of specific syndromes germane to motor development/programming for those with special education needs.
423 Readings In Physical Education (2) Review of current and classic literature in physical education.
480 Physiology of Exercise (3) Functions of body in muscular work: physiological aspects of fatigue, training and adaptation to environment. Prereq: Human Physiology or general physiology. 2 hrs and 1 lab. (Same as Zoology 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 project requiring special written work. Prereq: 522.
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
509 Graduate Seminar in Public Health (1) (Same as Public Health 509, Nutrition 509, Nursing 509 and Social Work 509.)
511 Administrative/Supervisory Processes in Physical Education (3) Organizational concepts, management strategies, and supervisory techniques related to Physical education programs at all levels.
512 Application of Theory to Curricular/Methodological Decision in Physical Education (3) Application of curricular principles and theories to educational situations for development of curricula and lessons in physical education. Various methodological approaches.
514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptual, moral, aesthetic, and social-political issues.
515 Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport. (Same as Sociology 554.)
528 Motor Behavior: A Theoretical Perspective (3) Motor behavior from information processing perspective: overview of current research that supports theoretical bases. Prereq: Undergraduate course in general psychology or consent of instructor.
531 Biomechanics of Human Performance (3) Human movement: teaching, coaching and sports medicine. Prereq: 422 or equivalent.
532 Seminar in Research Techniques in Physical Education (3) Evaluate, compare, and contrast research techniques in physical education with consideration for and experiences in appropriate review, design, and execution of research projects.
533 Psychology of Sport (3) Social psychological factors influencing human behavior in sport context; discussion of contemporary theory, research, and methodology. Prereq: General psychology course or consent of instructor.
534 Motor Behavior and Skill Acquisition (3) Topical explanation and application of principles of human movement behavior to acquisition and performance of skills. Prereq: Permission of instructor.
535 Sport Administration (3) Development of knowledge and analytic skills desirable for middle and upper level managers/administrators in sport business/organization.
541 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated.
542 Sociological Aspects of Sport and Physical Education (3) Social and cultural factors influencing sport and physical education. Pertinent issues and research applications. Prereq: Consent of instructor. (Same as Sociology 542.)
543 Human Motor Development (3) Changes in selected motor performance and related attribute areas during critical developmental periods within context of perceptual-motor development theories and explanations of factors affecting motor behavior.
544 Theories of Physical/Movement Education (3) Integration of various theoretical approaches to physical education/movement education within cultural context; research and field work.
553 Advanced Adapted Physical Education (2) Curriculum development and teaching methodologies in programming for child with special education needs. Prereq: 422 or consent of instructor. Coreq: 554.
554 Advanced Adapted Physical Education Practice (1) Curriculums and methodologies implemented in lab in school for handicapped. Coreq: 553.
555 Motor Assessment and Programming for the Development of Remedial Programs for Children as which purport to get at basis of dysfunction; those which norm-referenced tests used in development of individualization, blood chemistry, and gas analysis. Prereq: 480. S/NC only.

563 Laboratory Techniques in Exercise Physiology (2) Laboratory course in experimental methodology and instrumentation: respiratory and metabolic measurements, heart electrical protocols which purport to get at basis of dysfunction; those which norm-referenced tests used in development of remedial programs for children assessed appropriate for school/parent implementation.

565 Advanced Physiology of Exercise (3) Quantitative approach to current and classical questions in exercise physiology. Prereq: 480 and 563.


569 Fitness Testing, Programming, and Leadership for Diverse Populations (2) Clinical experience in selecting, administering, and evaluating exercise tolerance tests. Individualized instruction in equipment and treadmill. Individual fitness programs for diverse populations. Practice in leading variety of activities aimed at improved fitness. Prereq: 460 and 414/415. Coreq: 569. (Same as Public Health 569.)

585 Seminar in Gerontology (1) (Same as Human Ecology 585, Educational and Counseling Psychology 585, Nursing 585, Psychology 585, Public Health 595, Social Work 585, and Sociology 585.)

593 Directed Independent Studies (1-3) May be repeated. Prereq: 532 or consent of instructor. S/NC or letter grade.

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

601 Research Seminar in Physical Education (1) Research topics in different aspects of physical education, sport, and human movement. 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.

633 Advanced Motor Behavior (1-3) In-depth analysis, synthesis, and discussion of contemporary theory and topics; research development and production: motor control learning, sport psychology, motor development.

681 Seminar in Exercise and Applied Physiology (1) Selected topics in exercise and environmental physiology. Prereq: 563 and 565. May be repeated with consent of instructor.

661 Research Participation in Applied Physiology (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.

Dance

GRADUATE COURSES

410 Ballet: Level III (2) Instruction and practice in advanced classical ballet techniques. Prereq: Dance majors and minors, or consent of instructor. May be repeated. Maximum 16 hrs.

415 Teaching Creative Dance for Children (2) Theory, methods, materials and practical experiences in presentation and integration of creative dance in grades K-6. Mini-teaching experience.

420 Jazz: Level III (2) Instruction and practice in advanced jazz and musical theater dance styles and techniques. Prereq: Dance majors and minors and consent of instructor. May be repeated. Maximum 16 hrs.

430 Modern: Level III (2) Instruction and practice in advanced modern dance techniques. Prereq: Dance majors and minors or consent of instructor. May be repeated. Maximum 15 hrs.

450 Composition III (3) Application of choreographic and production skills culminating in presentation of two works. Prereq: 440 and 445 or consent of instructor.

460 Rhythmic Analysis (3) Basic nature and principles of music, rhythm, and rhythmic notation; correlation of dance movement and composition. Prereq: Consent of instructor.

465 Dance Notation (3) Fundamentals of movement notation, notation and reading of elementary movement studies.

480 Dance Through the 19th Century (3) Dance of various societies and culture from pre-history through 19th century.

481 History of Dance II (3) Development of dance in theatre, recreation and education during 20th century.

490 Dance in the 20th Century (3) History and philosophy of dance.

539 Directed Independent Studies (1-3) Independent study in specialized area with dance. Prereq: Consent of advisor. May be repeated. Maximum 9 hrs.

495 Dance Pedagogy (3) Principles and methods of teaching and applying dance to mini-teaching experience. Prereq: Upperclass or graduate standing and consent of instructor.

Industrial and Organizational Psychology

(College of Business Administration and College of Liberal Arts)

MAJOR

Industrial and Organizational Psychology .................................................. M.S., Ph.D.

Michael C. Rush, Director

Committee:

Dewhirst, H. Dudley, Management Dobins, Gregory H., Management Fowler, Oscar S., Management James, Lawrence R., Management Jenkins, Roger L., Business Administration Johnson, Michael G., Psychology Jones, Warren H., Psychology Ladd, Robert T., Management Larsen, John M., Jr. (Emeritus), Management Loensburg, John W., Psychology Russell, Joyce E., A., Management Schumann, David W., Marketing Sundstrom, Eric, Psychology (For complete Faculty Listing, see Departments of Management and Psychology.)

The Master's and doctoral programs are offered jointly by the Department of Psychology and the Department of Management. They are designed to prepare students for personnel, managerial, and organizational research; for university teaching; and for consulting relationships with industry. The program emphasizes a scientists/practitioner model in applying and conducting research based on accepted theory, organizational behavior, psychology, management, and statistics. The programs are administered by a joint committee of the two departments, appointed by the practical director, the Chancellor and Dean of The Graduate School on recommendations from the two department heads 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 Graduate School 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 application for admission to The Graduate School (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 semester only, and applications must be received by the Graduate Admissions and Records Office by February 15.

General Requirements

At least one year of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade point average of 3.0 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) and the Subject GRE (Psychology, 517-18) are required with no evidence of special weakness in mathematics and physical sciences.

The Master's degree can be completed with a maximum of 33 semester hours in the major as follows:

Management 567, 568 or Psychology 517-18; Psychology 557, Statistics 537, 538.

Twelve hours of additional coursework should be selected primarily from the following with the approval of the student's advisor: Management 511, 522, 610; Management/Psychology 625, 626, 627, 638; Psychology 505, 550, 610, 620, 621, 625.

Electives, as approved for an individual's plan of study, may be selected from graduate courses in psychology, social work, sociology, management, education, planning, etc. Students who wish to pursue special research interests...
ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal resi-
dents of some states to enroll in certain pro-
grams at UT Knoxville on an in-state tuition
basis. The M.S. and Ph.D. programs in In-
dustrial and Organizational Psychology are
available to residents of the states of South
Carolina or Virginia. The Ph.D. program is also
available to residents of Arkansas or Kentucky.
Additional information may be obtained from
the Residency Assistant in the Office of Graduate
Admissions and Records.

Industrial Engineering

(Graduate of Engineering)

MAJOR DEGREE
Industrial Engineering M.S.

John N. Snider, Head

Professors:
Bontadelli, J. A., Ph.D. .............. Ohio State
Claycombe, W. W., Ph.D. .......... VPI
DePorter, Eldon L., Ph.D. .......... VPI
Doulet, Dan C. (Emeritus), PE, M.S. Tennessee
Emerson, H. P. (Emeritus), PE, S.B. MIT
Garrison, G. (UTSi), Ph.D. ......... NC State
LaForge, R. M. (Emeritus), PE, M.S. Georgia Tech
Loveless, Howard L. (Emeritus), PE, M.S. NC State
Mitchell, John T. (UTSi), Ph.D. .... Vanderbilt
Snider, John N., PE, Ph.D. ...... Ohio State
Westbrook, Jerry D., PE, Ph.D. .... VPI

Associate Professors:
Aikens, Charles H., PE, Ph.D. ...... Tennessee
Balas, Myron J., Ph.D. .......... Engineering
Hailer, M. L. (UTSi), PE, Ph.D. ...... Texas Tech
Hungerford, J. C., Ph.D. .......... Ohio
Hutchinson, D. H., Ph.D. .......... Georgia Tech
Kirby, K. E., Ph.D. .............. University of Tennessee
Tippett, Donald T. (UTSi), Ph.D. .... Texas A & M

Assistant Professors:
Goodman, Marvin K. (Emeritus), PE, M.S. Tennessee
Jackson, D. F., M.S. .......... Tennessee

Lecturers:
Douglas, S., Ph.D. .............. Tennessee
Fortney, W. B., M.S. .......... Purdue
Greenwood, T. G., M.S. ......... Tennessee

THE MASTER’S PROGRAM

A graduate program leading to the degree of
Master of Science is open to graduates of A.B.E.T.-accredited undergraduate curricula in
industrial engineering or to graduates of other
technical curricula who take prerequisite
coursework depending on their academic
background. These courses will be determined
by the graduate committee. The thesis program
requires 24 hours of coursework and 6 hours of
thesis. A non-thesis option with at least 30
hours of coursework plus an oral presentation is
available.

Graduate work in Industrial Engineering

provides for concentrations in operations
research, engineering management, manufac-
turing systems, human factors, computer
applications, computerized information sys-
tems, reliability and quality control, and tradi-
tional industrial engineering. Either one or two
minors may be elected in the areas of: engi-
neering, mathematics, psychology, business,
computer science, statistics or econom-
ic.

Any 400-level course required in the
Bachelor of Science in Industrial Engineering
program at The University of Tennessee may
not be used for graduate credit in the M.S.
grade program in Industrial Engineering.

GRADUATE COURSES

400 Manufacturing/Processes (3) Char-
acteristics of materials and processes used in modern
production engineering industry. Prereq: 130, Engineering
Science and Mechanics 321.

401 Integrated Manufacturing Systems (3) NC and
CNC machine tools, robotics and related materials han-
dling systems, hard automation, alternative integrated
manufacturing systems, manufacturing and manufacturing/ 
control systems. Prereq: 400.

402 Production System Planning and Control (3)
Theory and application of forecasting systems, regres-
sion and time series models, Independent demand in-
ventory models, development of safety stock. Coverage of
all modules of Manufacturing Resource Planning
(MRP) Systems: master production scheduling, re-
source requirements planning, bill of material and inven-
tory file structures, material requirements planning,
capacity planning, shop floor and purchase order con-
trol. Overview of just-in-time inventory concepts and
MRP’s role in manufacturing automation. Prereq: 301.

403 Production Facilities Design and Material Han-
dling (3) Design of production facilities: plant layout,
analysis and planning for overall moving, packaging and
storage of materials. Office layout and service areas.
Design of facilities for such diverse groups as hospitals,
banking, industry. Prereq 302, 401.

405 Engineering Economy (2) Methods and problems
in selection or replacement of equipment. Decisions
among engineering alternatives involving capital recov-
ery, economic life of equipment, and rate of return on
investment.

406 Simulation (3) Simulation of complex industrial
processes. Use of available computer languages. Com-
puter generation of random numbers and outcomes of
random process variables. Design of industrial pro-
cesses using simulation. Analysis of systems with waiting
lines using system simulation. Prereq: 200, Statistics
251.

410 Pre-determined Time Systems (2) Work design
and measurement using predetermined time system:
Methods Time Measurement, Basic Motion Time Study

411 Planning and Scheduling (3) Forecasting tech-
niques and case studies in forecasting and planning.
Performance measures for job shop and flow shop
scheduling. Techniques for generating production schedules and comparison of different materials. Re-
quirement planning and just-in-time philosophies.
Prereq: 402.

412 Qualitative Methods in Project Management (2)
Project planning, scheduling, and control based on net-
working and precedence diagramming methods. Re-
source allocation and time-cost trade-off algorithms, multi-project control, computer applications, and DPT.
Methods of handling uncertainty in activity time esti-
mates.

413 Research Methods in Industrial Engineering (3)
Methods to collect and analyze data. Process control,
statistical modeling, sampling, quality assurance.
Single subject experimental designs, classical experi-
mental design methods, and time series models of ex-
periments. Validity and reliability concepts as related to


521 Human Factors Engineering Methodology (8) Background in methodology used by human factors engineering designer and systems analyst. Observational methods, function/task analysis, design aiding technology, problem solving and decision making, human reliability and human error prediction, training analysis, evaluation of man-machine interface, subjective and objective techniques, scaling techniques, questionnaire and survey design, critical incident technique, consensus techniques (Delphi), accident investigation behavioral instrumentation, performance measurement, statistical techniques in experimental design, and expert systems. Prereq: 520.

522 Optimization Methods in Industrial Engineering (8) Classical optimization theory, unidimensional and multidimensional search techniques, Lagrangean relaxation, separable programming, linearization techniques, quadratic programming, and dynamic programming. Prereq: 301 or 537.

523 Linear Programming and Extensions (3) Simplex and revised simplex methods, duality, parametric and postoptimality analysis, use of L.P. software, integer programming techniques, brand and bound and cutting planes, network programming. Prereq: 301 or 537.


531 Motivational Theories, Systems and Practices in Various Organizations (3) Application of motivational theories and concepts in use in technology based organizations. Impact of concepts evaluated according to results in various types of organization structures.

532 Productivity and Quality Engineering (3) Productivity and quality measures defined and used to analyze current competitive position of important sectors of American industry with respect of both internal and international competition. Causes which promote or inhibit productivity or quality improvements.

533 Theory and Practice of Engineering Management I (3) Comparison of classical management principles and theory with environment, needs, and practices of research and development and other scientific-engineering organizations. Cases used to illustrate contemporary problems and environments. Technical management function, marketing of technical services and products.

534 Engineering Management Control Systems (3) Underlying framework of accounting principles and practices reviewed as basis for evaluating productivity costs, requirements for new ventures, changes in strategy, financial condition. Computer data bases examined for control system alternatives.

535 Management of Technology (3) Challenges to implementing advanced technology equipment, systems, and methods in businesses and manufacturing organizations. Technology as catalyst, assimilating new technology, changing management roles, personnel practices and organizational structure, and dealing with impact of new technologies on business policies and strategic planning.

536 Project Management (3) Management and control of multifaceted engineering and technological projects. Coordination and cooperation between various departments and various service organizations. Selection of project manager and progress and management, typical problems associated with the development of large projects. Case studies illustrate theories and concepts.

537 Industrial Engineering Analysis and Control Techniques (3) Survey of management analysis and control systems through IE techniques. Qualitative and quantitative techniques. Analysis of inter- and intra-system developments, incentive systems, wage and salary development, production and inventory control, linear programming, and applied operations research techniques. Not for credit for students with undergraduate degrees in industrial engineering.

538 Industrial Development (3) Factors other than market or climate that influence successful establishment of manufacturing or service enterprise. Organizational and financial planning and evaluation. Cost and location studies and market analysis to determine commercial feasibility of new ventures.

539 Strategic Management in Technical Organizations (3) Strategic analysis of industries; generic and life cycle strategies applied to technology based organizations. Competitor analysis. Strategies for global environment.

540 Labor Relations and Collective Bargaining (3) Negotiation and administration of labor agreements. Survey of historical, legal, and structural environments that influence collective bargaining process. Final examination consists of 1/2 day collective bargaining simulation.

541 Foundations of Total Quality Management (3) Basic concepts of Total Quality Management (TQM). Understanding of TQM in context of fundamental building blocks of effective management: labor, work, participation, customer awareness, construction of supporting organizational cultures, and identification of appropriate traditional and tools for continuous improvement.

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

601 Operations Research Models in Engineering Economics (3) Management science 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.


604 Advanced Topics in Optimization (3) Multi-stage optimization theory: large scale problems; dynamic programmingadaptive optimization theory. Prereq: 523.


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.
Studies. Certain courses within these programs are available for graduate credit as listed below. See the Undergraduate Catalog for program descriptions and directors.

**Afro-American Studies**

**GRADUATE COURSES**

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

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

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

461 African Prehistory (3) (Same as Anthropology 461.)

473 Male in American Society (3) Development of historical images, myths and stereotypes. Impact of critical factors: Black feminism, violence, concepts of masculinity, family, white males, white females, homosexuality, nationalism, and athletics.

483 Afro-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.)

**Asian Studies**

**GRADUATE COURSES**

421 Comparative Studies in Asian and Asian American Societies (3) Education, religion, and social stratification. Views Asian-Americans and Asians have of each other and concept of Pan-Asianism.

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

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

471 Selected Topics in Asian Studies (3) (Same as Political Science 452.)

475 Teaching English as a Second or Foreign Language I (3) (Same as English 474.)

476 Teaching English as a Second or Foreign Language II (3) (Same as English 475.)

477 Asian American Studies Seminar (3) (Same as Political Science 452.)


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

**Cinema Studies**

**GRADUATE COURSES**

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

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

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

425 Women's Health (3) (Same as Health 425.)

426 Romance Linguistics (3) (Same as French 429 and Spanish 429.)

430 The Development of Synchronic Linguistics as a Science (3) (Same as German 420, Russian 425, and Spanish 425.)

431 Readings in Islamic Literature (3) Prereq: Mastery of intermediate-level Arabic or consent of instructor. May be repeated. Maximum 6 hrs.

432 Readings in Chinese Literature (3) Prereq: Mastery of intermediate-level Chinese or consent of instructor. May be repeated. Maximum 9 hrs.

433 Readings in Japanese Literature (3) Prereq: Mastery of intermediate-level Japanese or consent of instructor. May be repeated. Maximum 9 hrs.

434 Psychology of Gender (3) (Same as Psychology 434.)

435 Structure of the German Language (3) (Same as German 435.)

436 History of the German Language (3) (Same as German 436.)

437 Sociolinguistics (3) (Same as English 471 and Sociology 471.)

438 Special Topics in Language (3) (Same as English 488.)

559 Problems in Linguistics: Romance Languages (3) (Same as French 559 and Spanish 559.)

412 Opinion Writing (3) Analysis of editorial positions, practices, and pages. Writing of editorials and columns for newspapers, magazines, and company publications. Rhetorical devices and use of logic. Prereq: Communications 200, or consent of instructor.

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: Communications 200, or consent of instructor.

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

420 Print Media Management (3) Current business practice among print news media, especially newspapers. Problems in management and production.
outlook for new technologies. Prereq: 6 hrs mathematics and/or accounting and senior standing. Sp

430 Public Affairs Reporting (3) Reporting and writing about courts, governments, and public agencies. Event and issue-oriented journalism of politics and public af-

433 Advanced Editing (3) Sensitivity to language and editing skills. Headline writing, layout, and production. Prereq: 203.

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

470 Public Relations Campaigns (3) Research, planning and programming, and evaluation of public relations campaigns. Oral and written presenta-

480 Journalism in the High School (3) Functions and methods of high school publications. Problems related to staff selection, content of publications, copy, layout, photography, printing, advertising, and business. Plan-

490 Advanced Photojournalism (3) Advanced principles of photographic techniques, photojournalism, introduction to color photography. News and feature photographs and photo essays. Prereq: 290 or consent of instructor. Sp

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


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. F

535 Publications Management (3) Problems in management, production, market analysis, and design. Techniques of writing, editing, and presenting compre-

540 Seminar in Newspaper Operations (3) On-site study of newspaper management operations. Positioning medium for its target audience and how this affects profitability. Prereq: 550 or consent of instructor. Sp

550 Writing and Editing Projects (3) Specialized writing or editing interests: agriculture, politics, labor, fin-

561 Seminar in Journalism Issues (3) Topics vary. May be repeated. Maximum 6 hrs.

565 Publications Management (3) Problems in management, production, market analysis, and design. Techniques of writing, editing, and presenting compre-

571 Seminar in Public Relations (3) Analysis and management of problems in communication between institutions and organizations and their publics. Mea-

580 Seminar in Visual Communication (3) Behavioral aspects of communication with images. Theories of psychological effect in color, shape, texture, and other design elements. Prereq: 203 or Advertising 350 or Broadcasting 450 or equivalent.

590 Communications and International Develop-

597 Independent Study (3) Prereq: Consent of instruc-

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.

Law

(College of Law)

MAJOR

DEGREES

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

Marilyn Yarbrough, Dean

Professors:

Cohen, Neil P., LL.M. ....... Harvard
Cook, Joseph G., LL.M. ....... Yale
Gray, R. Macdonald (Emeritus), LL.M. ....... George Washington
Hardin, Patrick, J.D. ....... Chicago
Hess, Amy M., J.D. ....... Virginia
Jones, Durward S., J.D. ....... North Carolina
King, Joseph H. (Distinguished Prof.), J.D. ....... Pennsylvania
Lacey, Forrest W. (Emeritus), J.D. ....... Michigan
Le Clercq, Frederic S., LL.B. ....... Duke
Lloyd, Robert M., J.D. ....... Michigan
Miller, Charles H. (Emeritus), J.D. ....... Harvard
Oertven, Elvin E. (Emeritus), S.J.D. ....... Harvard
Phillips, Jerry J., J.D. ....... Yale
Picquet, Cheryn, M.S.L.S. ....... Tennessee
Rivkin, Dean H., J.D. ....... Vanderbilt
Sebert, John A., J.D. ....... Michigan
Sewell, Toxey H. (Emeritus), LL.M. ....... George Washington
Sobiecki, John L., J.D. ....... Michigan
Wirtz, Richard S., J.D. ....... Stanford

Associate Professors:

Anderson, Gary L., LL.M. ....... Harvard
Ansley, Frances Lee, LL.M. ....... Harvard
Beintema, William J., J.D. ....... Miami
Best, Reba, M.L.S. ....... Florida
Black, Jerry P., Jr., J.D. ....... Vanderbilt
Davies, Thomas Y., J.D. ....... Northwestern
Desse, Lawrence, J.D. ....... Harvard
Eisele, Thomas D., J.D. ....... Harvard
Gray, Grayford E., J.D. ....... Vanderbilt
Jones, Jack D. (Emeritus), J.D. ....... Wyoming
Kovac, Susan D., J.D. ....... Stanford
Morgan, Peter W., J.D. ....... Virginia
Mutter, Carol A., J.D. ....... Georgetown
Pierce, Carl A., J.D. ....... Yale
Reynolds, Glenn H., J.D. ....... Yale
Stark, Barbara, J.D. ....... New York
Stein, Gregory M., J.D. ....... Columbia
Thompson, James E., J.D. ....... Florida

Assistant Professor:

Thorpe, Steven R., J.D. ....... Mercer

Instructor:

Hoover, Mary Jo, J.D. ....... Brooklyn
Moore, Jean, M.A.L.S. ....... Michigan

The College of Law offers the Doctor of Jurisprudence degree program and a dual program with the College of Business Ad-

ministration leading to the J.D. and the Master of Business Administration degree. In addition graduate students may be eligible to take a limited number of law courses to count toward a graduate degree.
Admission

Students 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. degree and the Department of Political Science and The Graduate School for the M.P.A. degree. Admission 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, with the 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 taken at least 60 days prior to the last 15 weeks of 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 credited 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) and be encouraged to take both law and political science courses each semester. 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 fund raising or solicitations without approval of the J.D.-M.P.A. coordinators 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.

Awards 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 included in the computation of the student's grade average or class standing in the college where such grades are so converted. During the first two years, students may not take courses in fund raising or solicitations without approval of the J.D.-M.P.A. coordinators in both academic units. In the third and fourth years, students are strongly encouraged to take both law and political science courses each semester. Students pursuing a graduate degree in the other college may, upon approval of 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 law course during regular registration at the College of Law requesting an S/NC grade only. If a 2.0 or above is earned in a law course, an S will be recorded on the transcript. If a student earns below a 2.0, an NC will be recorded, and the course cannot be used toward meeting degree requirements. Grades for law courses will not be reflected in the cumulative average. Law courses will be taken for credit only by students enrolled in a graduate degree program. Credit will not be recognized toward the J.D. degree for courses in the other college. A student who enrolls only in law courses will not be included in the computation of the student's cumulative average or class standing in the College of Law. Grades awarded in courses in the other unit will be converted to either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college where such grades are so converted. During the first two years in the dual program, students will spend one academic year taking courses in the other program except as such courses qualify for credit without regard to the dual program.
commercial values, and interference with contract; con-

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

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 (3) Judicial review; limits on judicial power; national legislative power; regulation of commerce; power to tax and spend; other sources of national power; separation of powers; state taxation and regulation of commerce; intergovernmental immunities.

813 Evidence (4) Rules regulating introduction and exclusion of oral, written and demonstrative evidence at trial and other proceedings, including relevance, competence, impeachment, hearsay, privilege, expert testi-
ymony, and administrative, and judicial notice.

814 Legal Profession (3) Legal, professional and ethi-
cal standards applicable to lawyers.

816 Computer-Assisted Legal Research (6) Intro-
duction to the research of legal doctrine through data base retrieval systems, LEXIS and WESTLAW. Offered periodically throughout the year.


820 Administrative Law (3) Administrative agency decision making processes and judicial review of administra-
tive decisions; procedural standards for informal and formal administrative adjudication and rule-making (attention to federal Administrative Procedure Act); constitutional due process standards in administrative settings; and availability, scope and timing of judicial review of agency actions.

822 Legislation (3) Interpretation and drafting of stat-
utes, legislative process, and legislative power; compari-
sion of judicial views on legislative process with both realties of legislative process and applicable constitu-
tional principles.

824 Local Government (3) Distribution of power be-
tween state and local governmental units; sources of authority; functions and constraints on local government; creation of local boundaries; home rule; problems created by fragmentation of local government units; financ-
ing of local government; methods of public finance and local government finance and decision-making.

827 Business Associations (4) Legal problems asso-
ciated with formation, operation, and dissolution of un-
corporated and incorporated business firms; legal rights and duties of firm members ( principals and agents; partners and limited partners; and corporate shareholder-
s, directors and officers); and others with whom these members interact in connection with firm's business.

828 Advanced Business Associations (2) Selected topics from law of business associations. Prereq: 827.

830 Securities Regulation (3) Basic structure of federal se-
curities laws, investment banking, fiduciary responsibil-
ity of capital raising of capital by new and growing enterprises; securities transactions by promoters, officers, directors and other insiders; regulation of publicly held companies; litigation under Rule 10b-5 and other antifraud provisions; and provision of legal and other professional services in connection with securities transactions.

832 Business Planning Seminar (2) Selected prob-
lems on corporate and tax aspects of business planning and transactions. Prereq: 818, 827, and 970.

834 Antitrust (3) Federal antitrust laws; monopolization, price fixing, allocation of customers and territories; treble damage suits generally; government enforcement techniques and private treble damage suits.

835 Trade Regulation Seminar (2) Selected problems arising under the regulating competition and conduct of business enterprise.

837 Accounting for Lawyers (2) Basic accounting documents, problems, and techniques to enable law students to use and understand essential accounting information.

840 Commercial Law (4) Basic coverage of most signifi-
cant provisions of Uniform Commercial Code: security interests; negotiable instruments; Article 4 of U.C.C.; sales; and other U.C.C. codes; sales of goods, including coverage of portions of Art. 2 of U.C.C. not covered in Contracts.

841 Commercial Finance Seminar (2) Practical exper-
ience in large and medium-sized business transactions. Planning of financing transactions and negotiating and drafting documents. Financing techniques; equipment leasing and matched fund lending, current issues in commercial financing, and other important issues not normally covered in Commercial Law. Prereq: 840.

842 Debtor-Creditor Law (3) Enforcement of judg-
ments; bankruptcy and its alternatives for business and consumer debtor: emphasis on Federal Bankruptcy Code.

846 Constitutional Law II (3) First Amendment rights to freedom of religion, expression, association and press; Free Speech and Press Clause; equal protection and discrimination as equality of race, sex, etc.; rights to franchise and apportionment; substantive and procedural due process; civil rights under federal law, including post-Political Action Act; and constitutional analysis of post-War Amend-
ments to Constitution.

848 Civil Rights Acts (3) Litigation to vindicate constitutional rights in private actions against the govern-
ment. Special legal problems involving federal agencies, 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 indi-
vidual 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 invidious discriminatory practices as they affect political participation, education, em-
ployment, housing and welfare policies; recent issues in commercial financing, and other important issues not normally covered in Commercial Law. Prereq: 840.

851 Constitutional Law Seminar (2) Current con-
stitutional law problems.

854 Criminal Procedure I (3) Police practices and their legal limits; search and seizure; identification; interrogation; electronic eavesdropping; and right to counsel.

855 Criminal Procedure II (3) Pre- and post-trial proce-
dures in a criminal case: bail; preliminary hearing; grand jury; prosecutorial discretion; discovery; speedy trial; plea bargaining and its effects; and post-

857 Criminal Law Theory (3) Theoretical foundations of criminal law. Prereq: 809.

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 agreements, pre-
temual contracts; creation of common law and formal marriage; legal effects of marriage; support obligations within family; legal separation, annulment, divorce, ali-
mony, and property settlements; child custody and child support; adoption, illegitimacy.

863 Children and the Law (3) Legal relationship be-
tween children and their parents and the state: parental prerogatives and children's rights; rights of illegitimates; adoption; temporary and permanent removal of children from their parents by the state; juvenile court proce-
dures.

866 Environmental Law and Policy (3) Study, through methods of public policy analysis, of responses of legal frameworks to environmental problems; environmental legis-
lation; Clean Air Act; Clean Water Act; National Environ-
mental Policy Act; and selected regulatory issues.

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

869 Natural Resources Law (3) Nature of interests; conveyancing; royalties, grants and reservations, leases, and taxation of natural resources.

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

875 Empirical Studies of Legal Institutions (3) Social, economic and organizational factors that affect behavior of clients, lawyers, judges and other actors in legal institutions. Empirical insights into social structure and organization of bar; factors that affect filing, processing and disposition of claims in civil justice sys-
tems and the factors that affect process of case dispositions in criminal prosecutions: plea bargaining process. Fac-
tors that sometimes cause "law in action" to operate differently than "law on the books.""
906 Criminal Advocacy (6) Supervised fieldwork, re-quiring students to assume primary responsibility for defending clients accused of crime in Knox County. Exploration of theory, practice and ethics of interviewing, counseling, motion writing, class note-taking, and trial at preliminary hearings and misdemeanor trials. Prereq: 905 and third-year standing. Rec-ommended prereq: 493. 915 Conflict of Laws (3) Jurisdiction, foreign judg-ments, and conflict of laws. 916 Federal Courts (3) Jurisdiction of federal courts; conflicts between federal and state judicial systems. 918 Remedies (4) Judicial remedies; damages, restitu-tion, and equitable relief; availability, limitations and measurement of remedies; comparison of contract, tort and property-related remedies. 920 Trial Practice (3) Litigation through simulation, trial problems and preparation and presentation: basic trial strategy; profes-sional responsibility; fact investigation and witness preparation; discovery and presentation of evidence; selection and instruction of jurors; opening and closing arguments. Written work includes motions, interrogata-ries or memoranda. Prereq: 913. 921 Pre-Trial Litigation (5) Civil pre-trial process. Draft-ing of actual pre-trial documents in civil cases: complaint; motions for summary judgment, class action; new matters; motions to dismiss and for summary judgment; and various discovery papers. 923 Complex Litigation (3) Advanced civil procedure covering complex situations and conditions that are most pertinent in litigation involving multiple claims and multiple parties: per-missive and compulsory joinder; intervention; dispos-i- tion; abatement and remand; class action; class discovery in large cases; judicial control of complex litigation; res judicata and collateral estoppel problems. 925 Appellate Practice Seminar (2) Federal and Ten-nessee appellate procedure, lower court rules of federal circuits; review of complete records of several United States Supreme Court cases and preparation of an appellate brief based on record of actual case. 927 Interviewing, Counseling and Negotiation (3) Development of conceptual and practical frameworks for understanding interviewing, counseling and negotiation, and lawyer's role in tasks. Readings of different meth-ods, strategies and perspectives from recent literature involving lawyering skills. Simulations and videotape critiques, drafting of documents. Relevant ethical issues and law. Writings on dispute resolution. Not open to stu-dents who have taken 904 or 906. 929 Teaching Clients the Law (3) Communication of law as basic for decision by persons other than lawyers. Development of skills by induction in a practical law course to high school or adult students and by writing research papers that synthesize Tennessee of federal law in oral language. 935 Gratuitous Transfers (4) Nature, creation, termina-tion, and modification of trusts; fiduciary administration, intestate succession; execution, revocation, probate and contest; valuation; charitable trusts; private foundations; controls of future interests; construction of limitations; application of the rule against perpetuities. 937 Estate Planning Seminar (2) Problems of estate planning, relationship to estate planning of law and practice of fiduciary administration, insurance, property, wills, future interests, trusts, corporations, partnerships, and the drafting of will, trust and estate planning documents for hypothetical clients. Prereq: 973. Prereq or coreq: 950 and 935. 940 Land Finance Law (3) Financing devices: mort-gages, deeds of trust and land contracts: problems of priorities; transfer of secured interests when debt is as-sumed or taken subject to security interest; default, priority and dispute resolution; rights of secured creditors; collection of accounts receivable; mechanics of and limitations on recovery; dam-ages; enforcement; and defenses. 941 Land Acquisition and Development Seminar (2) Alternative business forms and major documents (notes, deeds, leases, contracts, etc.) necessary to accomplish acquisi-tion or development of large tracts of land prepared and presented for seminar discussion. Prereq: 940. 943 Land Use Law (3) Land use planning; nuisance and zoning and eminent domain. 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. Prepa-ration to think effectively concerning use of computers. Prior computer experience not necessary. 953 Education Law (3) Compulsory attendance laws; governmental control over curriculum and extracur-ricular activities; accountability; academic freedom; privacy and disciplinary process rights of students and teachers; religion in public schools, public aid to parochial schools; equality of educational opportunity. 956 Entertainment Law (3) Role of law and lawyer in entertainment industry. Course content varies: Music industry; music copyright laws; artist/manager relationships; recording and contract negotiation; industry, labor unions; and performing right organizations. 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 physician-patient relationship; unauthorized practice of medicine; medical education, licensing and special-ization; hospital staff privileges; medical malpractice liability; standard of care, proof, causation, defenses, and damages; informed consent; consent and statutory law; rights of mentally disabled; release and denaturalization; and mental health professional-patient relationship. 970 Income Tax II (3) Corporate reorganizations and distributions: transactions among corporations and shareholders. Prereq: 918. 971 Income Taxation of Entities (2) Federal income taxation of partners and partnerships, Subchapter S corporations and shareholders, and related topics. Prereq: 918. Recommended prereq or coreq: 970. 973 Wealth Transfer Taxation (3) Transfers of wealth at death (estate tax) and during life (gift tax), and of generation skipping transfers; fiduciary income taxation. Recommended prereq or coreq: 918 and 935. 975 Tax Theory (3) Comparative study of methods and purposes of governmental revenue collection through examination of economic theory and various actual and proposed schemes of taxation. Prereq: 918. 980 Insurance (3) Types of insurance: life, property, health, accident and liability insurance; regulation of insurance industry; interpretation of insurance con-tracts; insurance law and insurance and its regulation; war-ranties and representations; coverage and exclusions; duties of agents; excess liability; subrogation; and bad faith actions against insurers. Liability insurance defense problems: duty to defend, notice and cooperation issues, and conflicts of interest. 983 Products Liability (3) Scope of doctrine and theore-ies of recovery; potential plaintiffs and defendants; and contractual limitations on recovery; dam-ages: causation; and defenses. 985 Social Legislation (3) Systems other than tradi-tional tort remedies for compensating disabled persons and victims of accidents; Workers' Compensation: re-quirements for covered employer-employee relationship; injuries or occupational diseases arising out of and in the course of employment; nature of disability; medical and death benefits; and exclusiveness of compensation remedy against employer and co-employees. Social Security disability benefits; prerequisites for disability benefits; administrative process; rights to fair hearing; and counsel fees. 994 Independent Study (1-4) Independent study under direct supervision of faculty member. Proposals must be approved by supervising faculty member and by the Dean or the Dean's designee. Maximum of once each semester during last two years of study. Prereq: Second-year standing. 999 Independent Study (1-4) Independent study under direct supervision of faculty member. Proposals must be approved by supervising faculty member and by the Dean or the Dean's designee. Maximum of once each semester during last three semesters of study. 999 Law Review (1) Completion of a potentially publishable casenote, comment, or other article for the Tennes-see Law Review. May be repeated. S/N/C only. (Will not count toward total number of elective upper division courses taken S/N/C.) 999 Moot Court (1) Participation as member of faculty-supervised interscholastic moot court competition. May be repeated. S/N/C only. (Will not count toward total number of elective upper division courses taken S/N/C.)
facilitation of information transfer. Students will demonstrate:

1. Knowledge of the historical role of libraries and other information agencies in society.
2. A knowledge of how information flows through contemporary society.
3. An understanding of the role of the librarian and/or information specialist as a mediator between information and the user with an emphasis on the improvement of the quality of information services in response to the needs of society.
4. An understanding of and competence in the selection, acquisition, organization, storage, retrieval, and dissemination of information.
5. An understanding of bibliographic control and knowledge of information sources in various formats and subjects.
6. An understanding of management theory and practice, particularly as these are related to library and information services.
7. A knowledge of research methods sufficient to enable them to engage in effective problem solving.

To provide services to the state, region, and nation in association, consulting, and continuing education activities which will promote the development and improvement of information systems and services such that the school’s contributions reach beyond its immediate academic programs. The school will provide:

1. Continuing education for information professionals and, on a selective basis, to persons outside the information field.
2. Advisory services to libraries and other types of organizations.
3. Leadership for professional associations.
4. To conduct basic and applied research which promotes the generation of new knowledge, services, and technology. The school will encourage:
   1. Research which strengthens its instructional and public service programs.
   2. The use of a variety of research methods.
   3. Sharing the results of its research.
4. Increased research quality and productivity.

ADMISSION REQUIREMENTS

Candidates who have at least a 3.0 average in the junior and senior years will receive first consideration. Applicants are required to take the general test of the Graduate Record Examination. The test should be taken at least one semester in advance of application for admission to the Graduate School. A personal data sheet and three recommendations (obtained from the Graduate School of Library and Information Science) should be returned to the director of the school. Foreign applicants are required to take the Test of English as a Foreign Language.

MASTER OF SCIENCE IN LIBRARY SCIENCE

The program leading to the Master of Science in Library Science involves a total of 39 semester hours of graduate courses, 18 hours of which form a core curriculum required of all students. Either a thesis or a non-thesis option is available, with 6 hours required for thesis credit. At least 33 hours must be taken in the Graduate School of Library and Information Science, allowing up to 6 hours outside the school with a maximum of 6 from outside the University. Upon completion of the program, all students are subject to a final examination. For students who elect the thesis option, the examination will be a defense of the thesis. Students who elect the non-thesis option will be given a written comprehensive examination.

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 some other libraries and information agencies in the Knoxville area.

Students 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.L.S. in Library and Information Science, write to Admissions, Graduate School of Library and Information Science, 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 Knoxville on an in-state tuition basis. The M.S.L.S. program in Library Science is available to residents of the states of Arkansas, Georgia, West Virginia, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

430 History of the Book (3) History of writing and various methods of bookmaking from earliest times through 19th century. Sp
475 Utilization of Instructional Media (3) Same as Curriculum and Instruction 475s.
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15). Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/NG only. E
510 Information Professionals and Their Organizations (3) Variety and prospects of information professionals; professional organizations; achievements, responsibilities, goals, and issues. E, Su, A
520 Technical Services I (3) Technical services principles and techniques: acquisitions, basic manual and automated cataloging, structure and use of library catalogs, basic subject organization and indexing. E, Su, A
521 Technical Services II (3) Library of Congress subject organization and description, automated cataloging and cataloging of serials and more difficult materials. Prereq: 520. Sp
530 Information Sources and Services (3) Basic bibliographic and information sources, online databases, interview and search techniques, selection and evaluation of information collections and development and evaluation of services. E, Su, A
531 Sources and Services for the Social Sciences (3) Information sources in social sciences: political science, sociology, psychology, geography, history, anthropol- ogy; sources and services in business, education, and law. Prereq: 530. Sp
532 Sources and Services in Science and Technology (3) Information sources in engineering, physical and life sciences. Prereq: 530. Sp
533 Sources and Services for the Humanities (3) Information sources in philosophy, religion, fine arts, performing arts, literature and language, and history. Organization of collections for optimum use. Prereq: 530. Su
540 Research Methods in Library and Information Science (3) Research methods applicable to librarianship and information management. Preparation and conduct of empirical research; analysis of published research. Prereq: Admission to program or consent of instructor. E, Su
550 Library and Information Agency Management (3) Management and organizational concepts applicable to libraries and other information agencies. Prereq: Admission to program or consent of instructor. E, Su, A
551 School Libraries and Media Centers (3) Planning, implementing and evaluating school library programs. Curricular involvement, role of technology, relationships with district and state services. Prereq: 550 and 560 and consent of instructor. F, Su
552 Academic Libraries (3) Development and present status, mission and objectives within higher education institutions. Trends, problems, recurring issues. F
553 Special Libraries and Information Agencies (3) Development and present status, scope and objectives, administrative and organizational problems and techniques. F
554 The Library in the Community (3) Application of marketing analysis for planning and policy formulation. Public library focus. Sp
560 Development and Management of Collections (3) Philosophy and process of building and managing collections in library agencies. Environmental community analysis; policy statements; collection evaluation and preparation of buying lists. Prereq: 530, E, Su, A
561 Contemporary Book Publishing (3) Creation, design, production, marketing, and distribution of materials acquired by libraries; various types of publishers. F
562 Serials (3) Serials collections: selection, acquisition, bibliographic control, storage, maintenance, and public service. Prereq: 560 or consent of instructor. Sp
563 Nonbook Materials (3) Selection, acquisition, bibliographic representation, storage, utilization, and programming; microformats, films, video, sound recordings, and as information media. F
564 Records Management and Archives (3) Objectives and functional elements of records management and archives programs within various types of organizations, management of creation, distribution, retention, storage, retrieval, protection, and disposition of organizational records regardless of information medium. F
569 Advanced Production of Audiovisual Software (3) Same as Curriculum and Instruction 569.
572 Resources for Young Adults (3) Critical survey of books and related materials for young adults; personal and professional needs and interests. Evaluation, selection, and utilization for school and public libraries. Sp
573 Services for Children and Young Adults (3) Phi- losophy and objectives of public and school library serv-
The programs leading to the M.S. and Ph.D. degrees in Life Sciences are interdepartmental and interdisciplinary programs which augment the programs of individual departments. The Life Sciences Council supports studies and research in the following concentrations: biochemical and biophysical sciences, biotechnology, molecular and developmental biology, environmental toxicology, ethology, and plant physiology and genetics. Students interested in any of these areas should contact either the chair of Life Sciences or the director of the area of interest. Each program is overseen by a committee and may have unique admission and graduation requirements.

ADMISSION REQUIREMENTS

1. A Bachelor's degree with a major in a biological, behavioral, or physical science.
2. GRE (general) scores.
3. Three letters of recommendation.
4. 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.

DEGREE REQUIREMENTS

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. Within the biotechnology program only, a non-thesis M.S. option is available. Students choosing this option are expected to complete: (1) two summers' co-op experience in an appropriate industry. An evaluation by supervisor and a written report are required (529, Biotechnology Practicum Cooperative Experience, maximum 4 hrs.); (2) A written report in the form of a scientific paper in an area of specialization chosen by the student and advisor. The minimum requirements for the doctoral degree include at least 6 hours above the 600 level, 24 semester hours of course 600, a pattern of courses approved by the student's committee, and a defense of dissertation. Individual programs may have additional requirements.

CONCENTRATIONS

Biotechnology

The biotechnology program will prepare students to participate in the wide variety of opportunities presented by the use of living cells and their components for the production of useful materials. This will be achieved at the M.S. level by a prescribed course of study of the biology and biochemistry of cells and molecules; by formal study of cells and of engineering aspects of biotechnology; and by the development of special expertise in areas such as animal embryo manipulation, automated chemical synthesis of macromolecules, bioprocess engineering, bioproducts and biotransformations, liposomes, microscopy and image processing, monoclonal antibodies and hybridoma technology, plant tissue culture, recombinant DNA technology and risk assessment, and modeling. The production of a research thesis or an industrial co-op experience plus an area of specialization will also be an important part of the training experience. Required courses are: Life Sciences 509, 511, 512, 531, 532; Biochemistry 511; Microbiology 410; Botany 451; Chemical Engineering 475; and Zoology 507.

Cellular, Molecular and Developmental Biology

The interdepartmental program in cellular, molecular and developmental biology includes research in structural or functional aspects of cells or subcellular components, or the interactions between cells. Required courses are Life Sciences 511, 512, 531, and 532.

Environmental Toxicology

The toxicology program provides intensive training in basic toxicological principles and techniques. Courses and research expose trainees to mechanisms of intended and unintended interactions between living systems and potentially toxic agents from the point of view of biochemistry, physiology, ecology, public health, environmental law and regulation, pest management, pollution control and repair, and testing and residue analysis of toxicants. Required courses are Biochemistry 561, 562, 604; and Life Sciences 510.

Ethology

Ethology is the naturalist study of normally occurring animal and human behavior. The program provides intensive training in basic ethology with specialized studies available in the development, evolution, and physiology of behavior, comparative psychology, human ethology, and behavioral ecology and sociobiology. Required courses for the Master's are Psychology/Zoology 450, 459; Zoology 524, 583; Statistics 531-32; and Zoology/Psychology 516.

The Ph.D. requirements are the same as for the Master's with the additional requirements of one additional statistics course and six semester hours of courses numbered above 600 approved by student's committee.

Phyiology

The interdepartmental program in physiology includes research in the areas of cellular, comparative, developmental, exercise, muscle, neurophysiology, regulatory, or reproductive. Required courses are Zoology 520, 521; Human Anatomy, Comparative Vertebrate Biology, 420; Biochemistry 410; four 600-level semesters; and a statistics sequence.

Plant Physiology and Genetics

This program provides the opportunity for intensive training and research experience in areas transcending the usual boundaries of botany, biochemistry, and agricultural plant sciences. It devotes itself to seeking solutions of problems concerning the interactions of physiology and genetics and applied and fundamental aspects of plant science. Required courses are Life Sciences 510; Botany 521, 522; Biochemistry 511, 512; Plant and Soil Science 471 or Zoology 560; Plant and Soil Science 551, Microbiology 410.

GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and for faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N only. E

Life Sciences

(Office of the Vice Chancellor for Academic Affairs)

MAJOR DEGREES

Life Sciences M.S., Ph.D.

Howard I. Adler, Chair

Coordinating Council:

Becker, Jeff M., Cellular, Molecular and Developmental Biology
Bright, Janice L., Veterinary Medicine
Burghardt, Gordon M., Ethology
Conger, B. V., Plant Physiology and Genetics
Dougal, D. K., Biotechnology
Farkas, W. R., Environmental Toxicology
Vaughan, Gerald, Physiology
509 Biotechnology Seminar (1-2) Topics of importance to biotechnology. May be repeated. Maximum 6 hrs.

510 Special Topics in Life Sciences (1-3) Specializations in biotechnology; cellular, molecular, and developmental biology; environmental toxicology; ethnology; plant physiology and genetics; and physiology. May be repeated. Maximum 9 hrs.

511 Advanced Cellular Biology (3) Cell structures and functions at molecular and supramolecular level; membrane structure, function, and biogenesis; cellular communication; receptors and membrane flow; growth regulation and oncogenes; plant cell structure and function; contrastability and motility; mitosis and meiosis; blood and immune cells.

512 Advanced Molecular Biology (4) (Same as Biochemistry 512.)

525 Research Practicum in Life Sciences (1-3) Individual sections for each of biotechnology, cellular, molecular and developmental biology, environmental toxicology; ethnology; plant physiology and genetics; and physiology. May be repeated. Maximum 6 hrs.

529 Biotechnology Practicum Co-operative Experience (2) Work experience in commercial organization for students undertaking non-thesis option of biotechnology concentration. Evaluation by supervisor and written report by student. May be repeated. Maximum 4 hrs.

531 Biotechnology Laboratory (3) Growth of microorganisms, analysis of extracellular and intracellular components.

532 Biotechnology Laboratory (3) Pilot scale yeast cultivation, enzyme isolation, purification and characterization. Application of purified enzymes to food production, fermentation and fermentation process control.

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

610 Advanced Topics in Life Sciences (1-3) Topics vary. May be repeated. Maximum 6 hrs.

**Business Administration Concentrations**

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

**MBA Concentrations:** Management, Forest Industries Management.

Minimum course requirements for management—Three courses from the following: 511, 513, 522, 523, 541, 542, 561, 571, 593, Business Administration 510, 559. Selection must be approved by the Management Department MBA advisor. For forest industries management—511, 513; Foresty 560, 565.

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—513, 619, 611, 612.

**GRADUATE COURSES**

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

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

504 Management of Organizational Behavior (3) Integration of individual and group differences, organization theory and analysis, motivation, leadership, human resource planning, and career implications with strategic planning, and decision making.

505 Operations and Logistics Management (3) Concepts and techniques for managing operations and distribution systems. (Same as Logistics and Transportation 505.)

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.

513 Strategic Planning (3) Theoretical and applied literature, successful strategic positioning of business in variety of environments. Analysis of industry notes and case histories. Coreq: Business Administration 509.

521 Personnel Administration (3) Personnel functions and human resources management. Community relations, recruiting, selection, training, performance evaluation, wage and salary administration, legal framework as it affects personnel.

522 Labor Relations and Collective Bargaining (3) American labor history, structure and philosophy of bargaining, dispute settlement, and contract administration. (Same as Economics 562.)

528-26 Industrial and Organizational Psychology (1-3) Readings in industrial and organizational psychology. Available only by prearrangement with supervising faculty member. May be repeated. Maximum 6 hrs. S/N/C only.

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.

541 Operations Management I (3) Techniques applicable to design of systems in operations function.

542 Operations Management II (3) Operations planning and control function. Application of models to real-world systems.

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.

557-68 Proseminar in Industrial/Organizational Psychology (3,3) Basic thought, concepts, and issues required for advanced graduate study in industrial and organizational psychology. Must be taken in sequence during student's first year of study in industrial and organizational psychology program. Consent of instructor required for all non-industrial/organizational psychology program students. (Same as Psychology 517-18.)

571 International Management (3) Analysis of environment of international business firms and impact of internal and external factors on managerial decisions.

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/N/C or letter grade.

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

601 Research Methods (3) Seminar covering broad range of 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.

625 Seminar in Organizational Psychology (3) In-depth analysis of current theories, concepts, and issues associated with psychology of organizational leadership and work motivation. Prereq: 567, 568, consent of instructor. May be repeated. (Same as Psychology 625.)

626 Seminar in Industrial Psychology (3) In-depth analysis of current issues and problems: performance appraisal/criterion development, and training and development. Prereq: 567, 568, consent of instructor. May be repeated. (Same as Psychology 626.)

627 Seminar in Applied Industrial Psychology (3) In-depth analysis of current issues, concerns, and methods: advanced quantitative psychometrics and employee selection. Prereq: 567, 568, consent of instructor. May be repeated. (Same as Psychology 627.)

638 Current Topics in Industrial/Organizational Psychology (3) In-depth analysis of various topics: organizational change and development, psychology and problems of research. Prereq: 567, 568, consent of instructor. May be repeated. (Same as Psychology 638.)

640 Seminar in Operations Management (3) Re-examination of concepts and application of quantitative methods to operations management problems. May be repeated.

590 Field Work in Industrial and Organizational Psychology (1-12) Supervised field practice in industrial and organizational psychology. 1 hr per 50 hrs of practice. May be repeated. Maximum 12 hrs. (Same as Psychology 590.)
Management Science

(College of Business Administration and Intercollegiate Program)

MAJORS DEGREES
Management Science M.S., Ph.D.
Business Administration MBA

Kenneth C. Gilbert, Chairperson
Associate Professor:
Gilbert, Kenneth C., Ph.D. .......... Tennessee
Assistant Professors:
Bowers, Melissa R., Ph.D. .......... Clemson
Kaplan, Lori A., Ph.D. .......... Michigan
Noon, Charles E., Ph.D. .......... Michigan

THE MASTER'S PROGRAM

The M.S. program in Management Science is an intercollegiate program and 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 (excluding statistics) as well as in computer science, public administration, ecology, and other areas, subject to approval by the Management Science Committee.

Admissions Requirements

The Master's program requires three graduate school rating forms and the GRE or GMAT. Applications are encouraged from all majors, but mathematics background equivalent of 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 three semesters by full-time students. However, students may start the program in any semester and may pursue an M.S. degree in Management Science on a part-time program with the following time periods for full-time students and the next two semesters for part-time students.

Course Requirements

Core Requirements: 14 hours
Mathematics 531, 532, 533, 534
Statistics 563
Applied specialization area (approved by advisor) 9 hours
Statistics elective—500 level or above (approved by advisor) 6 hours

Mathematics—400 level or above (approved by advisor)
Electives selected from mathematics, statistics, computer science, and/or management science area.

TOTAL 38 hours

A thesis option is available to qualified students which substitutes 6 hours of thesis credit for the following 8 hours of course work: Management Science 594, 3 hours in the applied concentration area and 3 hours of electives in any area. 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. For example, an undergraduate major in a field requiring a strong background may be allowed to take 6 additional hours of electives in place of the mathematics requirements. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take such courses to fulfill the 6-hour mathematics requirement. The total course load will remain 38 hours for all non-thesis students and 36 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between 6 and 12 as a function of prior background.

THE DOCTORAL PROGRAM

The Ph.D. program in Management Science under the College of Business Administration 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.
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.

Qualifying Examinations

The doctoral program requires three graduate school rating forms and the GRE or GMAT. In addition to the Graduate School's requirements, 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 include numerical analysis, either Mathematics 471, 472, 453, or 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 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 man-
agagement science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose previous coursework does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

BUSINESS ADMINISTRATION CONCENTRATION

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

MBA Concentration: Management Science

Minimum course requirements are 531, 532, 533, and 534.

GRADUATE COURSES

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

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


533 Computational Mathematical Programming (3) Advanced modeling, computational and reporting techniques in practical mathematical programming. Prereq: 531 and proficiency in PASCAL.

534 Application of Management Science Methods (3) Application of methods from 531 and 532 to real-world problems. Exposure to existing problem in industry or elsewhere.


581 Special Topics in Management Science (3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

593 Management Science Problems (1-6) Directed study on subject of mutual interest.

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-basis tree methods. Prereq: 531 or equivalent.

631 Integer Programming (3) Theoretical and computational aspects of integer programming with linear variables, branch and bound, cutting plane, and group theoretic algorithms. Prereq: 531 or equivalent.


651 Nonlinear Optimization (3) Solution of constrained and unconstrained nonlinear programming problems. Practical algorithms that perform well in recent practice. Prereq: 531 or equivalent.


681 Special Topics (3) Prereq: 531, 532 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.

Marketing, Logistics and Transportation

(Office of Business Administration)

MAJOR DEGREES

Business Administration MBA, Ph.D.

David J. Barnaby, Head

Marketing


Associate Professors: McMillan, J. R., Ph.D. Ohio State Reizenstein, Richard C., Ph.D. Cornell Rentz, J. O., Ph.D. Missouri Schumann, D. W., Ph.D. Missouri

Assistant Professors: Dabholkar, P. A., Ph.D. Georgia State Cardial, S. F., Ph.D. Fordham Song, X. M., Ph.D. Virginia Speck, P. S., Ph.D. Texas Tech

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Marketing

Minimum course requirements are three courses from the following: 503, 504, 505, 506, 550, 593, 599, Logistics and Transportation 507, Business Administration 510, 599.

Ph.D. Concentration: Marketing

Minimum course requirements are 12 hours from among the following courses: 501, 602, 603, 604, 605, 606.

GRADUATE COURSES

501 Marketing Management (3) Marketing viewed as total system designed to plan, promote, and distribute goods and services to household consumers and industrial users. Demand analysis as basis for marketing decisions. Prereq: 531.

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

503 Buyer Behavior—Analysis for Marketing (3) Consumer behavior concepts and processes developed and applied to market analysis and design, and control of marketing programs. Social psychology and demographic factors that affect consumer product, brand and patronage decisions. Prereq: 501.

504 Analyzing Market Opportunity for Marketing Decisions (3) Major determinants of opportunity in markets, framework for finding markets and analyzing them for opportunity, application of market opportunity analyses to marketing strategy decisions. Prereq: 501.

505 Marketing Research and Information Planning (3) Design of a rigorous marketing study from inception to implementation of results by recognizing key decision points and critically evaluating merit of research project. Prereq: 501.

506 Marketing Strategy (3) Integration of concepts and analytical skills from each component area of marketing to formulate cohesive, well-organized marketing program. Prereq: 501.

550 Market Opportunity Analysis for New Ventures (3) Concepts for understanding coverage of new venture MOA and various information sources and procedures; identify and analyze sales opportunities in markets for new product or service. Prereq: Consent of instructor.

593 Independent Study (3) Directed research and study. Prereq: MBA Core and consent of instructor. May be repeated. Maximum 6 hrs.

599 Special Topics Seminar (3) Topics vary: new business marketing applications, macroenvironmental issues, market segmentation, international marketing, 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

501 Marketing Theory (3) Nature and scope of marketing, role of theory development and theory testing important to marketing research.

502 Research Methods I (3) Research process: problem formulation, research and experimental design, measurement and implementation of results. Design: experimental design, survey research, and measurement.

503 Marketing Thought (3) Marketing literature across number of research areas. Evaluate individual works, determine state of research in each area, and identify areas that merit further study.

604 Seminar in Buyer Behavior Research (3) Behavioral study of people in their roles as buyers and users of goods and services both individual and group processes.

605 Research Methods II (3) Analytical approach to marketing decisions and role of quantitative methods. Models and model building in marketing consideration of decision theory, linear programming, simulation and other mathematical representations of marketing phenomena.

650 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.

Logistics and Transportation

Professors: Davis, F. W., Jr., Ph.D. Michigan State Dieck, Gary N., DBA Indiana Frye, J. L. (Emeritus), Ph.D. Florida Hendrix, F. L. (Emeritus), Ph.D.

501 Marketing Management (3) Marketing viewed as total system designed to plan, promote, and distribute goods and services to household consumers and industrial users. Demand analysis as basis for marketing decisions. Prereq: 531.

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

503 Buyer Behavior—Analysis for Marketing (3) Consumer behavior concepts and processes developed and applied to market analysis and design, and control of marketing programs. Social psychology and demographic factors that affect consumer product, brand and patronage decisions. Prereq: 501.

504 Analyzing Market Opportunity for Marketing Decisions (3) Major determinants of opportunity in markets, framework for finding markets and analyzing them for opportunity, application of market opportunity analyses to marketing strategy decisions. Prereq: 501.

505 Marketing Research and Information Planning (3) Design of a rigorous marketing study from inception to implementation of results by recognizing key decision points and critically evaluating merit of research project. Prereq: 501.

506 Marketing Strategy (3) Integration of concepts and analytical skills from each component area of marketing to formulate cohesive, well-organized marketing program. Prereq: 501.

550 Market Opportunity Analysis for New Ventures (3) Concepts for understanding coverage of new venture MOA and various information sources and procedures; identify and analyze sales opportunities in markets for new product or service. Prereq: Consent of instructor.

593 Independent Study (3) Directed research and study. Prereq: MBA Core and consent of instructor. May be repeated. Maximum 6 hrs.

599 Special Topics Seminar (3) Topics vary: new business marketing applications, macroenvironmental issues, market segmentation, international marketing, 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

501 Marketing Theory (3) Nature and scope of marketing, role of theory development and theory testing important to marketing research.

502 Research Methods I (3) Research process: problem formulation, research and experimental design, measurement and implementation of results. Design: experimental design, survey research, and measurement.

503 Marketing Thought (3) Marketing literature across number of research areas. Evaluate individual works, determine state of research in each area, and identify areas that merit further study.

604 Seminar in Buyer Behavior Research (3) Behavioral study of people in their roles as buyers and users of goods and services both individual and group processes.

605 Research Methods II (3) Analytical approach to marketing decisions and role of quantitative methods. Models and model building in marketing consideration of decision theory, linear programming, simulation and other mathematical representations of marketing phenomena.

650 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.
Association Professor:

Foggin, J. H., DBA

BUSINESS ADMINISTRATION

CONCENTRATIONS

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

MBA Concentration: Logistics and Transportation

Minimum course requirements are 501, 508, and one course from the following: 504, 506, 507, 583, and 599.

Ph.D. Concentration: Logistics and Transportation

Minimum course requirements are 12 hours to include 601, 602, 603.

GRADUATE COURSES

501 Survey of Logistics and Transportation (3) U.S. logistics and transportation: physical, economic, social, and political environment; financing, managing, maintaining, and enhancing U.S. transport infrastructure.

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

504 Freight Carrier Systems and Management (3) Analysis of freight carrier management's efforts to provide services demanded by consumers in logistics and transportation marketplace.

505 Operations and Logistics Management (3)

(Same as Management 505.)

506 Logistics Systems Management (3) Development of strategy for management of logistics systems. Executive level integration of logistics operations with marketing, production, and other decision areas. Practical applications through case approach and simulation games.

507 International Logistics and Transportation (3) Logistics strategy in the multi-national firm: materials management, international sources and distribution, and import and export operations. International carrier management and operations and comparative national transport systems analysis.

508 Executive-In-Residence Seminar in Logistics and Transportation Strategy (3) Case study or experience-based seminar designed to develop student dissertation topics.

593 Independent Study (3-6) Directed research and study. Prereq: Consent of instructor. May be repeated.

599 Special Topics in Logistics and Transportation (3-15) 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.

601 Seminar in Logistics and Transportation Models (3) Analysis of contemporary models and methodologies in logistics and transportation research, topical coverage at discretion of instructor.

602 Seminar in Macrotransportation Systems (3) Contemporary national logistics and transportation systems, governmental policies in logistics and transportation sector, and current literature and research in field.

603 Research Methodology in Logistics and Transportation (3) Fundamental research process in areas of logistics and transportation, history and development of body of knowledge, and contemporary research methodology to develop student dissertation topics.

Materials Science and Engineering

(College of Engineering)

MAJORS

Metallurgical Engineering .......... M.S., Ph.D.
Polymer Engineering .......... M.S., Ph.D.

Joseph E. Spruill, Head

Professors:

Ashbee, K. H. G. (Racheff Chair of Excellence), Ph.D. .......... Delaware
Bogue, Donald C., Ph.D. .......... Birmingham (UK)
Borie, Bernard S., Ph.D. .......... MIT
Brooks, C. R., Ph.D. .......... Tennessee
Buchanan, Raymond A., Ph.D. .......... Vanderbilt
Clark, E. Erdal S., Ph.D. .......... California
Canonico, D. A., Ph.D. .......... Lehigh
Fellers, J. F., Ph.D. .......... Akron
Lin, J. S., Ph.D. .......... Kansas
Lowndes, Douglas H., Ph.D. .......... Colorado
Lundin, Carl D., Ph.D. .......... Rensselaer
McHargua, C. J., Ph.D. .......... Kentucky
Oliver, Ben F., Ph.D. .......... Penn State
Pedraza, A. J., Ph.D. .......... National (Argentina)
Phillips, Paul J., Ph.D. .......... Liverpool (UK)
Spruill, Joseph E., Ph.D. .......... Tennessee
Stansbury, E. E. (Emeritus), Ph.D. .......... Cincinnati

Associate Professors:

Becker, William T., Ph.D. .......... Illinois
Benson, R. S., Ph.D. .......... Florida State
Liu, C. T., Ph.D. .......... Brown
Meek, Thomas T., Ph.D. .......... Ohio State

Graduate programs are offered leading to the degrees of Master of Science and Doctor of Philosophy in Metallurgical Engineering or Polymer Engineering. Both the metallurgical and polymer 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. Prospective students should consult materials science and engineering faculty concerning development of individual concentrations or special programs compatible with their backgrounds and goals.

Areas of concentration within the metallurgical engineering program include physical metallurgy; materials processing; welding; materials joining; corrosion/fatigue behavior; failure analysis; and mechanical and physical behavior of materials. Specializations in electronic and ceramic materials are available.

Areas of concentration within the polymer engineering program include rheology and polymer processing; polymer morphology; mechanical, physical and chemical behavior of polymers and composite materials.

THE DOCTORAL PROGRAM

4. A major consisting of 12 to 18 semester hours of graduate courses in metallurgical engineering or polymer engineering. The polymer engineering major includes courses 540, 541, 542, 543, 544, 550 and 572 unless similar material has been covered in prior coursework.

5. Additional courses amounting to 6 to 12 hours total in any approved engineering, chemistry, mathematics, physics, or other related fields.

6. Master's thesis, 500 totaling 6 to 12 hours. All resident students are required to register for and participate in the graduate seminar in metallurgical engineering or polymer engineering, as appropriate, during each semester in which it is offered. Credits for the seminar do not count towards satisfying the coursework requirements.

Non-Thesis Option

Under certain conditions, a candidate may apply for a non-thesis option. To be eligible, the candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience or research publications would be examples of such evidence. A departmental faculty committee meeting would consider each application individually. Upon acceptance, a supervisory committee of three members will be appointed, at least two being from the Department of Materials Science and Engineering. The requirements for completion of the non-thesis option are as follows:

1. A total of at least 33 hours in graduate courses in metallurgical engineering, polymer engineering and related areas. The minimum requirements are 21 hours in the Department of Materials Science and Engineering and up to 12 hours in other engineering or science courses.

2. Satisfactory performance in an oral examination to be conducted by the faculty committee and covering the review paper and other areas of metallurgical or polymer engineering.

THE DOCTORAL PROGRAM

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

Department requirements consist of the satisfactory completion of:

1. Graduate courses in materials science and engineering amounting to approximately 24 semester hours, at least 8 of which must be in 600 series courses.

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

3. The comprehensive examination, usually given in two parts, and covering such topics as metals science and engineering, metallurgical or polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.
ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of selected states in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Metallurgical Engineering is available to residents of the state of Virginia, the M.S. and Ph.D. programs in Polymer Engineering are available to residents of Arkansas, Kentucky, Louisiana, Texas, or Virginia. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES


421 Mechanical Behavior of Materials II (3) R Descriptive description of stress and strain; linear elastic constitutive equations; strength of materials; yield criteria; brittle fracture; crazing; plastic strain constitutive equations, forming operations and limit criteria. Prerequisite: Mechanical Behavior of Materials I, sophomore mathematics.

422 Chemical Process Metallurgy (3) R Application of chemical thermodynamics to metallurgical processing. Ferrous and nonferrous pyrometallurgical refining, slag-metal equilibria, solidification, gas-metal processing. Prerequisite: 303. Sp

425 Metallurgical Applications in Manufacturing and Processing (3) R Fundamentals of the chemical and physical processes involved in the mechanical processing and finishing for finished and semi-finished products; casting, forming, joining, heat treatment, powder metallurgy, corrosion control. Prerequisite: 251.

426 Materials Joining (3) R Processes for joining metals, polymers and ceramics: mechanical, adhesive, fusion, solidification. Introduction to crystal structure determination; surface characteristics necessary for joining and chemical bonding; thermal effects on structure and properties of joints; design of joints. Prerequisite: Introduction to Materials Science and Engineering.

443 Polymer Processing (3) R Rheological measurements; flow through tubes and slits, end effects and extrudate swell; selected application, screw extrusion, injection molding, synthetic fibers and moduli in various materials; solidification, isotropic and anisotropic, modulus in various materials; yield criteria; brittle fracture; crazing; plastic strain constitutive equations, forming operations and limit criteria. Prerequisite: Mechanical Behavior of Materials, Mechanics of Materials I, sophomore mathematics.

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

503 Graduate Seminar in Metallurgical Engineering (1) R Prerequisite: admission to graduate program. May be repeated. S/N only. E

504 Graduate Seminar in Polymer Engineering (1) R Prerequisite: admission to graduate program. May be repeated. S/N only. E

505 Engineering Analysis (3) (Same as Chemical Engineering 505) R Continuum mechanics, formulation of viscoelasticity; solution methods and spectroscopy. Introduction to electron microscopy.

523 Plastic Deformation of Metals (3) R Geometry and mechanisms of single crystal plastic 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. Prerequisite: 301, 320 or consent of instructor.

524 Metallurgical Thermodynamics (3) R Applications of chemical thermodynamics to metallurgical problems: phase equilibria, solidification, alloy systems. Prerequisite: 570 or equivalent.

525-26 Welding Metallurgy (3,3) R Welding processes; physical metallurgy of welding; phase transformations; heat flow; residual stresses, theories of hot cracking; cold cracking and porosity formation; applications to process utilization.

529 Diffusion in Solids (3) R Phenomenology and atomic mechanisms of diffusion in solid state. Solution and applications of diffusion equations; random walk problem and mechanisms of diffusion; diffusion in dilute and concentrated alloys; Kirkendall effect; high diffusivity paths.

530 Phase Transformations in Metallic Materials (3) R Thermodynamics of phase equilibria, theory of nucleation in solids; kinetics and morphology of diffusion controlled growth; kinetics of interface controlled phase transformations; crystallography and kinetics of martensitic transformations.

531 Advanced Corrosion (3) R 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, stress corrosion. Prerequisite: 470 or consent of instructor.

532 Metallurgy of Deformation and Fracture (3) R Analysis of effect of stress state, strain rate, environment, temperature and martensitic structure on mechanical behavior. Brittle fracture, creep, stress rupture and fatigue. Prerequisite: Course in mechanical behavior.

540 Basic Polymer Chemistry (3) R Synthesis, reactions and degradation of polymers, Molar characterisation; solution methods and spectroscopy. Prerequisite: Semester of organic chemistry and thermodynamics of polymer processing.

541 Fluid Mechanics and Polymer Processing (3) R Navier-Stokes equations and illustrative problems; applications in chemical engineering and polymer engineering. Prerequisite: 219. Sp

542 Further Topics in Polymer Processing (3) R Description and analysis of selected polymer processing operations. Prerequisite: 541.

543 Basic Polymer Physics (3) R Essential structure and properties of polymers. Mechanical, electrical, and thermal properties. Corequisite: 540.

544 Polymer Solution Thermodynamics and Characterization (3) R Theories of solutions, statistical thermodynamics, polymer solutions, treatment of chromatographic, viscosity, light scattering and osmotic pressure. Prerequisite: Undergraduate physical chemistry.

545 Physical Characterization of Polymers (3) R Fringe theory; small angle x-ray and light scattering; spherulitic and fibrillar structures; introduction to electron microscopy.

546 Mechanical Properties of Solid Polymers (3) R Typical mechanical properties: Hookean and non-Hookean elasticity; plastic deformation; fracture; linear viscoelasticity; dynamic mechanical behavior and testing; loss factor. Prerequisite: Chemical Engineering 541.

549-50 Laboratory Methods in Polymer Engineering (1,1) R Basic experimental techniques and instrumentation associated with characterization, x-ray and light scattering, calorimetry, microscopy, thermal analysis, structure and applications of solid polymers, polymer processing operations. Corequisite: 540 or consent of instructor.

550 Principles of Ceramic Processing (3) R Treatment of ceramic processing; raw materials preparation and characterization; powder consolidation; drying, firing, sintering techniques, mechanisms and kinetics. Prerequisite: 360 or equivalent.

551 Inorganic Glass Forming Systems (3) R Physical and chemical nature of inorganic glasses; structural theories of glass formation; major glass forming systems; silica, oxide glasses, nitride glasses, water glasses, and chalcogenide glasses. Prerequisite: 360, Chemistry 371.

560 Chemical Thermodynamics (3) R Entropy and equilibrium of mixing. Gibbs function and chemical potential; thermodynamic measurement of temperature; heat capacity; heat of mixing; heat capacity of gases, liquids and solids; calculation of phase diagrams. Prerequisite: 363 or equivalent.

571 Electron Microscopy (3) R Operation of electron microscopes, kinetic effects and dynamical diffraction theories; structure determination; analysis of lattice defects. Prerequisite: 364 or equivalent.

572 X-Ray Diffraction (3) R Symmetry of crystals, space group theory, reciprocal lattice and application to determination of structures; powder and single crystal x-ray techniques; introduction to crystal structure determination; characterization of organic materials. Prerequisite: Inorganic, metallic and polymer structures.

573 Biomaterials Analysis and Development (3) R Physical property limitations of current surgical implant materials and methods of improvement; resistance to corrosion and mechanical damage; detrimental effects of specific metal ions; development of new biomaterials and new materials processing techniques. Prerequisite: 470, 474 or consent of instructor.

574 Formability of Materials (3) R Modeling and analysis of finite plastic strain with application to primary and secondary forming operations; crystalline and noncrystalline materials. Finite element methods; instability; predictive testing. Prerequisite: Consent of instructor.

576-77 Special Topics in Materials Science and Engineering (3,3) R Topics of current significance and interest. Prerequisite: Consent of instructor.

580 Technical Review and Assessment (3) R Prepartion of critical review of literature in area related to materials science and engineering. Must be taken by students in non-thesis option. Prerequisite: Consent of faculty committee.

600 Doctoral Research and Dissertation (3-15) R Prerequisite: 580 Technical Review and Assessment. E

621-22 Theoretical Metallurgy (3,3) R 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. Prerequisite: Consent of instructor.

623-24 Solidification and Crystal Growth (3,3) R Theories of solidification, fluid flow effects, magnetohydrodynamics of incompressible fluids, growth stability theory, thermodynamic applications, rapid solidification theory, metastability. Prerequisite: Consent of instructor.

641 Advanced Rheology and Viscoelasticity Theory (3) R Continuum mechanics, formulation of viscoelastic theories for describing the mechanical behavior of living materials. Application to polymer processing problems. Recommended for MS candidates working in rheological area.

642 Advanced Topics in Polymer Processing (3) R Application of theories of rheological behavior and of...
structure development to analysis of polymer processing operations. Prereq: 541. (Same as Chemical Engineering 642.)

643 Phase Transformations in Polymers (3) Glass transitions, amorphous state, annealing of polymeric glasses; crystalization 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, electron and field-ion techniques for examination of microstructures of materials. Prereq: 472.


676-77 Advanced Topics in Materials Science and Engineering (3,3) Latest developments and/or advanced special topics. Prereq: Consent of instructor. May be repeated.

678-79 Seminar in Recent Advances in Materials Science and Engineering (3,3) Directed and independent study of advanced topics. Prereq: Consent of instructor. May be repeated.

Mathematics (College of Liberal Arts)

MAJOR DEGREES

Mathematics ............ M.M., M.S., Ph.D.

John B. Conway, Head

Professors:

Albert, G. E. (Emeritus), Ph.D. .......... Wisconsin
Alexiades, V., Ph.D. ............... Delaware
Alikakos, N., Ph.D. ............... Brown
Anderson, D. F., Ph.D. .......... Chicago
Baker, G. A., Ph.D. ............... Cornell
Bradley, John S., Ph.D. .......... Iowa
Carruth, J. H., Ph.D. .......... Louisiana State
Clark, C. E., Ph.D. .......... Louisiana State
Conway, J. B., Ph.D. .......... Louisiana State
Daveyman, Robert J., Ph.D. .......... Wisconsin
Dessart, Donald J., Ph.D. .......... Maryland
Dobbie, D. E., Ph.D. .......... Cornell
Dykj, J. Ph.D. .......... Warsaw
Eaves, E. D. (Emeritus), Ph.D. .......... Texas
Frandsen, Henry, Ph.D. .......... Illinois
Hallam, T. G., Ph.D. .......... Missouri
Hinton, D. B., Ph.D. .......... Tennessee
Householder, A. S. (Emeritus), Ph.D. .......... Chicago
Husch, L. S., Ph.D. .......... Florida State
Johannson, K., Ph.D. .......... Bielefeld
Jordan, G. Samuel, Ph.D. .......... Wisconsin
Kupermark, B. A. (UTSI), Ph.D. .......... MIT
McConnel, R. M., Ph.D. .......... Duke
Mathews, H. T., Ph.D. .......... Tulane
Miller, D. M. (Emeritus), Ph.D. .......... Michigan
Rajput, B. S., Ph.D. .......... Illinois
Reddy, K. C. (UTSI), Ph.D. .......... Indian IT
Scheef, F. W., Ph.D. .......... Maryland
Serbin, Steve, Ph.D. .......... Cornell
Soni, K., Ph.D. .......... Oregon State
Stallman, F. W. (Emeritus), Ph.D. .......... Giessen
Stephenson, K. R., Ph.D. .......... Wisconsin
Wachep, E., Ph.D. .......... Rensselaer
Wade, W. R., Ph.D. .......... California (Riverside)
Wagner, C. G., Ph.D. .......... Duke

Associate Professors:

Gross, L. J., Ph.D. .......... Cornell
Karakashian, O., Ph.D. .......... Harvard
Kimble, K. R. (UTSI), Ph.D. .......... Ohio State
Kuo, Y., Ph.D. .......... Cincinnati
Lenhard, S., Ph.D. .......... Kentucky
Murry, S., Ph.D. .......... Purdue
Rosienski, J., Ph.D. .......... Wroclaw
Row, W. H., Jr., Ph.D. .......... Wisconsin
Simpson, H., Ph.D. .......... Cal Tech
Smith, J., Ph.D. .......... California
Soni, R. P., Ph.D. .......... Oregon State
Sundberg, C. D., Ph.D. .......... Wisconsin
Thistlethwatke, M. B., M.D., Ph.D. .......... Manchester

Assistant Professors:

Fitzpatrick, B., Ph.D. .......... Brown
Jank, T., Ph.D. .......... Warsaw Tech
Overholt, M., Ph.D. .......... Michigan
Richer, Stefan, Ph.D. .......... Michigan
Svirsy, R. Ph., Ph.D. .......... Johns Hopkins

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 obtain 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.

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 or secondary school teaching experience, or (c) a bachelor's degree in mathematics (or equivalent). A student may complete any course desired from the following list:

- Real Analysis 541-42
- Topology 561-62
- Modern Algebra 551-52
- Complex Variables 539-40
- Combinatorics 537-38
- Mathematical Ecology 533-34
- Partial Differential Equations 535-36
- Ordinary Differential Equations 531-32
- Numerical Mathematics 571-72
- Core Courses (500) in which a term paper or project is required.

Any student offering mathematics as a minor for the Master's degree is required to obtain at least 30 hours of coursework of which 21 must be at the 500 level. The coursework must include 504, 505, 506, 507, and 6 hours in 509. At most, 6 hours may be taken outside the Department of Mathematics (selected in consultation with the advisor).

A pass final examination upon completion of all coursework.

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 of 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.

THE DOCTORAL PROGRAM

For the Ph.D. in Mathematics, the student must meet the following four requirements in addition to those of The Graduate School:

1. Satisfy either of the following: the standard program or the mathematical ecology concentration. A student intending to work in mathematical ecology may complete either, but she/he is encouraged to complete the 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 a transfer is determined by the complete history of his/her earlier examinations from the standard program and part 1 of the mathematical ecology concentration. A description of both programs is below.

2. Demonstrate proficiency in one foreign language, normally French, German or Russian. This requirement is to be met prior to the examination in the area of specialization. The student's doctoral committee may require that the student pass a second language exam.

3. Pass an examination in the field of specialization. This examination will be given by a committee appointed by the department head at some time after the requirements in 1. have been met. A student may take this specialty examination only twice.

4. Take a one-year, 600-level sequence in mathematics outside of that in a field of specialization. The use of the course selected to fulfill this requirement must be approved by the department head and the student's doctoral committee (such approval may occur after completion of the course).

Standard Program

Pass written examinations covering four subjects, at least three of which must be from the following list:

- Modern Algebra 551-52
- Complex Analysis 543-44
- Topology 561-63
- Real Analysis 541-42
- Applied Linear Analysis 547-48
- Partial Differential Equations 535-36
- Ordinary Differential Equations 531-32
- Numerical Mathematics 571-72
- Statistics (courses numbered above 500) in which a term paper or project is required.

The Doctoral Program

Students may not count examinations in both d. e. f. and g. for the required four passes. Those who choose four from this list must choose at least two from a. through e., and the students who choose only three from this list must choose one from a. through e.
Students selecting only three from the above list will also be required to pass a written exam on an area of applied mathematics (e.g., fluids, elasticity, mathematical ecology) approved as an examination topic for that student by the Graduate Committee and the Applied Mathematics Committee. The Graduate Committee will appoint a section of faculty who will submit a list of topics and references to the Graduate Committee and the Applied Mathematics Committee for approval.

Students may take as many of the written examinations as desired at any time these exams are given, subject to the following conditions:

1. The exams to be taken must be approved in advance by the student's advisory committee.
2. At most, 4 minus n exams may be taken at any one time, where n denotes the number of exams previously passed by the student.
3. Students may take a collection of written examinations a maximum of four times, but no one failing five exams, counting possible repetitions, will be permitted to take another round of exams.

Mathematical Ecology Concentration

Students must pass examinations in two areas:

1. Three subjects in mathematics. One must be mathematical ecology and two must be from the list under the standard program. Students may not count passes on examinations in both d. and e., if n. and g., nor in i. and j. toward the required three passes. At least one exam must be chosen from a. through e.
2. One practice by writing many written examinations as desired at any time these exams are given subject to the following conditions:
   a. The exams to be taken must be approved in advance by the student's advisory committee.
   b. At most 3 minus n exams may be taken at any one time, where n denotes the number of exams previously passed by the student.
   c. Students may take a collection of written examinations a maximum of three times, but no one failing four exams, counting possible repetitions, will be permitted to take another round of exams.
3. A student, covering material selected from nine hours of coursework outside of mathematics at the 500 level or above.

GROWTH COURSES

400 History of Mathematics (3) Development of major ideas in the subject in modern times 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: Calculus.

401 Mathematics and Microcomputers (3) Primarily for students seeking certification as mathematics teachers at secondary level. Use of microcomputers to study concepts and techniques in mathematics. Does not satisfy the major requirements for a B.S. or M.S. in mathematics. Prereq: 141 plus 1 semester of discrete mathematics. 221 or 504.

404 Applied Vector Calculus (3) Topics from multivariable and vector calculus: line and surface integrals, divergence theorem and theorems of Gauss and Stokes. Prereq: 241.

405 Models in Biology (3) Difference and differential equations and models of biological systems. Prereq: 141-42 or 151-52.


421 Combinatorics (3) Introduction to problems of construction and enumeration for discrete structures: sequences, partitions, graphs, finite fields and geometries, or experimental designs. Prereq: 323 or consent of instructor.

423 Probability II (3) Law of large numbers and central limit theorems for discrete and continuous random variables; Poisson processes; discrete and continuous parameter Markov chains and their applications. Kolmogorov differential equations; Brownian motion process as limit of random walks. Prereq: 323.

425 Statistics (3) Derivation of standard statistical distributions: f, F, t, X2, exponential, binomial, geometric, normal, exponential, Poisson; sampling distribution; central limit theorems; point and interval estimation; Bayesian estimates; statistical hypotheses, Neyman-Pearson theorem; likelihood ratio and other parameter and non-parametric tests; sufficient statistics. Prereq: 323.


444 Complex Variables II (3) Applications of complex variables to steady-state temperatures, electrostatics, and fluid flow. Prereq: 443.

445-46 Advanced Calculus II (3,3) Theory of sequences, series, continuity, and uniform integrability of functions of one or more variables. Prereq: 341 or consent of instructor.

447-48 Honors: Advanced Calculus II (3,3) Honors version of 445-46. Prereq: 341 or consent of instructor.

451 Topics in Algebra (3) Number theory and theory of polynomial equations such as quadratic reciprocity law and Sturm separation. Prereq: 351.


455-56 Abstract Algebra II (3,3) Algebraic structures: groups, rings, fields, vector spaces and linear transformations. Prereq: 351 or consent of instructor.

457-58 Honors: Abstract Algebra II (3,3) Honors version of 455-56. Prereq: 351 or consent of instructor.

460 Geometry (3) Axiomatic and historical development of neutral, Euclidean, and hyperbolic geometry using proof technique and critical reasoning. Models of Non-Euclidean geometries. Prereq: Calculus and Discrete Mathematics, or consent of instructor.

461 Topology (3) Topology of line and plane, separation properties of sets, connectedness, compactness, continuity, functions, homeomorphisms, compact and topological invariants. Prereq: 341 or consent of instructor.

471 Numerical Analysis (3) Computation, instabilities, and rounding error, solution of equations and approximation by polynomials and piecewise polynomials. Quadrature and numerical solution of initial and boundary value problems of ordinary differential equations and stiff systems. Prereq: 371 (Same as Computer Science 471).


490 Readings in Mathematics (1-3) Open to superior students with consent of department head. Independent study. Prereq: Consent of department head. May not be used toward degree requirements. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

499 Seminar in Mathematics (1-3) Topics vary. Requires oral and written examinations by students. Credit hours announced for each seminar. Prereq: Consent of instructor. May be repeated. Maximum 5 hrs.

500 Thesis (1-15) P.N.P. only. E

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

503 MBA Calculus (3) Review of derivatives and antiderivatives; exponential functions, functions of two variables, applications to optimization. Credit available only to satisfy MBA core requirements. Prereq.: 121.

504 Discrete Mathematics for Teachers (3) Mathematical logic and methods of argument, sets and relations, combinatorics. Normally first graduate course for students seeking M.M. 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. E

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. E

506 Algebra for Teachers (3) Algebraic structures: integral domains and fields and their applications to algebra of integers and 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. Prereq: 1 yr calculus or equivalent. E

507 Probability and Statistics for Teachers (3) Probabilistic models. Discrete 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. E

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 12 hrs.


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 Applied Combinatorics (3,3) Application of finite differences, generating functions, and recursion equations to enumeration problems. Coding theory, experimental design, graph theory, or decision theory.

523-24 Probability (3,3) Particular facts from measure theory, probability models, and theorems of Kolmogorov's existence theorem; series of independent
random variables and laws of large numbers; general theory of distributions of random vectors and their character- istic functions; weak convergence concept, weak compactness, Prohorov's and Levy's continuity theorems in Euclide- an spaces; finitely divisible distributions and central limit problem; general concept and properties of condi- tional expectation and Levy's continuity theorems in Euclid- ean spaces; infinitely divisible distributions and central limit problem; general concept and properties of condi- tional expectation and Levy's continuity theorems in Euclid- ean spaces; infinitely divisible distributions and central limit problem; general concept and properties of condi- tional expectation and Levy's continuity theorems in Euclid- ean spaces; infinitely divisible distributions and central limit problem; general concept and properties of condi- tional expectation and Levy's continuity theorems in Euclid- ean spaces; infinitely divisible distributions and central limit problem; general concept and properties of condi- tional expectation and Levy's continuity theorems in Euclid- ean spaces; infinitely divisible distributions and central limit problem; general concept and properties of condi- tional expectation and Levy's continuity theorem. 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 fami- lies, Bayesians models; methods of estimation and opti- mization. Prereq: Consent of instructor. Maximum 12 hrs.

559 Seminar in Topology (1-3) Prereq: Consent of instruc- tor. May be repeated with consent of instructor. Maximum 12 hrs.


575 Matrix Theory and Techniques in Numerical Analysis (3) Advanced topics in study of iterative and direct methods for solving systems of linear equations: sparse matrix analysis, relationship to modern computer architectures. Prereq: 453, 471-72, or consent of instruc- tor. May be repeated. Maximum 8 hrs. (Same as Computer Science 575.)

579 Seminar in Numerical Mathematics (1-3) Prereq: Consent of instructor. 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.

583 Mathematical Evolutionary Theory (3) Population genetics and evolutionary theory. Prereq: 431, 453 or consent of instructor.

584 Mathematical Systems Theory (3) Analytic ap- proach to discrete and continuous dynamical control systems; optimal control. Applications to ecology. Prereq: 431, 453, 445-46 or consent of instructor.

585 Optimal Control Theory (3) Deterministic optimal control, costs and optimal control problems; variational calculus, optimal trajectories, and engineering control problems. intro- duction to stochastic control. Prereq: 445-46 or consent of instructor.

589 Seminar in Mathematical Ecology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

593 Independent Study (1-15) See page 31.

598 Graduate Reading in Mathematics (1-3) Independ- ent study with faculty guidance. Prereq: Graduate standing and consent of instructor. May be repeated. Maximum 12 hrs.

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

617-18 Lie Algebras in Mechanics and Physics (3,3) Analytical tools of mechanics and physics arising from differential manifolds, tensors, Lie derivatives, Lie groups, differential forms, Lie algebras, applications to Hamiltonian mechanics, adiabatic and barotropic fluids and plasmas, numerical methods in continuum mechan- ics. Prereq: 431, 455, 457, 571-72. (Same as Physics 617-18.)

619 Seminar in Applied Mathematics (1-3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

623-24 Advanced Probability (3,3) Selected topics in probability theory and stochastic processes. Ito's calculus and stochastic differential equations, inte- gration 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.

631-32 Advanced Ordinary Differential Equations (3,3) Theory of ordinary differential equations from ad- vanced 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.

639-30 Advanced Partial Differential Equations (3,3) Selected topics in classical and modern theoretical par- tial differential equations. Prereq: 541-42 or 547-48 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, inver- sion, duality, Plancherel transform, Hilbert transform, Hardy-Littlewood maximal function, interpolation of operators, or Paley-Wiener-Stein duality. Prereq: 541-42 and 543. May be repeated with department. Maximum 12 hrs.

649 Seminar in Analysis (1-3) Prereq: 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 instruc- tor. May be repeated with consent of department. Maximum 12 hrs.


665-66 Topological Algebra (3,3) Topological semi- groups, topological groups, Lie groups, transformation groups, topological lattices, relations in topological spaces; topological rings, fields, algebras. Prereq or coreq: 561-62. May be repeated with consent of department. Maximum 12 hrs.

679 Seminar in Numerical Mathematics (1-3) Prereq: Consent of instructor. 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.

Mechanical and Aerospace Engineering (College of Engineering)

MAJORS

DEGREES

Aerospace Engineering ............ M.S., Ph.D.

Mechanical Engineering .......... M.S., Ph.D.

Donald R. Pitts, Head

A. J. Edmondson, Associate Head
THE MASTER'S PROGRAM

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. Three program options are available.

Thesis Option

The requirements of this option are that the student must satisfactorily complete a program of study that includes:
1. A minimum of 24 semester hours of coursework that includes at least 12 semester hours of graduate (500-level or above) courses in the discipline and normally 6 semester hours of coursework (400-level or above) in mathematics.
2. Six semester hours of thesis.
3. Participation in the departmental seminar programs.
4. Submission and defense of a written thesis that demonstrates the ability to conduct and report on an independent investigation.
5. Passing a final examination on all work submitted for the degree.

Course Option

This option is restricted to those students who have had the equivalent of a thesis experience. The evaluation of the work experience and the final selection of the student's program of study are left to the student's committee. The requirements of this option are that the student must satisfactorily complete a program of study that includes:
1. A minimum of 30 semester hours of coursework that includes at least 18 semester hours of graduate (500-level or above) courses in the discipline and normally 6 semester hours of coursework (400-level or above) in mathematics. No more than 3 semester hours of engineering coursework may be below the 500 level.
2. Participation in the departmental seminar program.
3. Passing a comprehensive written and oral final examination on all coursework submitted for the degree. The student's committee will be of sufficient size to include all of the study areas reflected in the course program.

Problems Option

The requirements of this option are that the student must satisfactorily complete a program of study that includes:
1. A minimum of 24 semester hours of coursework that includes at least 12 semester hours of graduate (500-level or above) courses in the discipline and normally 6 semester hours of coursework (400-level or above) in mathematics.
2. A minimum of 6 semester hours in 890 Selected Engineering Problems. A written report must be presented for each problem investigated.
3. Participation in the departmental seminar program.
4. Passing a comprehensive written final examination on all coursework submitted for the degree and an oral examination on all work (including problems).

The DOCTORAL PROGRAM

Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds. The student must satisfactorily complete an approved program of study that includes a minimum of 72 semester hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems, including:
1. Twenty-four semester hours in doctoral dissertation.
2. 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.
3. A minimum of 24 semester hours in the discipline in courses numbered 500 and above, with at least 9 semester hours of 600-level courses. 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 courses that are more appropriate.
4. Participation in the departmental seminar program.
5. The passing of a written and oral comprehensive examination is required as well as a successful defense of the dissertation.

ACADEMIC COMMON MARKET

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

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Senior (400-level) mechanical and aerospace engineering courses may be taken for graduate credit by non-mechanical or non-aerospace engineering majors, if approved by the student's major department. Mechanical or aerospace engineering majors may not normally use more than one 400-level engineering course to meet their advanced degree requirements. Non-mechanical or non-aerospace engineering graduate students should consult with instructors regarding prerequisites for undergraduate courses.

Mechanical Engineering

GRADUATE COURSES

422 Environmental Noise (3) Basic principles of acoustics; measurements and control of noise in industrial and community environments. Prereq: Senior standing in engineering or consent of instructor.
445 Lubrication (3) Hydrodynamic theory of lubrication of sliding bearings; application of Navier-Stokes equation to determination of fluid flow; general theory of lubricants; and selection and application of specific lubricating fluids. Prereq: 344, Aerospace Engineering 351.


455 Introduction to Design (2) Engineering economy, optimization, design for automation, reliability, patents and product liability; design of mechanical engineering solid mechanics system. Participation in team design election. Prereq: MATH 210 and Introduction to Applications of Machines. Elements of Machine Design I. F.

456 Introduction to Thermal Design (2) Engineering economy, optimization, design for automation, reliability, patents and product liability; design of mechanical engineering solid mechanics system. Participation in team design election. Prereq: MATH 210 and Introduction to Applications of Machines. Elements of Machine Design I. F.


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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or is involved in activities that require use of student time or degree credit. Must not be used toward degree requirements. May be repeated. S/NC only. E

507 Application of Numerical Linear Algebra in Systems and Control Engineering (3) (Same as Chemical Engineering 507 and Electrical and Computer Engineering 507.)


514 Phase Change Heat Transfer (3) Mechanisms and modeling of phase change, boiling and condensation processes; critical heat flux; forced convection boiling and pool dry-out heat transfer; condensation processes; heterogeneous solid/liquid phase transitions and discrete condensation; flow condensation; liquid-solid phase change processes; moving phase fronts; mathematical modeling. Prereq: 341, 363, 511.

521-22 Thermodynamics I and II (3,3) Macroscopic thermodynamics, including First and Second Law analyses, availability, phase and chemical equilibrium criteria, combustion, gas mixtures, and property relations, determination of thermodynamic properties from molecular structures, spectroscopic data, kinetic theory, statistical mechanics of quantum physics, Schrodinger equation. Prereq: 332.

523 Special Topics in Thermodynamics (3) Application of thermodynamics to topics of current interest in mechanical engineering. Prereq: Consent of instructor.

525 Combustion and Chemically Reacting Flows I (3) Fundamentals: thermochemistry, chemical kinetics and conservation equations; phenomenological approach to laminar flames; diffusion and premixed flame theory; single droplet combustion; deflagration and detonation theory; stabilization of combustion waves in laminar streams; flammability limits of remixed laminar flames; introduction to turbulent flames. Prereq: 522, 531.

526 Combustion and Chemically Reacting Flows II (3) Advanced topics in combustion: mathematical approaches to turbulent flames: fundamentals of turbulent flow; application of probability density functions to turbulent flames; turbulent reacting flows with premixed and/or non-premixed reactants; spray combustion models; fluidized bed combustion; chemically reacting boundary layer flow; gas turbine and/or rocket motor combustion; furnaces; introduction to supersonic combustion and hypersonic flows. Prereq: 525.


541-42 Research in Mechanical Engineering I and II (3,3) Design of experiments; data analysis; experimental investigation. Prereq: Consent of instructor.

551-52 Mechanical Engineering Design (3,3) Design of mechanical system, components, and devices and systems. Prereq: Consent of instructor.

553 Development of Superior Products and Processes (3) Case studies of latest techniques of superior product and process design, creative and effective design for product development practiced in industry. Case study of product or process yielding superior results developed by student. Prereq: B.S. in Engineering Science and Mechanics 321 and Basic Engineering 201. Sp.


560 Computer Aided Mechanical Design (3) Application of computer programs to analysis, design and computer-aided design of structures and their dynamic analysis and re-design of complex, three-dimensional, statically indeterminate structures. Prereq: 464 or consent of instructor.

581 Experimental Stress Analysis (3) Experimental stress analysis, photoelasticity, strain gauges. Prereq: Consent of instructor.

587-68 Dynamics of Machinery (3,3) Kinematics and kinetostatic forces, motion, and rotating co-ordinate systems; linear and angular momentum; energy methods; computational techniques derived from Lagrangian mechanics; variable mass, rigid body dynamics. Prereq: 363, 391.

596 Vibrations (3) Free and forced vibration of single and multi-degree of freedom systems. Analysis of vibration of mechanical and structural systems and design for vibratory or axial forces. Prereq: Undergraduate vibrations course.


581 Rocket Propulsion I (3) Rocket propulsion fundamentals: thermodynamics of nonreacting and chemically reacting ideal gases; rocket nozzle design; ideal rocket performance parameters; rocket heat transfer; chemistry of propellants; 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, abrasive burning; analysis of heavy 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 and design, design of internal combustion systems (inlets, nozzles, combustors, compressors, turbines), flow theory, turbine engine combustion, advanced turbine operation, surge and rotating stall, engine control systems, structural considerations. Prereq: First year graduate standing and consent of instructor.


588 Measurement Science I (3) (Same as Nuclear Engineering 588, Chemical Engineering 588, Civil Engineering 588, Electrical and Computer Engineering 589, Engineering Science and Mechanics 588, and Aerospace Engineering 586.)

589 Measurement Science II (3) (Same as Nuclear Engineering 589, Chemical Engineering 589, Civil Engineering 589, Electrical and Computer Engineering 589, Engineering Science and Mechanics 589, and Aerospace Engineering 586.)

590 Selected Engineering Problems (2-6) Enrollment limited to students in programs program. Prereq: Consent of advisor. May be repeated. S/NC only.

595 Seminar (1) All phases of mechanical engineering, reports on current research at UT. May be repeated. S/NC.

599 Special Topics in Mechanical Engineering (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.
Aerospace Engineering

GRADUATE COURSES

422 Aerodynamics (3) Theory and design of aero-
dynamic systems. Generalized and unified character-

423 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods. Prereq: 422 or Heat Transfer or consent of instructor. Sp

424 Astronautics (3) Propulsion, trajectories, guid-
ance, control, and atmospheric reentry of space vehicle systems. Prereq: 362, Mechanical Engineering 332. Sp

425 Propulsion (3) Principles of propulsion devices; turbo-jet, ramjet 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, economic and technical aspects. Participation in team design effort, final presentations and design report. Prereq: 425, 426. Sp

449 Aerospace Engineering Laboratory (3) De-
signing, conducting, and reporting results of experi-
ments. Techniques of test methods and specifications. Analysis of data and formation of conclusions. Prereq: 345, 351. 3 labs, F

450 selected topics in Aerospace Science (1-4, 3-4) Current problems and topics in aerospace science. Prereq: Consent of instructor.

451 Aircraft Design (3) Aircraft stability, control and performance. Prereq: Mechanical Engineering 433 and consent of instructor.

454 Selected Topics in Aerodynamics (3) Current problems and topics in aerodynamics. Prereq: Consent of instructor.

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


521 Advanced Aerospace Engineering (3) Advanced study of various aspects of aerospace engineering. Prereq: Consent of instructor.

528 Aerodynamics (3) Nondimensional analysis and similarity considerations. Fluid mechanics, boundary layer theory, viscous and inviscid flow, compressible flows, shock waves, boundary layer separation, hypersonic flows, stability of boundary layers, transition, laminar and turbulent flows. Prereq: Consent of instructor.

530 Aerodynamics (3) Kinematics and dynamics of aero-
dynamic systems, including airfoils and wings, aeroelasticity, aerodynamics of ground vehicles, and aerospace vehicles. Prereq: Consent of instructor.

534 Selected Topics in Aerospace Science (3) Advanced problems of current interest. Prereq: Consent of instructor.

540 selected topics in Mechanical Engineering (3) Selected topics in the field of mechanical engineering. Prereq: Consent of instructor.

545-55 Aerospace Vehicle Stability and Control (3, 3) Static and dynamic longitudinal directional and stability and control of air vehicles, including aircraft and space vehicles. Prereq: Consent of instructor.

556 Vertical or Short Take Off and Landing Aircraft (4) Current problems and topics in VTOL aircraft design. Prereq: Consent of instructor.

557 Aerospace Vehicle Flutter and Vibration (3) Flutter and vibration of aerospace vehicles. Prereq: Consent of instructor.

561 Advanced Topics in Fluid Mechanics (3) Advanced study of various aspects of fluid mechanics. Prereq: Consent of instructor.

565 Advanced Topics in Thermodynamics (3) Advanced study of various aspects of thermodynamics. Prereq: Consent of instructor.

568 Selected Topics in Aerospace Science (3) Advanced problems of current interest. Prereq: Consent of instructor.

590 Selected Engineering Problems (2-6) Enrollment limited to students in programs problem. Prereq: Consent of advisor.

594-95 Selected Topics in Aerospace Science (1-4, 1-4) Current problems and topics in aerospace science. Prereq: Consent of instructor.

599 Special Topics in Aerospace Engineering (1-3) May be repeated. Maximum 6 hrs.

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


621 Advanced Topics in Solid Mechanics (3) Advanced study of various aspects of solid mechanics. Prereq: Consent of instructor.

622 Advanced Topics in Mechanical Engineering (3) Advanced study of various aspects of mechanical engineering. Prereq: Consent of instructor.

625 Advanced Topics in Thermodynamics (3) Advanced study of various aspects of thermodynamics. Prereq: Consent of instructor.

630 Advanced Topics in Fluid Mechanics (3) Advanced study of various aspects of fluid mechanics. Prereq: Consent of instructor.


633 Magnetohydrodynamics (3) Advanced study of various aspects of magnetohydrodynamics. Prereq: Consent of instructor.

634 Advanced Topics in Thermodynamics (3) Advanced study of various aspects of thermodynamics. Prereq: Consent of instructor.

635 Magnetic Fluids and Their Applications (3) Magnetic fluids and their applications in various fields. Prereq: Consent of instructor.

636 Advanced Topics in Fluid Mechanics (3) Advanced study of various aspects of fluid mechanics. Prereq: Consent of instructor.

637 Advanced Topics in Thermodynamics (3) Advanced study of various aspects of thermodynamics. Prereq: Consent of instructor.

638 Advanced Topics in Fluid Mechanics (3) Advanced study of various aspects of fluid mechanics. Prereq: Consent of instructor.

639 Advanced Topics in Thermodynamics (3) Advanced study of various aspects of thermodynamics. Prereq: Consent of instructor.

640 Advanced Topics in Fluid Mechanics (3) Advanced study of various aspects of fluid mechanics. Prereq: Consent of instructor.


643-44 Advanced Aerodynamics (3, 3) Advanced study of various aspects of aerodynamics. Prereq: Consent of instructor.

645 Theory of Turbulence (3) Advanced study of various aspects of turbulence. Prereq: Consent of instructor.

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


Prerequisites of group theory. Special problem areas of interest to students. Prereq: Consent of instructor. Maximum 9 hrs. S/NC only. E.

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

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

522 Special Topics in Cancer (1-3) Prereq: 521 and consent of instructor. May be repeated. Maximum 9 hrs. F,Sp.

531 Principles of Hematology (3) Pathophysiology of blood and blood forming systems. Lectures, class discussions and demonstrations. Prereq: Upper division histology and/or cell biology. Zoology 410 and 420.

532 Special Topics in Hematology (1-3) Prereq: 531 and consent of instructor. May be repeated. Maximum 9 hrs. F,Sp.


541 Molecular Basis for Metabolic Disease (4) Disease at molecular level. Changes in molecular events in cells that lead to disease and occur as result of disease. Correlation with clinical and pathological states. Prereq: Biochemistry 410-419 or equivalent. F,Sp.

542 Special Topics in Metabolic Disease (1-3) Biochemical and physiological basis of selected diseases of humans and animals. Clinical-pathological correlations. Prereq: 541 and consent of instructor. May be repeated. Maximum 9 hrs. F,Sp.


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

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


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Medical Biology

(For College of Medicine-Knoxville Unit)

Carmen B. Lozio, Acting Chair

Professors:

Carroll, R., Ph.D. ........................................ Cornell
Chen, J. P., Ph.D. ........................................ Penn State
Carswell, R., Ph.D. ....................................... Duke
Fuhr, J. E., Ph.D. ........................................... St. John's
Congdon, C. G. (Emeritus), M.D. ....................... Michigan
Lange, R. D. (Emeritus), M.D. ............................. Washington (St. Louis)
Lozio, Carmen B., M.D. ................................... Buenos Aires
McDonald, T. P., Ph.D. ..................................... Tennessee
Wigler, P., Ph.D. ........................................... Indiana
Wust, Carl J., Ph.D. ........................................... Indiana

Associate Professors:

Goodman, M. M., Ph.D. .................................... Alabama
Hanna, W. T., M.D. ........................................ Ainshams
Ichiki, A. T., Ph.D. .......................................... UCLA
Schoedler, E. C., D.V.M. .................................... Michigan State

Graduate Medical Program:

The faculty with the College of Veterinary Medicine participates in the graduate program leading to M.S. and Ph.D. in Comparative and Experimental Medicine. Other advanced degree students can do thesis research in the department by arrangement with other life science departments at the University.

Medical Biology

(College of Medicine-Knoxville Unit)

Associate Professors:

Brown, Arthur (Emeritus), Ph.D. ......................... Chicago
Lozio, Carmen B., M.D. (College of Medicine-Knoxville Unit)
McDonald, T. P., Ph.D. ..................................... Tennessee

Assistant Professors:

Beck, Raymond W., Ph.D. .................................... Wisconsin
Becker, Jeffrey M., Ph.D. .................................... Cincinnati
Brown, John T., D.V.M. ..................................... Michigan State
Friggsby, W. Stuart, Ph.D. ................................... Yale
Rous, B. T., Ph.D. ........................................... Guelp
Saveg, Dwayne C., Ph.D. ..................................... California
Sayler, Gary S., Ph.D. ......................................... Idaho
White, D. C. (Distinguished Scientist), Ph.D. .......... Rockefeller
Woodward, J. M. (Emeritus), Ph.D. ....................... Kansas

Graduate Interdisciplinary Program:

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 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.

Metallurgical Engineering

See Materials Science and Engineering

Microbiology

(Majors in Liberal Arts and College of Veterinary Medicine)

MAJOR DEGREES

Microbiology ............................................. M.S., Ph.D.
Veterinary Medicine ..................................... D.V.M.

Dwayne Savage, Head

Professors:

Beck, Raymond W., Ph.D. .................................... Wisconsin
Becker, Jeffrey M., Ph.D. .................................... Cincinnati
Brown, John T., D.V.M. ..................................... Michigan State
Montie, T. C., Ph.D. ......................................... Maryland
Rous, B. T., Ph.D. ........................................... Guelp
Savage, Dwayne C., Ph.D. ..................................... California
Sayler, Gary S., Ph.D. ......................................... Idaho
White, D. C. (Distinguished Scientist), Ph.D. .......... Rockefeller
Wust, Carl J., Ph.D. ........................................... Indiana

Associate Professors:

Bemis, D. A., Ph.D. ........................................... Cornell
Moore, R. N., Ph.D. .......................................... Texas
Stacey, G., Ph.D. .............................................. Texas

Assistant Professor:

Villafane, Robert J., Ph.D. .................................... NYU
...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 and 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 in the department; (3) 3.0 GPA in courses taken in the department; (4) a complete course sequence in biochemistry; (5) coursework in at least five of the subdisciplines recognized by the department: microbial physiology, pathogenic bacteriology, virology, mycology, immunology, microbial genetics, microbiological ecology, molecular biology, and applied microbiology; and (6) 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 require 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 system; (2) a 3.0 GPA in courses taken in the department; (3) satisfactory performance in at least one seminar as a teaching assistant; (4) one semester of physical chemistry; (5) one course in statistics; (6) courses in at least five of the sub-disciplines listed in the Master's program; (7) satisfactory performance in a comprehensive examination, that must be 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 structure and function 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. F

429 Medical Microbiology Laboratory (2) Laboratory exercises designed to accompany 420. Prereq: Introduction to Microbiology Laboratory. Coreq: 429. Sp

430 Immunology (3) Principles of inflammation and immunity; immune globulin structure and theories of formation and diversity; complement, hypersensitivities, cell cooperation and recognition in immune mechanisms; soluble factors. Prereq: Biology 220. (Same as Zoology 430). F

439 Immunology Laboratory (1) Laboratory exercises designed to accompany 430. Coreq: 430. (Same as Zoology 439). F


449 Virology Laboratory (1) Laboratory procedures for isolation, handling, and culturing of animal viruses. Prereq: 310. Coreq: 440. 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. Sp

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

502 Registration for Use of Facilities (1-15) Required each 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 Microbial Physiology (3) Topics in microbial physiology and metabolism. Prereq: 410, Biochemistry 415; consent of instructor. May be repeated. Maximum 12 hrs.

520 Pathogenesis of Infectious Disease (3) Topics in pathogenesis: microbial factors and host responses. Prereq: 420, 430; consent of instructor. May be repeated. Maximum 12 hrs.

530 Immunology and Immunoochemistry (3) Topics in molecular and genetic aspects of immune response, immunobiology, and immunopathobiology. Prereq: 420, 430; consent of instructor. May be repeated. Maximum 12 hrs.

540 Molecular Virology (3) Topics in replication, assembly, and expression of viruses. Prereq: 440 or consent of instructor. May be repeated. Maximum 12 hrs.

550 Microbial and Molecular Genetics (3) Topics in transmission and expression of genetic information at molecular level. Prereq: 411, Biochemistry 415; consent of instructor. May be repeated. Maximum 12 hrs.

560 Recombinant DNA (3) Plasmid and bacteriophage molecular biology applied to development of recombinant DNA techniques. Prereq: 411 or consent of instructor.

569 Recombinant DNA Laboratory (3) Practical details and procedures applicable to recombinant DNA methodology and techniques. Prereq: or coreq: 560 or consent of instructor.

570 Applied and Environmental Microbiology (3) Topics in applied and environmental microbiology that treat physiology, metabolism, and genetics of microorganisms: fermentations and natural and simulated ecosystems. Prereq: 470; consent of instructor.

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

590 Laboratory Problems (2-4) Laboratory methods for development and interpretation of microbiological research. Prereq: Graduate standing. May be repeated. Maximum 6 hrs. S/NC only.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Selected Topics in Microbiological Research (2-4) Literature surveys and discussions of selected topics. Prereq: Graduate standing. May be repeated. Maximum 8 hrs. S/NC only.

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.

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

606 Current Topics in Biological Membrane Research (1) (Same as Biochemistry 606.)

610 Advanced Topics in Microbiological Physiology (3) Prereq: 510 or consent of instructor. May be repeated. Maximum 12 hrs.

620 Advanced Topics in Microbial Physiology (3) Prereq: 520, 530 or consent of instructor. May be repeated. Maximum 12 hrs.

630 Advanced Topics in Immunology (3) Prereq: 520 or consent of instructor. May be repeated. Maximum 12 hrs.

640 Advanced Topics in Virology (3) Prereq: 440, 540, or consent of instructor. May be repeated. Maximum 12 hrs.

650 Advanced Topics in Microbial and Molecular Genetics (3) Prereq: 550 or consent of instructor. May be repeated. Maximum 12 hrs.

670 Advanced Topics in Environmental Microbiology (3) Prereq: 570 or consent of instructor. May be repeated. Maximum 12 hrs.

Microbiology - Veterinary Medicine

See Veterinary Medicine for program description.

Music

(College of Liberal Arts)

MAJOR DEGREES

Music ........................................ M.M., M.A.

Kenneth A. Keeling, Sr., Head

Professors:

Bitzas, George C., M.M., Converse
Brock, John P., M.M., University of Alabama
Carter, W. J. (Emeritus), D.M.A., Eastern
Coker, J., M.A., Sam Houston
Combs, F. M., M.A., Missouri
DeVine, George F. (Emeritus), Diploma
Dorn, W. (Emeritus), M.A., Columbia
Fred, Herbert W. (Emeritus), Ph.D.
Hofford, A. G. (Emeritus), M.M., Northwestern
Huber, Calvin R., Ph.D., Northwestern
Lennon, J. A., D.M.A., Michigan
Keeling, Kenneth A., Sr., D.M.A., Catholic
Mecham, John J., M.M., Northwestern
Northington, D. B., D.M.A., Yale
Pederson, D. M., Ph.D., Iowa
Starr, W. J. (Emeritus), M.M., Eastern
The Department of Music offers the Master of Music degree with concentrations in accompanying, choral conducting, composition, instrumental conducting, jazz, performance, pedagogy, sacred music, and theory. A thesis is required of students in composition and theory. Anyone applying for admission to the Master of Music degree must have completed an undergraduate degree approximately equivalent in music requirements from the Department of Music. A reading knowledge of French or German must be demonstrated by Department of Music. A reading knowledge of French or German must be demonstrated by applicants before being admitted to candidacy.

**Music General**

**GRADUATE COURSES**

- **500 Thesis** (1-15) P/NP only. E
- **501 Graduate Recital** (2)
- **502 Registration for Use of Facilities** (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used for the student not otherwise registered during any semester. S/NC only. E
- **511 Lecture Recital** (2)
- **521 Special Topics in Performance** (1-3) Prereq: Consent of department head.
- **561 Church Music Performance Project** (1-2) May be repeated. Maximum 3 hrs.

**Music History**

**GRADUATE COURSES**

- **410 Music History Genre** (3) Topics vary. May be repeated. Maximum 6 hrs.
- **420 History of Opera** (3) Dramatic, vocal, and orchestral elements in opera of Italian, French, and German schools. 1600-present.
- **430 Symphonic Literature** (3) Literature for orchestra from Baroque to present, evolution of symphony.
- **440 Music of North America** (3) Folk and art music of U.S. and Canada from colonial times to present.
- **450 Composer Seminar** (3) Life and works of single composer. Subjects vary.
- **460 Music Aesthetics** (3) Nature of music and musical experience, sense perception and emotions, music, and role of artist in society. Aesthetic viewpoint of individuals and historical areas through selected writings.
- **490 Church Music Methods and Administration** (3)
- **510 Music Bibliography** (3) Bibliographic methodology in music.
- **520 Music Research** (1) Principles of research methodology applied to writing of research proposal and project.
- **530 Music in the Middle Ages** (3) Gregorian and medieval chant, secular monophony, and rise of polyphony.
- **540 Music in the Renaissance** (3) From 1400 to 1600. Mass, motet, chansons, madrigal, and other vocal and instrumental forms and genres.

**Music Instrumental**

**GRADUATE COURSES**

- **410 Band Arranging** (3) Study and application of techniques employed in scoring for marching and concert bands. Prereq: Music Theory 320.
- **490 Instrumental Conducting** (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of different styles to conductor's art; musical analysis and practice in conducting. Prereq: Music Education 320 or equivalent.
- **570 Advanced Suzuki Pedagogy** (2) Study of psychological, pedagogical, and content aspects of Suzuki technique and practice in small groups. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.
- **580 Band Literature** (3) Band literature and origins of band; important developments in the band during the 20th century. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.
- **582 Instrumental Conducting Performance** (1-3) Performance of band and orchestra in public. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs.
- **584 Practicum for Instrumental Conductors** (1) Intern experience in choral music. S/NC only.
- **595 Instrumental Conducting Seminar** (3) Rehearsal and performance problems and techniques allied to score reading and preparation. Prereq: Consent of instructor. May be repeated. Maximum 3 hrs.

**Music Jazz**

**GRADUATE COURSES**

- **410 Advanced Improvisation** (3) Further development of individual skills and solving individual problems in jazz improvisation. Prereq: 210 and 220.
- **420 Jazz Pedagogy** (1-3) Methods and materials relating to teaching of jazz, designing and administering jazz programs, and rehearsal techniques for jazz ensembles. Prereq: Studio music and jazz major or consent of instructor.

**Music Keyboard**

**GRADUATE COURSES**

- **410 Early Keyboard Literature** (2) Keyboard music through baroque period, music for harpsichord. Prereq: Music History 210-20.
**Music Performance**

**GRADUATE COURSES**

All performance courses require an audition and consent of instructor. May be repeated. Maximum 8 hrs toward M.M. degree.

- 403 Flute (1-4)
- 405 Oboe (1-4)
- 410 Bassoon (1-4)
- 415 Clarinet (1-4)
- 420 Saxophone (1-4)
- 425 Horn (1-4)
- 430 Trumpet (1-4)
- 435 Trombone (1-4)
- 440 Baritone (1-4)
- 445 Tuba (1-4)
- 450 Percussion (1-4)
- 455 Voice (1-4)
- 460 Violin (1-4)
- 465 Viola (1-4)
- 470 Cello (1-4)
- 475 String Bass (1-4)
- 476 Electric Bass (1-4)
- 479 Guitar (1-4)
- 480 Piano (1-4)
- 485 Harpsichord (1-4)
- 490 Organ (1-4)
- 494 Composition (1-3)
- 495 Composition with Electronic Media (1-3)
- 496 Composition for Media (2)
- 499 Improvisation (1-2) May not be used toward applied music requirement.

- 503 Flute (1-4)
- 505 Oboe (1-4)
- 510 Bassoon (1-4)
- 515 Clarinet (1-4)
- 520 Saxophone (1-4)
- 525 Horn (1-4)
- 530 Trumpet (1-4)
- 535 Trombone (1-4)
- 540 Baritone (1-4)
- 545 Tuba (1-4)
- 550 Percussion (1-4)
- 551 Accompanying and Coaching (1-4)

## Music Ensemble

**GRADUATE COURSES**

- 501 Woodwind Choir (1) May be repeated.
- 503 Small Jazz Ensemble (1) May be repeated. Maximum 12 hrs.
- 504 Jazz Ensemble (1) May be repeated.
- 505 Studio Orchestra (1) May be repeated. Maximum 12 hrs.
- 506 Trombone Choir (1) May be repeated.
- 509 Tuba Ensemble (1) May be repeated.
- 510 Percussion Ensemble (1) May be repeated.
- 511 Marimba Choir (1) May be repeated.
- 512 Baroque Ensemble (1) May be repeated.
- 513 Synthesizer Ensemble (1) May be repeated.
- 514 Brass Choir (1) May be repeated.
- 515 Chamber Music Ensemble (1) May be repeated. Maximum 12 hrs.
- 520 UT Singers (1) May be repeated.
- 530 Chamber Singers (1) May be repeated.
- 532 Collegium (1) May be repeated.
- 534 Saxophone Choir (1) May be repeated.
- 540 Opera Theatre (1) May be repeated.
- 542 Opera Workshop (1) May be repeated.
- 550 Concert Band (1) May be repeated.
- 552 Campus Band (1) May be repeated.
- 554 Varsity Band (1) May be repeated.
- 556 Laboratory Band (1) May be repeated.
- 559 Marching Band (1) May be repeated.
- 570 Symphony Orchestra (1) May be repeated.

## Nuclear Engineering

**MAJOR**

DEGREES

Nuclear Engineering ....................... M.S., Ph.D.
Thomas W. Kerlin, Head

Professors:
- Dodds, H. L., Ph.D., Tennessee
- Kerlin, T. W., Ph.D., Tennessee
- Keshock, Edward G., Ph.D., Oklahoma State
- Mihalczo, J. T., Ph.D., Tennessee
- Pasqua, P. F. (Emeritus), PE, Northwestern
- Perez, R. B., Ph.D., Madrid
- Roland, H. C. (Emeritus), Ph.D., Tennessee
- Stavens, P. N., Ph.D., Northwestern
- Uckan, N. A., Ph.D., Michigan
- Uhrig, R. E. (Distinguished Prof.), Ph.D.
- Upadhyaya, B. R., Ph.D., California

Associate Professors:
- Katz, E. M., Ph.D., Tennessee
- Miller, L. F., Ph.D., Texas A&M
- Scott, T. H., Ph.D., Florida

Assistant Professor:
- Groer, P. G., Ph.D., Vienna

The Department of Nuclear Engineering offers programs leading to the Master of Science and Doctor of Philosophy degrees. Students may elect a traditional nuclear engineering M.S. or Ph.D. program (focusing on fusion energy or fusion energy) or a radiation protection engineering concentration at the Master's level.

The radiation protection engineering concentration prepares students for careers in the radiation safety field (health physics). The program is designed for graduates of undergraduate programs in engineering, physics, biology and chemistry.

A joint fusion energy program has been developed between the Nuclear Engineering and the Electrical and Computer Engineering Departments. Cross-listed courses from each department are used to satisfy degree requirements. Students may have the opportunity to do their research at the Fusion Energy Division of Oak Ridge National Laboratory or at the Plasma Science Laboratory, affiliated with the Electrical and Computer Engineering Department. A limited number of Graduate Research Assistantships are available at each location. Further information about this program is available from the department.

Students in the Nuclear Engineering Department have an opportunity to affiliate with the Measurement and Control Engineering Center and the Waste Management Research and Education Institute. These organizations provide unique research opportunities.

THE MASTER'S PROGRAM

A graduate program leading to the Master of Science is available to graduates of recognized undergraduate curricula in engineering and physics. Each applicant will be advised as to the necessary prerequisite courses before he/she enters the program.

The student must complete 24 semester hours of coursework approved by the student's advisory committee that includes the following:

1. A major consisting of a minimum of 12 semester hours of graduate courses in nuclear engineering. This must include at least one of the following two-semester sequences: 511, 512; 561, 562; 584, 571; 572.

2. A minor of 6 semester hours of elective courses in mathematics, statistics or computer science.

3. Six semester hours in either nuclear engineering or a related field.

The M.S. candidate must also demonstrate research or design capability. This requirement may be satisfied by preparing a thesis or participating in the nuclear engineering practice school, as described below.

**Thesis** - The student performs independent research on a topic approved by the graduate committee. He/she submits a thesis on this research. The student then must pass an oral examination on the thesis and all graduate coursework. The student must enroll for six semester hours of NE 500 (Thesis).

**Practice School** - The student addresses two to four separate research problems approved by his/her graduate committee. Each is similar to a thesis problem, but smaller in scope. The student must make an oral report and submit written reports on each project. He/she must pass an oral examination on practice school research and all graduate coursework. The student must enroll for sixteen semester hours of NE 598 (Nuclear Engineering Practice).

**THE DOCTORAL PROGRAM**

Students in the field of nuclear engineering desiring to study for the Doctor of Philosophy must have a Bachelor of Science or Master of Science from a recognized university, with a major in engineering or physics. All candidates will be required to demonstrate general competencies in a comprehensive examination in the areas of engineering science, mathematics, physics, and nuclear engineering.

Specific course requirements for the Ph.D. in Nuclear Engineering include:

1. A minimum of 48 semester hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.
2. A minimum of 24 semester hours in doctoral research.
3. A minimum of 30 semester hours in nuclear engineering courses numbered 500 and above (or the equivalent), with at least 9 semester hours of 600-level courses. These are exclusive of thesis or dissertation registration.
4. A minimum of 12 semester hours in mathematics, computer science, or statistics courses beyond nuclear engineering under-graduate requirements numbered 400 or above.
5. A minimum of 6 semester hours in courses numbered 500 or above from a department other than nuclear engineering. The choice depends on the student's overall program and should expand his/her knowledge in a given field.
6. A reading knowledge of one foreign language may be specified by the student's doctoral committee.

The comprehensive examination is prepared by the nuclear engineering faculty and consists of 12 hours of written examinations. All past examinations are filed in the library, and students are encouraged to review them. Students are invited to take the comprehensive examination after completing approximately 30 semester hours of coursework. A student who fails the written part of the examination must take and pass the examination the next time it is offered to remain in the Ph.D. program.

**GRADUATE COURSES**

- **Nuclear Reactor Theory (3)** Thermal and fast spectrum computational methods; homogeneous and heterogeneous media. Equations that relate thermal and neutronic variables, power distribution calculations, and reactivity control methods. Prereq: 302.
- **Nuclear Engineering Laboratory (3)** Cross-sectional density, critical loading experiment, control rod calibration, statistical weight, shielding, xenon poisoning, dynamics and controls experiments. Prereq: 304 or equivalent. Coreq: 401, 405 or equivalent.
- **Introduction to Nuclear Criticality Safety (3)** Fundamentals of nuclear criticality safety; criticality accidents; safety standards; overview of experiments, computational methods, and applications. Prereq: Introduction to nuclear engineering and nuclear reactor theory.
- **Fusion Energy (3)** Same as Electrical and Computer Engineering 463.
- **Fusion Energy II (3)** Same as Electrical and Computer Engineering 464.
- **Special Topics in Nuclear Engineering (3)** Problems related to recent developments and practice. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 6 hrs.
- **Thesis (1-15)** P/NP only. E

**Registration for Use of Facilities (3-15)** Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used
511-12 Transport Processes in Nuclear Engineering (3,3) Rheology of Newtonian and non-Newtonian fluids; integral and system conservation equations for single and multiphase transport; application of differential conservation equations for mass, energy, and momentum; exact and approximate solutions of equations of motion; single and multi-layer analysis; numerical analysis of fluid flow and heat transfer.

521 Nuclear Systems Dynamics and Control (3) Introduction to state variable methods for system dynamics and control analysis and application of these methods to nuclear plant dynamics, simulation and control problems.


541 Reactor Fuel Management (3) Topics relative to in-core fuel management. Applicable topics in reactor physics, fuel depletion, isotopic inventories, reactivity control and numerical methods. Prereq: 491.


543 Selected Topics in Nuclear Criticality Safety (3) Criticality safety principles, application of criticality experimental methods for enrichment, fabrication, storage, reprocessing, and transport applications; regulatory requirements; review of world's existing light and heavy water facilities in East Tennessee. Prereq: 421.

550 Nuclear Instrumentation (3) Physics and electronics associated with radiation detection, methods of data analysis, applicability of particular instrument measurement and fundamentals of nuclear instrumentation operation.

551 Radiation Protection (3) Interactions of photons, neutrons, beta particles, and heavy charged particles with matter and mechanisms of energy loss; methods of radiation detection, internal and external radiation dosimetry; chemical and biological effects of radiation; regulations and standards. Prereq: Introduction to Nuclear Engineering or equivalent.

552 Radiation Monitoring and Dose Assessment (3) Methods for work area and environmental monitoring; dose assessment; pathways analysis; risk projections and regulations. Prereq: 551.

561 Plasma Diagnostics (3) (Same as Electrical and Computer Engineering 561.)

562 Plasma Diagnostics II (3) (Same as Electrical and Computer Engineering 562.)

563 Plasma Engineering (3) Introduction of plasma physics models, fusion engineering design criteria, and fusion technology into design of future plasma experiments. Magnetic confinement, equations of motion, and energy balance equations. Simulation of various fusion reactor plasmas. Prereq: 464 or consent of instructor. (Same as Electrical and Computer Engineering 563.)

564 Fusion Technology (3) Engineering problems associated with fusion reactor design; vacuum and magnetic systems; materials and irradiation; plasma heating, fueling and impurity control; review of major design studies. Prereq: 563. (Same as Electrical and Computer Engineering 564.)


572 Reactor Theory and Design (3) Analytical and numerical techniques for neutronics modeling of nuclear systems. Multigroup cross section theory for homogeneously and heterogeneous systems. Selected topics from literature. Class project: solution of nuclear design problem. Prereq: 571 or equivalent.

575 Applied Artificial Intelligence (3) Symbolic methods for artificial intelligence systems with focus on application to engineering problems. Prereq: Consent of instructor. (Same as Engineering Science and Mechanics 575.)

576 Expert Systems in Engineering (3) Application of expert systems in engineering; logic and rationale, developing expert systems, programming, advanced topics. Prereq: 575 or consent of instructor. (Same as Engineering Science and Mechanics 576.)

577 Neural Networks in Engineering (3) Neural network technology for use in intelligent systems; rationale for neural computing, structure of neural computing systems, programming. Prereq: Consent of instructor. (Same as Engineering Science and Mechanics 577.)

581 Reactor Shielding (3) Application of analytic/deterministic solutions of Boltzmann transport equation to shield design problems. Spherical harmonics; moment methods, discrete ordinates, adjoint calculations, coupled analysis, and fast reactor shield design. Prereq: 526 or equivalent.


585 Process System Reliability and Safety (3) Qualitative and quantitative techniques for assessing and improving process systems reliability and safety. Fault tree analysis and associated dependent failure analysis. (Same as Chemical Engineering 585.)


589 Measurement Science II (3) Modern industrial measurement systems, advanced topics in measurement. Prereq: 586. (Same as Chemical Engineering 589, Civil Engineering 589, Electrical and Computer Engineering 589, Engineering Science and Mechanics 589, Mechanical Engineering 589, and Aerospace Engineering 589.)

597 Special Topics in Nuclear Engineering (3) Lectures and recitation on recent advances in nuclear engineering. Prereq: Consent of instructor. May be repeated with consent of department.

598 Nuclear Engineering Practice (3-6) Experience in solving and reporting on engineering problems. Prereq: Approval of department. May be repeated. Enrollment limited to alternative plan students. S/N/C only.

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

611-12 Selected Topics in Reactor Theory (3,3) Transport theory, control rod theory, stochastic methods. Selected topics from literature. Prereq. 572.

621 Selected Topics in Radiation Protection (3) Prereq: 521 or 552. May be repeated with consent of department.

651 Plasma Engineering II (3) Detailed modeling of plasma breakdown, start up, burn dynamics. Prereq. 564.

652 Special Topics in Fusion Engineering (3) Selected advanced topics in plasma engineering and fusion reactor engineering and technology. Prereq: 651.

653 Theory of Information Processing (3) Modern system theoretical methods for evaluating system performance from dynamic measurements. Prereq: 525 or equivalent.

671 Advanced Topics in Applied Artificial Intelligence (3) Recent advanced in engineering applications of artificial intelligence. Prereq: 527. (Same as Engineering Science and Mechanics 671.)

697 Special Topics in Nuclear Engineering (3) Investigation of new developments. Prereq: Consent of instructor.
4. Each student must present evidence of current CPR certification.
5. Non-registered nurse students must have completed 9 semester hours of chemistry or biology, a nutrition, microbiology and anatomy and physiology course, and 12 semester hours of behavioral science courses.

**Thesis and Non-Thesis Options**
The thesis option is available for interested students and is especially encouraged for those who are considering pursuit of doctoral degrees sometime in the future. Students who choose the non-thesis option must complete a research-oriented project while registered for 580 Nursing Project.

**Program Requirements**
All students must complete a minimum of 36 semester hours distributed as follows:

**Core (12 credits)**
- 503-04 Holistic Nursing
- 510 Theoretical Foundations of Nursing
- 520 Nursing Resource Management
- 521 Research (9-12 credits)
  - Graduate level statistics course
- 501 Nursing Research: Methods, Design, and Analysis
- 500 Thesis
- 580 Nursing Project
- 530-31 Adult Health Nursing I,II
- 540-41 Family Nurse Practitioner I,II
- 550-51 Parent-Child Nursing I,II
- 560-61 Mental Health Nursing I,II
- 590-91 Nursing Administration

**Concentration (12 credits)—choose one**
- 530-31 Adult Health Nursing I,II
- 540-41 Family Nurse Practitioner I,II
- 550-51 Parent-Child Nursing I,II
- 560-61 Mental Health Nursing I,II
- 590-91 Nursing Administration

**Elective (3 credits)—waived for those who choose thesis option**

Students who are not nurses must complete the following undergraduate nursing courses in addition to meeting the requirements listed above:

- 301 Pharmacology
- 302 Introduction to Professional Nursing
- 304 Nursing Assessment and Health Promotion
- 311 Acute Care Nursing
- 313 Nursing Research
- 414 Community Mental Health Nursing
- 415 Family/Community Health Nursing

Registered nurses whose undergraduate degrees are not in nursing must complete 304, 305, 313, 315 Clinical Nursing Practicum, and 403. They must also complete or successfully challenge the following:

- 301 Pharmacology
- 312 Acute Care Nursing Theory
- 402 Family Health Nursing Theory
- 412 Psychosocial Long Term Nursing Theory

Students whose science backgrounds are deficient may also need to take 214 Integrated Biomedical and Health Sciences and/or 450 Physiological Principles.

**Final Examination Requirements**
All students must successfully complete a final examination as required by The Graduate School. For thesis students, the examination will consist of an oral defense of the thesis as well as other written or oral questions designed to measure student mastery of the entire program of study. For non-thesis students, the written examination will cover the entire program of study and may, at the discretion of the student's committee, be followed by an oral examination.

**Special Policies**
1. If the clinical performance of any student for any course is found to be unsatisfactory, the student will receive a grade of "F" for the course.
2. If a student achieves a final grade of "D" or "F" for any required graduate course, he or she will not be permitted to repeat the course and will be required to withdraw from the program.
3. If the clinical performance of any student is characterized by unethical, unprofessional or unsafe behavior, or behavior that places the client in jeopardy, the student will be required to withdraw from the program.

**REQUIREMENTS FOR SECOND MASTER’S DEGREE**
1. Those who already hold a Master's or doctoral degree may apply up to 6 semester hours from that degree to meeting MSN program requirements. To apply these hours to the MSN degree, the following criteria must be met:
   a. The courses used must be relevant to the MSN.
   b. The credits must have been earned within the time limits established for the MSN.
   c. The use of these courses must be approved by the student's committee, by the Dean of the College, and by the Dean of The Graduate School.
2. Regardless of the specific courses transferred to reduce degree requirements, the following distribution of required nursing courses must be completed:

<table>
<thead>
<tr>
<th>Core</th>
<th>12</th>
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<tbody>
<tr>
<td>Concentration</td>
<td>12</td>
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<tr>
<td>Research</td>
<td>6</td>
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**THE DOCTORAL PROGRAM**
The College of Nursing offers a doctoral program leading to the Doctor of Philosophy degree with a major in Nursing. This is a cooperative program offered jointly with the University of Tennessee, Memphis College of Nursing. Students may complete all or part of the program at either site. The dissertation must be completed in its entirety at one site.

The doctoral program prepares nursing scholars capable of integrating research, theory, and practice into their roles as researchers, educators, and/or administrators. Specifically, the graduate of this program should be able to:

1. Analyze, test, refine, extend, and expand the theoretical basis of nursing practice.
2. Conduct nursing research that generates and advances nursing as a discipline.
3. Provide leadership as nurse researchers, educators, and/or administrators in current and emerging health care settings.
4. Collaborate with members of other disciplines in health-related research of mutual concern.
5. Analyze, develop, and recommend health care policy at various levels.

**Admission Requirements**
1. Meet requirements for admission to The Graduate School.
2. Hold a Master's degree in nursing from a program accredited by the National League for Nursing.
3. Have a minimum cumulative grade point average of 3.3 on a 4.0 scale.
4. Have a cumulative score of at least 1000 on the verbal and quantitative sections of the Graduate Record Examination.
5. Have successfully completed a basic statistics course.
6. Complete Graduate Program Data Form, College of Nursing.
7. Submit Graduate School Rating Forms from three college level instructors and/or nurses and administrators who have supervised applicant's professional work.
8. Have a personal interview with the College of Nursing Graduate Student Admission Committee.
9. Submit entire application (Graduate Application for Admission, 3 Graduate School Rating forms, Graduate Program Data form, academic transcripts, and GRE scores) and schedule personal interview by March 1st of the year preceding Fall admission.

**Program Requirements**
The following courses are required for all students:

| 601-2 Theory Construction and Analysis I,II | 6 |
| 602-4 Advanced Nursing Research I,II | 6 |
| 605-6 Nursing Research Seminar | 4 |
| 611 Advanced Nursing Seminar | 2 |
| 614 Nursing Preceptorship | 3 |
| Statistics | 6 |
| Computer Science | 6 |
| Electives | 12 |
| 600 Dissertation | 24 |
| TOTAL | 66 |

The electives should constitute a cognate area. All 12 hours should be selected from a specific area of concentration. Appropriate cognate areas are anthropology, child and family studies, clinical psychology, educational administration, educational psychology, management, medical ethics, public health, and social work.

**Doctoral Committee**
The student and major professor identify a committee composed of at least five faculty members who hold the rank of assistant professor or above, four of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. Two of the faculty members must be from an academic unit other than nursing. The committee should be formed during the student's first year of doctoral study.

**ACADEMIC COMMON MARKET**
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The Ph.D. program in Nursing is available to residents of the state of Alabama. Additional information may be obtained from the Residency
500 Thesis (1-15) P/NP only. E

501 Nursing Research: Methods, Design, and Analysis (3) Measurement and data analysis issues and their interrelationships in planning, implementation, and evaluation of nursing and health-related research. Investigation of various data analysis techniques. Prereq or coreq: Graduate level statistics course, 510, F, Sp, Su.

502 Registration for Use of Facilities (3-15) Required for registration of administrative, educational, or clinical use of facilities. Waived if student uses University facilities and/ or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S, N/C only.

503 Holistic Nursing: Wellness (3) Examination of philosophy of holistic nursing and new paradigms for nursing assessment, diagnosis, and intervention. Exploration and application of principles of health promotion, education, and innovative strategies for achievement of wellness. Roles of health habits, genetics, psychological factors, and culture in lifestyle diseases. F.

504 Holistic Nursing: Illness (3) Exploration, analysis, and application of principles of holistic nursing of clients with acute and chronic illnesses, mind-body influences and interactions. Prereq: Nursing Assessment and Wellness Promotion and Physiological Principles or equivalents. Prereq or coreq: 503. F.

505 Advanced Clinical Pharmacology (3) Pharmacological agents utilized to treat common, recurrent health problems; indications, contraindications, side and interactive effects of commonly prescribed drugs. Prereq: 501 or equivalent or consent of instructor. F.

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

510 Theoretical Foundations of Nursing (3) Historical evolution of nursing science; examination and critical analysis of nursing's metaparadigm and selected conceptual models, philosophies, and theories; contemporary ethical theories and application to nursing practice dilemmas. F, Sp, Su.

520 Nursing Resource Management (3) Selected organizational, conflict management, decision-making, leadership, professional, technological, and other theories, principles, and concepts applicable to advanced clinical nursing practice. Prereq or coreq: 503. F, Sp.

530 Adult Health Nursing I (6) Exploration and application of advanced nursing, physiological, developmental, and psychosocial theories to nursing care and management of clients and their families who are experiencing situations of acute or chronic illnesses and related crises; role of clinical nurse specialist in helping clients and families achieve optimal wellness. Prereq: 504, Prereq or coreq: 501, 520. 2 hrs and 4 labs. Sp.

531 Adult Health Nursing II (6) Further emphasis on role of clinical nurse specialist in providing and managing nursing care for acutely and chronically ill adults across life span; exploration, analysis, and application of selected advanced management, supervisory, organizational, and leadership theories; application of health related concepts and research to implementation of clinical nurse specialist role. Prereq: 530. 2 hrs and 4 labs. F.

533 Directed Study in Technical Nursing Education (3) Philosophy, history, and contemporary issues in technical nursing education and nursing practice issues for adult learner in community college; investigation of selected topics. Prereq: Graduate student or consent of instructor.


541 Family Nurse Practitioner II (6) Continuation of 540. Observe, participate, and practice issues in selected health problems in all developmental life stages; role refinement and exploration of major issues in delivering holistic primary nursing care; clinical experiences in variety of settings. Prereq or coreq: 540. 2 hrs and 4 labs.

550 Parent Child Nursing I (6) Exploration and application of selected advanced nursing, physiological, psychological, developmental, environmental, cultural, and other theories, principles, and concepts to child-bearing and child-rearing families in acute care or community settings; family wellness promotion and interventions designed to enhance wellness of all family members, parents, neonates, children, and adolescents. Prereq: 504. Prereq or coreq: 551, 520. 2 hrs and 4 labs.

551 Parent Child Nursing II (6) Continuation of 550. Seminar and clinical practicum designed to further development of specialized knowledge and skills used for advanced practice. Role refinement of clinical nurse practitioner in nursing management of women and/or child-bearing and child-rearing families in community, hospital, or other health care settings. Prereq. 550. 2 hrs and 4 labs. F.

552 Parent Child Nursing Field Work and Seminar (3) Seminar and intensive clinical practicum designed to further development of specialized knowledge and skills utilized for advanced parent-child nursing practice. Prereq or coreq: 551. 1 hr and 4 labs. Sp.

560 Mental Health Nursing I (6) Exploration and application of advanced theories of therapeutic nursing intervention to clients experiencing mental health problems. Options include: Options include: Psychiatric-mental health and psychiatric mental health problems, groups in acute care or community facilities. Prereq: 504, Prereq or coreq: 501, 520. 2 hrs and 4 labs.

561 Mental Health Nursing II (6) Continuation of 560. Groups and families with mental health problems. Seminar and clinical practicum designed to focus on advanced practice and development of specialized knowledge and skills. Prereq: 560. 2 hrs and 4 labs.

563 Teaching Strategies and Practicum (5) Exploration, analysis, and application of educational, curricular, teaching-learning, measurement, and evaluation principles and theories to instruction of undergraduate nursing students; teaching practicum in collegiate nursing program. Prereq or coreq: 531, 541, 551, or 561. 3 hrs and 2 labs.

577 Special Topics (1-3) Topic is determined by faculty and student interest. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. F, Sp.

580 Nursing Project (3) Research-oriented, student-initiated endeavor that culminates in scholarly paper suitable for publication and/or presentation; project may take form of development of innovative nursing intervention program, comprehensive literature review that reflects synthesis or comprehensive analysis, or other format approved by nursing faculty member. Required for all MSN candidates who select non-thesis option. Prereq: 501, 510, or 520. May be repeated. Maximum 6 hrs. F, Sp.

583 Directed Clinical Practice I (1-9) Additional opportunities for advanced nursing practice. Objectives to be developed collaboratively by student and faculty. Prereq: Enrollment in or completion of graduate level courses in clinical nursing. Maximum 9 hrs. S, N/C or letter grade E.

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

590 Nursing Administration I (6) Exploration, analysis, and application of selected organizational, management, and leadership theories and financial principles to delivery of nursing services. Structure, functions, organization, behavior, and adaptive process of health care organizations. Prereq: 504, Prereq or coreq: 501, 520. 2 hrs and 4 labs.

591 Nursing Administration II (6) Continuation of 590. Utilization of human and financial resources, conflict resolution, and organizational development with application to mid-level and top-level nursing administration positions. Prereq: 590. 2 hrs and 4 labs. F.

593 Independent Study (1-3) Prereq: Consent of instructor. Prereq or coreq: 501, 520. 1 hr and 4 labs. F.

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

601-02 Theory Construction and Analysis I, II (3, 3) Theory development; analysis of existing health and nursing theories; theory building from existing knowledge. Prereq: 503, 510, or consent of instructor. F, Sp.

603 Advanced Nursing Research I (3) Advanced concepts in research methodology and data analysis and interpretation. Quantitative nursing research. Prereq: 601. 6 hrs of graduate-level statistics.


612 Health and Nursing Policy/Planning (3) Policies affecting nursing education and practice; health policies and political processes; interactions between health professionals, consumer groups, and government in health policy development and health planning activities. Prereq: 611. F.


614 Nursing Preceptoryship (3) Individually-designed practicum, field, or internship experiences in administrative, educational, research, or clinical practice settings. Prereq: 612. Prereq or coreq: 613. Sp.
students may choose a concentration in nutrition science or public health nutrition. A graduate degree combined with an approved pre-professional practice experience (AP4) beyond the baccalaureate degree qualifies the graduate to apply for the Registration Examination to become a Registered Dietitian (R.D.). Students may request more information from the department about the AP4 program.

ADMISSION REQUIREMENTS
A final file for review includes the Graduate School application file, completed departmental application form, Graduate Record Examination (GRE) scores for the general section, and three Graduate School Rating Forms completed by individuals who can attest to the applicant's potential for graduate education. Forms may be obtained from the Graduate Office, 229 Jessie Harris Building, University of Tennessee, Knoxville, 37996-1900.

Admission into any of the graduate programs in the department is dependent on completion of undergraduate coursework that gives the necessary background for success in the graduate program. For programs in Nutrition, essential undergraduate courses include: general and organic chemistry, physiological chemistry, physiology, statistics and advanced nutrition. For the Master's program in Foodservice and Lodging Administration, undergraduate courses in foodservice and lodging administration, quantity food production, cost control, marketing, and personnel development are essential. Applicants to all programs with related work experience may be given preference.

THE MASTER'S PROGRAM
Students may choose a thesis or non-thesis option in Nutrition or Foodservice and Lodging Administration. Application for the Master's program must be made in writing to HRA 537 (Foodservice and Lodging Administration) or NTR 540 (Nutrition) required every semester.

Nutrition
Thesis Option: The program consists of a minimum of 33 hours with at least 16 hours of coursework in the department. NTR 511, 512, 540, 541 and 3 hours of graduate level statistics are required. Students in public health nutrition must take NTR 512, 513, 514, 515, 541 and the minor in public health. Six hours of Thesis 500, and 6 hours outside the department are required. A minimum of 22 hours at the 500 or 600 level is required.

An oral comprehensive examination is required upon completion of the thesis.

Non-Thesis Option: The program consists of a minimum of 36 hours with at least 20 hours of coursework in the department. HRA 537, 546, NTR 541 and 3 hours of graduate-level statistics are required. Six hours in one area outside the department are required. A minimum of 24 hours at the 500 and 600 level is required. A written comprehensive examination is required after completion of the program.

THE PH.D. CONCENTRATIONS
Nutrition Science
The nutrition science concentration enables students to develop expertise in one of the following areas: human nutrition, nutritional epidemiology, experimental nutrition, and human intermediary metabolism. Cognate areas may include anthropology, biochemistry, chemistry, communications, education, food technology, human development, physiology, public health, sociology, statistics, and/or toxicology.

Minimum requirements include:
1. Sixteen hours in nutrition including 4 hours at the 600 level (exclusive of dissertation);
2. NTR 511, 512, 541, and 2 hours from either NTR 542 or 543;
3. Three hours of graduate-level statistics.
4. Four hours of NTR 540, attendance required every semester;
5. Professional seminar, HE 610;
6. Six hours of statistics;
7. Six hours in a cognate area;
8. Nine hours at the 600 level;
9. Students without college teaching experience are required to take the fall semester teaching seminar (NTR 546) and NTR 548 comprising a faculty-supervised problem in college teaching.

Consumer Environments
Students enrolled in the Ph.D. program with a concentration in consumer environments are provided with a foundation of coursework relevant to understanding the consumer in the designed environment and the management of facilities. For the Master's program in Foodservice and Lodging Administration, coursework focuses on areas of specialization in foodservice systems and in lodging administration to further theory and the application of theory in the field. Further information, see consumer/environments concentration under Human Ecology.

ACADEMIC COMMON MARKET
An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs of the Graduate School of the University of Tennessee. The M.S. programs in Foodservice and Lodging Administration are available to students enrolled in these states of Arkansas, Kentucky, South Carolina, or West Virginia. The M.S. program in Nutrition is available to students of Arkansas, South Carolina, or Virginia. Additional information may be obtained from the Office of Graduate Admissions and Records. For the Ph.D., see Human Ecology.

Nutrition
GRADUATE COURSES
413 Experimental Food Science (3) Individual and group laboratory experimentation in food science; microcomputer applications. Prereq: Science of Food, Plant and Soil Science 471, 1 hr and 2 labs.
414 Nutrition-Diet Interactions (2) Nutrient effects on efficacy and toxicity of drugs; drug effects on absorption and metabolism of nutrients. Prereq: Fundamentals of Nutrition or equivalent, Sp.
500 Thesis (1-15) P/NP only E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only, E
508 Culture, Food, and Nutrition (3) Food-related behavior of individuals and groups in the United States. Sociology of food and food surveys, public policy. Prereq: Nutrition for Educators or Advanced Nutrition or consent of instructor. F
509 Graduate Seminar in Public Health (1) Same as Public Health 509, Nursing 509, Physical Education 509 and Social Work 509. Sp
511 Advanced Physiological Chemistry (4) Bioenergetics, flux control and hormonal interrelationships. Prereq: Advanced Nutrition or equivalent.
513 Community Nutrition I (3) Orientation to community; assessment of nutrition problems, needs, and resources; functional roles of public health nutritionist. Conc. field experiences. Prereq: Advanced Nutrition or consent of instructor. F
514 Community Nutrition II (3) Planning, implementation, and evaluation of public health nutrition programs. Conc. field experiences. Prereq: 513 or consent of instructor. Sp
515 Field Study in Community Nutrition (1-12) Personal participation in and analysis of state or regional community nutrition program. Location of in-depth study to be selected in consultation with instructor. Prereq: 513, 514 and consent of instructor. S/NC only. Sp
516 Maternal and Child Nutrition (3) Nutrition principles related to growth and development during pregnancy, infancy, and childhood to age 5, high risk conditions. Prereq: Advanced Nutrition or consent of instructor. F
517 Childhood and Adolescent Nutrition (3) Application of nutrition principles to school age children; effects of diseases on growth and health maintenance; nutritional assessment and counseling for nutrition. Prereq: Advanced Nutrition or consent of instructor. Sp
518 Nutrition and Aging (3) Nutritional problems of adults; nutritional requirements, dietary intakes; affects of nutrition on biological aging. Prereq: Advanced Nutrition or consent of instructor.
520 Nutritional Ecology (2) Examination of issues in natural, political, physical, and social environments that impact availability of food and nutrients in U.S. food supply. F
521 Physiological Basis for Diet and Disease (2) Altered nutrient needs as result of metabolic changes that occur in selected disease states. Prereq: Nutrition in Disease or consent of instructor.
522 Nutrition Counseling (2) Individual eating habits and disorders, evaluation strategies for effectiveness of helping process. Prereq: Nutrition in Disease or consent of instructor. F
523 Nutrition and Behavior (2) Influence of nutrients on intracerebral metabolic processes, electro-physiological indicators of brain function and behavior of individuals: sensory, motor, intellectual, and personality aspects. Prereq: Consent of instructor. Sp
526 Foodservice Technology (3) Principles of technology, human development, physiology, communications, etc. for the design and operation of a food service facility.
541 Field Study in Community Nutrition (1-12)"
524 Nutrition Education: Principles, Implementations, and Evaluation (3) Conceptual models, principles, application, and evaluation models in nutrition education. Prereq: 508 or consent of instructor. S, A

526 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course. Required of all students in training at Child Development Center, UT, Memphis. Supervised project in related area. Prereq: Consent of department head. E

527 Nutrition in Mental Retardation and Developmental Disabilities (1-9) Interdisciplinary diagnosis and treatment of developmentally-handicapped child; role of nutritionist; clinical experiences and lectures at Child Development Center, UT, Memphis. Prereq: Consent of department head. E

529 Management in Nutritional Care (2) Administrative roles and management functions of diétitians in clinical settings; program development, planning, and evaluation. Prereq: Foodservice Systems Administration, Food and Lodging Personnel Development, or consent of instructor. S

540 Seminar in Nutrition (1) May be repeated. S/NC only. E

541 Research Methods (1) Basic principles of planning, conducting, and interpreting nutrition and foodservice systems administration research. Prereq: 6 graduate hrs in nutrition and food system administration and statistics. Sp

542 Advanced Experimental Nutrition (2) Application of research principles to individual project using experimental animals. Prereq or coreq: 541. Sp

543 Human Metabolic Research Methods (2) Application of research principles to conducting and interpreting metabolic study. Prereq or coreq: 541. Sp

544 Food and Nutrition Survey Methods (2) Project for assessment of food consumption, nutrient intake, nutritional status, and sociocultural economic parameters in populations. Prereq or coreq: 541. Sp

547 Field Experience (3-9) Experience in food-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. E

548 Directed Study in Nutrition (1-3) Advanced study in nutrition. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

549 Special Topics (1-3) Recent advances in nutrition or food systems administration. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

602 Advanced Topics in Nutrition Science (1-3) Comprehensive individual study and group discussion of topics related to current problems in nutrition. Prereq: 512 or consent of instructor. May be repeated. F

603 Current Trends in Food and Sociocultural Change (2) Critical evaluation of research. Prereq: 508 or consent of instructor. F, A

Hotel and Restaurant Administration

GRADUATE COURSES

421 Foodservice Systems Design and Equipment (3) Physical facility design; production and delivery system analysis; equipment selection and purchase. Prereq: Quantity Food Procurement, Production and Service with lab or consent of instructor. F, A

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

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

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

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

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

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

534 Special Topics in Foodservice and Lodging Administration (1-3) Lecture/discussion format. Contemporary developments and trends in industry. Prereq: Consent of instructor. May be repeated. E

535 Directed Study in Foodservice and Lodging Administration (1-3) Problems selected for study by student with guidance of faculty member. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

537 Seminar in Foodservice and Lodging Administration (1) May be repeated. S/NC only. Sp

542 Advanced Hotel Administration (3) Strategic management of hotel organizations. Theoretical and applied literature on formulation and implementation of strategy: external and internal factors relevant for business and corporate level decisions. Consideration of role of marketing in hotel firms. Analysis of industry and case studies. Prereq: 531, 532.

544 Experimental Study of Quantity Food Production (3) Design and preparation of food products applicable to foodservice industry. Market research, sensory evaluation, production techniques, and microbiological evaluation of food. Prereq: Quantity Food Procurement, Production and Service with lab, Observation, Hospitality Sales and Marketing, 542 and Nutrition 413, or equivalents.

546 Foodservice and Lodging Administration Research Methods (2) Application of research methods to foodservice and lodging. Prereq or coreq: Nutrition 541. Sp

547 Field Experience (3-9) Experience in food- or lodging-related industry or agency under supervision of faculty member. Prereq: Consent of instructor. S/NC only. E

555 Foodservice and Lodging Law (3) Management organization and policy as imposed or granted by law. Legal research to determine legal principles at state and federal levels which impact industry. Prereq: Hospitality Law or equivalent, or consent of instructor.

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

610 Advanced Topics in Lodging Administration (1-3) Individual study and group discussion of topics related to current problems. Prereq: 542 or consent of instructor.

620 Advanced Topics in Foodservice Administration (1-3) Individual study and group discussion of topics related to current problems. Prereq: 533 or consent of instructor.

Ornamental Horticulture and Landscape Design

Ornamental Horticulture and Landscape Design

MAJOR

Ornamental Horticulture and Landscape Design

G.Douglas Crater, Head

Professors:

Gailahan, L. M., Ph.D. Rutgers
Crater, G. Douglas, Ph.D. Ohio State
Graham, E. T., Ph.D. Penn State
Gresshoff, Peter M. (Racheff Chair of Excellence), Ph.D. Australian National
McDaniel, G. L., Ph.D. Iowa State
Williams, Don B., Ph.D. Penn State

Associate Professors:

Day, J. W., Ph.D. Mississippi State
Witte, Willard T., Ph.D. Maryland

Assistant Professors:

Augé, Robert M. Ph.D. Washington State
Rogers, S. M. M. LA. Georgia
Trigiano, R., Ph.D. NC State

The Department of Ornamental Horticulture and Landscape Design offers the Master of Science with concentrations in floricultural science and technology, nursery science and technology, turfgrass science and technology. Various interests may be emphasized in any of these commodity areas, including micropropagation, innovative production and maintenance systems, computer-aided management systems, and the molecular biology, genetics, histology and stress physiology of ornamentals. For admission, the student must have a B.S. in ornamental horticulture, horticulture, plant science, or a related agricultural or basic science discipline. Undergraduate transcripts must be evaluated by the department for prerequisite requirements, if any. Graduate research assistantships are available on a competitive basis. For further information, contact the department head.

THE MASTER'S PROGRAM

Thesis Option

1. A thesis is required. A Master's committee of no fewer than 3 faculty members will be selected. Prior to research for the thesis, a proposal must be approved by the Master's committee. Registration for 6 hours of Thesis 500 is required.

2. In addition to the thesis requirement, a minimum of 24 hours of graduate credit is required. Not more than 10 hours of the minimum 30 hours can be below the 500 level. The academic program must be approved by the Master's committee which may require additional course work if the student's progress or background indicates such need.
3. All students are required to include 510 Research Methods and 2 hours of 590 Seminar in their program and are expected to attend this course and participate in discussions each semester enrolled.

4. Twelve hours of coursework in the department must be at the 500 level or above exclusive of Thesis 500.

5. An oral examination covering the thesis and coursework is required.

Non-Thesis Option
1. A Master's committee of no fewer than 3 faculty members will be selected.
2. Thirty-four hours of graduate coursework are required of which 22 hours must be at the 500 level or above.
3. All students are required to include 2 hours of 590 Seminar in their program and are expected to attend this course and participate in discussions each semester enrolled.

4. Twelve hours of coursework in the department must be at the 500 level or above.

5. Final examinations written and oral examinations shall be taken upon completion of no fewer than 32 hours of approved graduate work.

GRADUATE COURSES

410 Nursery Management and Production (3) Modern management methods as applied to retail and wholesale nurseries and landscape contracting firms. Methods of producing liners, container and field-grown woody ornamental plants. Prereq: 220, 330, 490 and Botany 321, or consent of instructor. 2 hrs and 1 lab. Sp, A

440 Advanced Turfgrass Management (4) Principles and scientific basis of turfgrass culture; adaptation, ecology, physiology, soil fertility, and grass nutrition. Climatic influences on grass culture; physiology of clipping and water management; design, construction, and management of golf courses; and physiological influences of pest infestation and control measures. Prereq: 340 or consent of instructor. 3 hrs and 1 lab. Sp

450 Professional Practices in Landscape Construction and Management (2) Professionalism, salesmanship, proposals, bidding, estimating, specification, and contract management in landscape services industry. Interaction with industry representatives through special presentations. Prereq: 350 or consent of instructor. F

480 Advanced Landscape Design (4) Comprehensive application of landscape design skills. Design applications involving site layout, landscape grading, applied landscape construction, planting design, analysis, programming, design, detailing, estimating, and specifying applicable to a variety of landscape projects. Prereq: 280, 350, and 380, or consent of instructor. 1 hr and 2-3 hrs labs. Sp

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

501 Special Topics in Ornamental Horticulture and Landscape Design (1-3) Topics to be assigned. May be repeated. Maximum 8 hrs. Prereq: Consent of instructor. E

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

503 Comparative Pathology (3) Pathogenic mechanisms. Comparative aspects. Study of gross, microscopic and ultrastructural lesions. Prereq: Histology. 2 hrs and 1 lab. Sp, A

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

501 Advanced Topics in Pathobiology (1-3) Neoplasia, histopathology, clinical pathology, clinical parasitology, clinical immunology, clinical bacteriology and mycology, and clinical virology. May be repeated. Maximum 8 hrs. E, A

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

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

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

505 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar term enrolled. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. Class meets once monthly. E

506 Ultrastructural Pathology (1) Ultrastructural changes in diseased cells. Interpretation of observations. Prereq: Professional medical degree or consent of instructor. F, A

507 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (2) Advanced study of virus diseases important to domestic animals: virus biology, pathogenesis, pathology and diagnosis Technical training in viral diseases diagnosis. Prereq: Cellular and Comparative Biochemistry, and Advanced Topics in Biochemistry, Virology, and Virology Lab, or Microbiology-Veterinary Medicine 611-612. 2 hrs and 1 lab. Sp, A

508 Techniques in Pathology (2) Fixation, processing and staining of tissue specimens; specialized gross dissection techniques; photography of gross specimens and photomicrography. Prereq: Consent of instructor. F, A

509 Principles of Pathology (4) Advanced topics in pathology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, heredity. Principal biochemical and morphologic responses of various cells, tissues, and organs to injury and other metabolic derangements. Participants present seminars on selected topics from current literature and textbooks. Prereq: Consent of instructor. F, A

Residents:

Bouley, D., D.V.M. ........................................ Tennessee
Dean, D. F. D.V.M. ........................................ Tennessee
Donnell, R., D.V.M. ........................................ Tennessee
Dunbar, R. B., D.V.M. ...................................... Ohio State
Silva-Krott, I., B.V.Sc. ..................................... Austria

See Veterinary Medicine for Program Description.

GRADUATE COURSES

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

501 Special Topics in Pathobiology (1-2) May be repeated. Maximum 6 hrs. E

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

503 Comparative Pathology (3) Pathogenic mechanisms. Comparative aspects. Study of gross, microscopic and ultrastructural lesions. Prereq: Histology. 2 hrs and 1 lab. Sp, A

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

501 Advanced Topics in Pathobiology (1-3) Neoplasia, histopathology, clinical pathology, clinical parasitology, clinical immunology, clinical bacteriology and mycology, and clinical virology. May be repeated. Maximum 8 hrs. E, A

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

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

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

505 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar term enrolled. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. Class meets once monthly. E

506 Ultrastructural Pathology (1) Ultrastructural changes in diseased cells. Interpretation of observations. Prereq: Professional medical degree or consent of instructor. F, A

507 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (2) Advanced study of virus diseases important to domestic animals: virus biology, pathogenesis, pathology and diagnosis Technical training in viral diseases diagnosis. Prereq: Cellular and Comparative Biochemistry, and Advanced Topics in Biochemistry, Virology, and Virology Lab, or Microbiology-Veterinary Medicine 611-612. 2 hrs and 1 lab. Sp, A

508 Techniques in Pathology (2) Fixation, processing and staining of tissue specimens; specialized gross dissection techniques; photography of gross specimens and photomicrography. Prereq: Consent of instructor. F, A

509 Principles of Pathology (4) Advanced topics in pathology and mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, heredity. Principal biochemical and morphologic responses of various cells, tissues, and organs to injury and other metabolic derangements. Participants present seminars on selected topics from current literature and textbooks. Prereq: Consent of instructor. F, A

Residents:

Bouley, D., D.V.M. ........................................ Tennessee
Dean, D. F. D.V.M. ........................................ Tennessee
Donnell, R., D.V.M. ........................................ Tennessee
Dunbar, R. B., D.V.M. ...................................... Ohio State
Silva-Krott, I., B.V.Sc. ..................................... Austria

See Veterinary Medicine for Program Description.
Philosophy
(College of Liberal Arts)

MAJOR DEGREES

Philosophy .................................................. M.A., Ph.D.

George G. Brenkert, Head

Professors:

Aquila, Richard E., Ph.D. .................................. Northwestern
Brenkert, George G., Ph.D. .................................. Michigan
Cebik, L. B., Ph.D. ........................................... Nebraska
Davis, John W., Ph.D. ........................................ Emory
Edwards, Rem B., Ph.D. ...................................... Emory
Graber, Glenn C., Ph.D. ...................................... Michigan
Postow, Beisly C., Ph.D. ..................................... Yale
Van de Vate, Dwight, Jr., Ph.D. ............................ Yale

Associate Professors:

Bennett, James O., Ph.D. ...................................... Tulane
Cohen, Sheldon M., Ph.D. ..................................... Northwestern
Bohstedt, Kathleen Emmett, Ph.D. ....................... Ohio State
Lavin, Michael, Ph.D. ........................................ Stanford
Nott, John E., Ph.D. .......................................... Ohio State
Osborne, Martha Lee, Ph.D. ................................ Tennessee

Assistant Professor:

Hamlin, H. Phillips, Ph.D. .................................... Georgia

The Department of Philosophy offers graduate study leading to the Master of Arts and Doctor of Philosophy. The M.A. program includes thesis and non-thesis options and offers concentrations in medical ethics and in religious studies. The Ph.D. program also has a concentration in medical ethics. Detailed information may be obtained from the Director of Graduate Studies in Philosophy.

THE MASTER’S PROGRAM

The department offers both a thesis and a non-thesis option. The course requirements for an M.A. with thesis are 30 hours, including 8 hours in Philosophy 500. Of non-thesis hours, at least two-thirds must be in courses at or above the 500 level. No philosophy course numbered under 400 may be taken for graduate credit. There are no particular courses that M.A. students are required to take. The nature of the student’s coursework should be determined in consultation with the student’s faculty committee. The non-thesis M.A. requires 30 hours of coursework of which at least two-thirds must be in courses at or above the 500 level. Students seeking the non-thesis option must also pass a final written examination on all work offered for credit. An additional oral examination may be required.

THE DOCTORAL PROGRAM

Specific requirements for doctoral students in Philosophy include a minimum of three academic years of graduate study involving at least 48 semester hours in coursework (normally 16 semester courses or their equivalent, exclusive of credit for thesis and dissertation) of which no fewer than 30 hours shall be in courses numbered over 500 and no fewer than 6 hours shall be in courses numbered over 800. The specific number and distribution of courses will be determined by the student’s faculty committee.

Students must demonstrate a reading knowledge of one foreign language, normally a living language in which there exists a significant body of philosophical literature. (In special circumstances relating to the area of dissertation research, the Graduate Committee may approve a language not satisfying these conditions.) This may be done by passing the doctoral language examination given by the appropriate department, if available, or by passing French 302 or German 332 with a B or better. Bi- or multilingual (normally, foreign) students, whose native language (other than English) is one in which there is a significant body of philosophical literature, are exempted from the foreign language requirement. Students receiving the Ph.D. with concentration in medical ethics are also exempted.

CONCENTRATIONS

Medical Ethics
The department has an M.A. and Ph.D. program of graduate study with a concentration in medical ethics. Detailed information concerning the program may be obtained from either the Director of Graduate Studies in Philosophy or the Director of the Medical Ethics Program.

Religious Studies
The department has an M.A. program of graduate study with a concentration in religious studies. Details concerning the program may be obtained from either the Director of Graduate Studies in Philosophy or the Department of Religious Studies.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.A. and Ph.D. programs in Philosophy are available to residents of the states of Alabama, Kentucky, Maryland, Texas, Virginia, or West Virginia; and the Ph.D. program to residents of Arkansas, Louisiana, or Mississippi. Additional information may be obtained from the Residency Assistant in the Office of Graduate Admissions and Records.

GRADUATE COURSES

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

411 Modern Religious Philosophies (3) (Same as Religious Studies 411.)

412 Classical Indian Systems of Philosophy: The Moksha Tradition (3) (Same as Religious Studies 412.)

420 Topics in History of Philosophy (3) Figures or movements from antiquity through mid-twentieth century. Prereq: 6 hrs of philosophy or consent of instructor. May be repeated when topic varies. Maximum 9 hrs.

425 American Philosophy (3) Colonial to early 20th Century. Prereq: 6 hrs of philosophy or consent of instructor.

430 Topics in Logic (3) Prereq: 6 hrs of logic or consent of instructor. May be repeated when topic varies. Maximum 6 hrs.

440 Contemporary Ethical Theory (3) Topics in metaethics or ethics. Prereq: 6 hrs of philosophy or consent of instructor.

446 Theoretical Issues in Medical Ethics (3) Prereq: 240 or 345 or consent of instructor. (Same as Religious Studies 446.)

460 Philosophy of Science (3) Methodological and conceptual issues in natural and social sciences. Patterns of theory modification and replacement, nature of explanation and causation, status of discovery. Prereq: 360 and 1 yr of natural or social science, or consent of instructor.

465 Philosophy of History (3) Speculative and critical aspects of philosophy of history. Prereq: 6 hrs of philosophy or consent of instructor.

473 Philosophy of Mind (3) Problems of mind and body in relation to consciousness and personal identity. Prereq: 6 hrs of philosophy or consent of instructor.

475 Analytic Metaphysics and Epistemology (3) Topics in metaphysics and epistemology in recent Anglo-American tradition. Prereq: 6 hrs of philosophy or consent of instructor.

476 Philosophy of Language (3) Survey of issues such as meaning, reference, and truth. Prereq: 6 hrs of philosophy or consent of instructor.

479 Studies in Recent Continental Philosophy (3) Selected thinkers or topics: existentialism, phenomenology, hermeneutics, structuralism, post-struc-turalism. May be repeated when topic varies. Maximum 6 hrs.

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

502 Registration for Use of Facilities (3-15) Required for independent study not regularly 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 Topics in the History of Ancient and Medieval Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

522 Topics in the History of Modern Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

524 Topics in the History of Twentieth-Century European Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

527 Topics in the History of American Philosophy (3) Intensive critical work on major philosopher or school. May be repeated. Maximum 9 hrs.

530 Topics in Logic and Philosophy of Mathematics (3) May be repeated. Maximum 9 hrs.

540 Topics in Value Theory (3) May be repeated. Maximum 9 hrs.

542 Ethics (3) Dominant movements in history of ethics. May be repeated. Maximum 9 hrs.

544 Applied Ethical Theory (3) Single author, tradition, or topic in ethical theory. Application to issues in health, business, technology, ecology, and other practical fields. May be repeated. Maximum 9 hrs. (Same as Religious Studies 544.)

545 Orientation to Medical Ethics (3) Survey of ethical theories in application to issues in medical ethics. Prereq: Consent of Medical Ethics Committee.

547 Clinical Medical Ethics (3) Medical terminology, history of medical ethics, case study discussion, clinical observation. Open only to students concentrating in medical ethics. May be repeated. Maximum 4 hrs. S/NC or letter grade.

548 Clinical Residency in Medical Ethics (3-12) Open only to students concentrating in medical ethics. Prereq: Consent of Medical Ethics Committee. May be repeated. Maximum 20 hrs. S/NC only.

553 Philosophical Topics in Literature and the Arts (3) Aesthetics, criticism, art and society. May be repeated. Maximum 9 hrs.

556 Philosophy of Natural Sciences (3) Nature of subject matter and method of science. May be repeated. Maximum 9 hrs.


570 Philosophy of Religion (3) Examination of central problems. (Same as Religious Studies 570.)
Physics and Astronomy  
(Conce of Liberal Arts) 

MAJOR

Physics

MAJOR DEGREES

William M. Bugg, Head

Professors:

Bingham, C. R., Ph.D. .............................................. Tennessee
Bliss, E. W., Ph.D. .................................................. Michigan State
Bottcher, C., Ph.D. ................................................. Belfast
Breazeale, M. A. (On Leave), Ph.D. ......................... Michigan State
Bugg, W. M., Ph.D. .................................................. Tennessee
Burgdörfer, J., Ph.D. .............................................. Freie Universität Berlin
Callcott, T. A., Ph.D. .............................................. Purdue
Childers, R. W., Ph.D. ............................................ Vanderbilt
Christophorou, L. G., Ph.D. ..................................... Manchester
Close, F. E. (Distinguished Scientist) (On Leave), Ph.D. ..... Michigan State
Colglazier, E. W., Ph.D. .......................................... Cal Tech
Collins, T. C., Ph.D. ............................................... Florida
Condo, G. T., Ph.D. ............................................... Illinois
Cramer, H. W. (UTSI), Ph.D. .................................... Yale
Davey, W. E. (Emeritus), Ph.D. ................................ Ohio State
Duckett, K. E., Ph.D. ................................................... Tennessee
Foer, K. D., Ph.D. ..................................................... Tennessee
Gallar, N. M. (Emeritus), Ph.D. .................................. Michigan State
Georgiou, S., Ph.D. ................................................. Manchester
Guidry, M. W., Ph.D. .................................................. Tennessee
Harris, E. G. (Distinguished Prof.), Ph.D. .................... Tennessee
Hart, E. L., Ph.D. ................................................... Cornell
Jacobson, H. C., Ph.D. ............................................. Yale

King, D. T. (Emeritus), Ph.D. .................................... Bristol
Lewis, J. W. L. (UTSI), Ph.D. ................................... Mississippi
Lovell, R. J. (Emeritus), Ph.D. ..................................... Vanderbilt
Macek, J. (Distinguished Scientist), Ph.D. ................. Rensselaer
Mahan, G. D. (Distinguished Scientist), Ph.D. ............ California
Mason, A. A. (UTSI), Ph.D. ...................................... Tennessee
McGregor, W. K. (UTSI), Ph.D. .................................. Tennessee
Nielsen, A. H. (Emeritus), Ph.D. .................................. Michigan
Obenshan, F. E., Jr., Ph.D. ........................................... Pittsburgh
Painter, L. R., Ph.D. ............................................... New Hampshire
Quinn, J. J., Ph.D. ................................................... Maryland
Riedinger, L. L., Ph.D. ............................................ Vanderbilt
Ritchie, R. H., Ph.D. .............................................. Pennsylvania
Rusk, W. R. (Emeritus), M.S. ...................................... Tennessee
Selin, I. A. (Chancellor's Research Scholar), Ph.D. .......... Chicago
Shih, C. C., Ph.D. .................................................. Cornell
Stelson, P. H., Ph.D. ................................................. MIT
Strayer, M. R., Ph.D. ................................................. MIT
Thompson, J. R., Ph.D. ............................................. Duke
Thomson, J. O., Ph.D. .............................................. Illinois
Ward, B. F. L., Ph.D. .............................................. Princeton
Wheeler, G. W. (Emeritus), Ph.D. ................................ Yale
White, J. W. (Emeritus), Ph.D. .................................. North Carolina

Assistants:

Breinig, M., Ph.D. .................................................. Oregon
Elston, S. B., Ph.D. .................................................. MIT
Ferrell, T., Ph.D. ..................................................... Clemson
Handler, T. H., Ph.D. .............................................. Rutgers
Lide, R. W., Ph.D. .................................................. Michigan
Muehlauser, J. W. (UTSI), Ph.D. .................................. Tennessee
Shieh, S. Y., Ph.D. ................................................... Maryland
Sorensen, P. S., Ph.D. .............................................. Copenhagen

Research Associate Professors:

Du, Yuan-Cai, Ph.D. ............................................... Beijing
McCorrild, D. L., Ph.D. ............................................ Tennessee

Research Assistant Professors:

Davis, L. (UTSI), Ph.D. .......................................... Auckland
Faidas, H., Ph.D. ................................................... Tennessee
Warmack, R. J., Ph.D. ............................................ Tennessee

Lecturers:

Fairman, R. C., B.A. .............................................. Earlham
Riedinger, T., M.S. .................................................. Vanderbilt

Graduate programs leading to the Master of Science and the Doctor of Philosophy are offered in a number of concentration areas:

Atomic and low temperature physics, biophysics, chemical physics, elementary particle physics, health physics, heavy ion atomic physics, molecular spectroscopy, nuclear physics, plasma physics, condensed matter physics, theoretical physics, and ultrasonics.

Non-Thesis Option

This program is designed primarily for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking the non-thesis option must apply to the department's graduate committee for permission to enroll under this program. The requirements are the same as the thesis option, except for the completion of 30 hours of coursework composed of 18 semester hours from Physics 511-12, 521-22, 531-32, 541-42, and 571-72; 6 semester hours in a minor field; and 6 semester hours from other courses numbered above 400 (preferably of advanced laboratory nature). At least 20 hours must be taken at the 500 level or above. In addition, the candidate must pass a written examination administered by the department head.

DOCTORAL PROGRAM

All students are expected to take Physics 521-22, 531-42, 551, 561, 571-72, and 611. Physics 601-62 are normally required of students specializing in atomic physics; Physics 621-22 of students in nuclear physics; Physics 626-27 of students in elementary particle physics; Physics 663-64 of students in plasma physics; Physics 661-62 of students in health physics; Physics 671-72 of students in solid state physics; and Physics 881-82 of students specializing in molecular spectroscopy. Students specializing in chemical physics may...
Astronomy
GRADUATE COURSES

411 Astrophysics (3) Development of analytical physical models of galactic structure of universe, stellar and interstellar matter, and planetary systems. Topical and interdisciplinary coverage of quasars, pulsars, black holes and current developments in field. Acceptable for major credit in physics. Prerequisite: Physics 232 and consent of instructor.

490 Special Topics in Astronomy (1-3) Topics of current interest in astronomy and astrophysics. Acceptable for graduate credit in physics with consent of department. May be repeated with consent of department. Maximum 9 hrs.

Physics
GRADUATE COURSES

402 Forefront of Physics (2) Survey of modern developments in physics: various forms of quantum mechanics, quantum electrodynamics and recent theories of particles, fields and their interactions. Discussion of unsolved questions in physics, experiments of current interest, readings in recent literature, and applications in other fields with final oral report and term paper. Recommended for beginning graduate students. Prerequisite: 401 or consent of instructor.

411-12 Introduction to Quantum Mechanics (3,3) Fundamental principles of quantum mechanics and methods of calculation. Solution of Schrodinger equation for simple systems. Application to atomic, molecular, nuclear, and condensed matter physics. Must be taken in sequence. Prerequisite: 232 or equivalent. Mathematics 435.

421 Modern Optics (4) Transmission of light in uniform, isotropic media; reflection and transmission at inter- faces; mathematics of wave motion and interference effects. Rudiments of Fourier optics and holography. Prerequisite: 431 or 232 and consent of instructor. 3 hrs and 3 labs.

425 Principles of Nondestructive Testing (3) (Same as Engineering Science and Mechanics 425.)

431-32 Electricity and Magnetism (3,3) Electrostatics, magnetostatics, coupled electric and magnetic fields, Maxwell's Equations, electromagnetic waves and radiation. Prerequisite: 232.


461-62-63 Modern Physics Laboratory (3,3,3) Experimental techniques: spectroscopy, electron beam, x-rays, gammas, resonance detectors and statistical analysis, applied to experiments in nuclear, atomic, and molecular systems. Classical experiments in quantum physics for advanced undergraduates, and more modern experiments useful for entering graduate students. Prerequisite: 232 and basic knowledge of circuits.

471-72 Health Physics (3,3) Radioactivity, interaction of electromagnetic radiation with matter, radiation quantities and units, point kernel and extended sources, x-rays and gamma rays, neutron activation, interaction of charged particles with matter, stopping power, range-energy relations, counting statistics, shielding, dosimetry, waste disposal, critically preirradiation, radiation biology and ecology. Prerequisite: 340 or 341.

490 Senior Seminar (1-3) Topic of current interest. May be repeated with consent of department. Maximum 6 hrs.

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

501 Graduate Research Participation (3) Advanced research techniques under supervision of staff research director whose research area coincides with interests of student. Open to all graduate students in good standing. Prerequisite: Consent of department and research director. May be repeated with consent of department. Maximum 6 hrs. S/NC only: E

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

505 Physics of Fluids (3) Fluid physics, overview of fluid mechanics and associated computational techniques; general description of laminar and turbulent flows; subsonic, supersonic and hypersonic flows; continuum, transitional and free-molecular flows; pipe flow, nozzle flow and sonic orifice expansion flows; reacting and nonreacting flows; shock-tube physics; and an introduction to the method of characteristics and Monte Carlo computational techniques.

506 Experimental Methods (3) Principles, real operational behavior, and hazards of laser types, radiation detectors, photomultiplier tubes, image intensifiers, image converters, image dissectors, streak cameras, and fast framing cameras; high vacuum systems including cryogenic-based devices, data acquisition techniques including synchronous detection, digital electronics methods and micro-computer data acquisition and registration methods.

507 Contemporary Optics (3) Topics in geometrical, physical, Fourier, and nonlinear optics and introductory laser physics. Methods of calculation and design of practical and sophisticated optical systems.

508 Laser Physics (3) Mode analysis, stable and unstable resonators, cavity construction, Q-switching, temperature stabilization; specific laser types: semiconductor and gas lasers; coherence; mode-locking, Q-switching and frequency stabilization; quantum theory of laser, photon coherence and nonlinearity; laser stability; quantum theory of laser, photon coherence and nonlinearity; laser stability; quantum theory of laser, photon coherence and nonlinearity; laser stability; quantum theory of laser, photon coherence and nonlinearity; laser stability; quantum theory of laser, photon coherence and nonlinearity; laser stability; quantum theory of laser, photon coherence and nonlinearity; laser stability.

511-12 Theoretical Physics (3,3) Classical theoretical physics, with limited use of mathematics. Prerequisites: 312, 432, advanced calculus, differential equations, and vector analysis.

521-22 Quantum Mechanics (3,3) Fundamental principles of quantum mechanics, free particle, harmonic oscillator, hydrodynamic, quantum mechanics on a rotating frame, many-particle systems, Bessel functions, atomic physics, the quantum theory of angular momentum, electron spin, particles in electric and magnetic fields, perturbation theory, variational methods, scattering theory. Application of quantum mechanics to quantum systems of atoms, molecules, nuclear, and solid state physics. Prerequisites: 521, 531, 571. For prerequisite: 522, 521, 572.

531 Classical Mechanics (3) Classical particle dynamics. Lagrange's equations, Hamiltonian and canonical equations of motion, curvilinear coordinate systems, normal coordinates, rigid body motions. Prerequisite: 311.

532 Advanced Classical Mechanics (3) Variational principles, conservation laws, the wave function, quantum mechanics, nonrelativistic mechanics, fluid mechanics. Prerequisite: 531.


551 Statistical Mechanics (3) Ergodic theorem, classical ensemble theory, quantum mechanical ensembles, relation of statistical mechanics to thermodynamics, transport theory and approach to equilibrium, phase transition, fluctuations and correlations. Prerequisites: 521, 531, 571-72. Prerequisite or corequisite: 522.

551-72 Mathematical Methods in Physics (3,3) Linear vector spaces, matrices, tensors, curvilinear coordinates, functions of a complex variable, partial differential equations and boundary value problems, Green's functions, integral transforms, use of computational schemes, spherical harmonics, Bessel functions, calculus of variations. Prerequisite: Advanced calculus and differential equations. May be taken in sequence. (Same as Mathematics 517-18.)

573 Numerical Methods in Physics (3) Numerical methods for solution of physical problems, use of digital computers, analysis of errors. Prerequisite: 571-72 or consent of instructor.

574-75 Group Theory for Physicists (3,3) Introduction to abstract group theory, discrete and continuous groups, representation theory. Noether's theorem, symmetries and degeneracies, application of group theoretical methods to atomic physics, solid-state physics, and particle physics. Prerequisite: 571-72.

591 Foreign Study (1-18) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

594 Special Problems (3) Especially assigned theoretical or experimental work on problems not covered in other courses. May be repeated. Maximum 9 hrs. E


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


605 Laser Spectroscopy (3) Application of lasers to spectroscopy of atomic and molecular systems; review of classical multiple-pole radiation, atomic L-S and J-J coupling and Zeeman effects, spontaneous emission of atomic systems and oscillator strengths, stimulated emission with cavity formation, stimulated Raman processes, two- and multi-photon processes, quantum theory of atomic systems, quantum mechanical and classical approaches to laser operation and formation of spectral lines. Study of saturated absorption spectroscopy, resonance fluorescence, dye lasers, semiconductor lasers. Laser effects; coherent and double resonance, optical pumping and hyperfine spectroscopy. Prerequisite: 521, 541, 508.

606-07 Nonlinear Optics (3,3) Nonlinear optical susceptibilities, wave propagation in nonlinear media, sum frequency and difference frequency generation, harmonic generation, parametric amplification and oscillation, stimulated Raman processes, two- and multi-photon processes, four-wave mixing and phase conjugation, transient coherent optical effects and free induction decay, optical breakdown and nonlinear effects in plasmas. Prerequisite: 522.
Planning

609-09 Quantum Electronics and Electro-Optics (3,3) Electromagnetic propagation in anisotropic and periodic media; elementary theory of quantum electronic effects and devices, acousto-optical effects and devices, guided waves, photo- and femtosecond optical switching and electronics, and optical computers and processors. Prereq: 506.

610 Quantum Optics (3) Quantum theory of emission and absorption of radiation; frequency-dependent susceptibility; quantum coherence theory; field quantization and coherent photon states; interaction of radiation with atoms; photon optics, counting and higher-order coherence; atomic scattering phenomena. Prereq: 522.

611 Advanced Quantum Mechanics & Field Theory (3) Second quantization, quantization of electromagnetic field, emission, absorption, and scattering of light, bremsstrahlung, pair creation and annihilation, quantum field theory methods in condensed matter physics, and quantum optics. Topics vary according to instructor. Prereq: 522 and of physics. Prereq or consent of instructor.

612 Advanced Topics in Quantum Field Theory (3) Renormalization, Lamb shift, anomalous magnetic moments, gauge theories, electroweak theory, quantum chromodynamics, grand unified theories, and advanced topics in laser physics and quantum optics. Topics vary according to instructor. Prereq: 522 and of physics. Prereq or consent of instructor.

617-18 Lie Algebras in Mechanics and Physics (3,3) (Same as Mathematics 617-18.)

621-22 Nuclear Structure (3,3) General properties of nuclei; two-body scattering problems; saturation and symmetry properties of nuclear forces; theory of light nuclei; nuclear spectroscopy; special nuclear models; theory of nuclear reactions; theory of beta-decay. Prereq: 571.

626-27 Elementary Particle Physics (3,3) --Survey elementary particle physics covering experimental methods, conservation laws, invariance principles, and models of interactions. 627--Advanced topics: quark model, strong, weak, and electromagnetic interactions and unification of elementary forces. Prereq: 522.

631 Advanced Topics in Relativity of Cosmology (3) Topics vary according to interests of students, instructor, and available literature. Cosmological solutions of Einsteins field equations, black holes, inflationary universe, unified field theories or interaction between cosmology and nuclear and elementary particle physics. Prereq: 531 and 561.

641 Advanced Topics in Classical Theory (3) To meet special needs of students. Advanced dynamics and hydrodynamics, electrodynamics, statistical mechanics, or theory of nonequilibrium processes. Prereq: 532, 542, 551. May be repeated with consent of department. Maximum 9 hrs.

642 Advanced Topics in Quantum Theory (3) To meet special needs of students. Angular-momentum theory, beta-ray theory, theory of atomic spectra, molecular structure and valence theory, theory of radiation, electric and magnetic susceptibilities, high energy processes, scattering and collision processes, or theory of fields. Prereq: 532. May be repeated with consent of department. Maximum 9 hrs.

643 Computational Physics (3) Developing computer algorithms for solving representative problems in various fields of physics. Celestial dynamics in astrophysics, boundary value problems in electromagnetism, atomic and nuclear structures, band structure on solid state physics, transport problems in statistical mechanics, Monte Carlo simulation of liquids, fitting and interpolation of data, correlation analysis, or optimization strategy. Prereq: 522, 542, and 572.

651-62 Collision Interactions (3,3) Interaction of electromagnetic radiation and charged particles with atoms and molecules or free particles, scattering, ionization, transport and capture, collective excitations, Cerenkov radiation, and stopping power. Prereq: 522.

663 Advanced Plasma Physics (3) (Same as Electrical and Computer Engineering 663.)

664 Advanced Plasma Physics II (3) (Same as Electrical and Computer Engineering 664.)


681-82 Molecular Spectroscopy (3,3) Spectroscopic methods of determining molecular properties, theoretical and experimental aspects of intra- and inter-molecular energy and charge transfer, group theoretical methods and selection rules in gases and condensed phases, normal coordinates and potential functions, vibration-rotation interaction theory, intensities, frequencies and line shapes of molecular transitions. Prereq: 552 and 542 or consent of instructor.

Planning

(College of Architecture and Planning)

MAJOR

Planning.................................................. M.S.P.

James A. Spencer, Director

Professors:

Johnson, David A., Ph.D. ........... Cornell
Kenney, Kenneth B., Ph.D. ............ Prochaska, J. M., M.U.P ............ Michigan State
Shouse, Walter L. (Emeritus), M.C.P ... Harvard
Spencer, James A., M.C.P. ............. Ohio State

Associate Professors:

Bown, George E., M.A. ...... George Washington
Fisher, Patricia, Ph.D. .............. Florida State

Assistant Professor:

Anderson, Annette, M.P.A. .... Missouri (Kansas City)

The Graduate School of Planning offers a program of studies leading to the professional degree of Master of Science in Planning. The degree is the normal route for entry into professional positions in urban and regional planning or related positions. Graduates are candidates for positions as assistant administrators and planners in metropolitan planning agencies; in local, state, and federal agencies concerned with physical, economic, and administrative planning; in private business and organizations dealing with development problems; and in private consulting.

The Master of Science in Planning program is accredited by the Planning Accreditation Board, a joint undertaking of the American Institute of Certified Planners and the Association of Collegiate Schools of Planning.

THE MASTER'S PROGRAM

Admission Requirements

Applicants are to submit an application for admission to The Graduate School; two letters of reference from faculty familiar with their prior academic work, and a statement describing personal career objectives. If the applicant has prior work experience in planning, a reference letter should also be provided by the work supervisor. Graduate Records Examination scores are requested of applicants whose undergraduate GPA is below 3.0. Other applicants are encouraged to submit them.

Degree Requirements

The M.S.P. requires completion of at least 48 hours of graduate credit, at least 50 of which must be in planning. The following courses are the core curriculum required of all students: 510, 511, 515, 520, 521, 523, 530, 531, 532, 540, and 545.

Students should plan to enter the program in the fall term to take the core courses in the proper sequence.

Each student is required to develop an area of concentrated competence beyond the core curriculum. After selecting the area of concentration, usually by the end of the second semester, the student takes a prescribed set of courses in the subject area. Further enhancement of the concentration is gained by taking additional elective courses in the subject and by focusing the thesis or major paper on the subject. Concentration courses are drawn from the planning curriculum and from other departments in the University. Concentrations include at least 9 hours of coursework in one area, usually in one of the core departments in the University.

To be eligible for the major study option, the student must complete at least 12 hours of graduate coursework in planning with at least 3.5 cumulative grade-point average. The student meeting these criteria may present a proposal to his/her committee for a major study that will include at least 6 hours of subsequent coursework. The proposal shall justify the selection of the topic, describe the approach to the ideal, and describe the nature of the final product. The topic will normally be expected to reinforce or complement the student's concentration.

Student academic progress is monitored by the faculty. A student entering the program with an acceptable grade-point average may be placed on probation or dismissed from the program.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

401 The City in the U.S. (3) Development and character of U.S. cities. Contemporary issues and selected case studies. (Same as Urban Studies 401.)

402 Survey of Planning (3) History of city development and planning; U.S. experience in urban and other levels of planning. State of the art; process, comprehensive plan, implementation devices. Planning issues in society. Not for credit for M.S.P. degree.
Planning and Soil Science

(College of Agricultural Sciences and Natural Resources)

MAJOR

Plant and Soil Science .................. M.S., Ph.D.

John E. Foss, Head

Professors:

Allen, Fred L., Ph.D .................. Minnesota
Beil, Frank F. (Emeritus), Ph.D .... Iowa State
Conrey, D. L., Ph.D .................. Purdue
Conger, B. V. (Distinguished Prof.), Ph.D ............... Washington State
Duck, B. N., Ph.D .................. Auburn
Foss, John E., Ph.D ............... Minnesota
Frijlich, B., Ph.D .................. Iowa State
Hayes, R. M., Ph.D ............... Illinois
Hoskinson, P. E., M.S .................. Tennessee
Howard, D. D., Ph.D ............... Auburn
Josephson, L. M. (Emeritus), Ph.D ............... Wisconsin

Mullins, C. A., Ph.D ............... Tennessee
Parks, William L. (Emeritus), Ph.D ............... Purdue
Peckett, B. S. (Emeritus), Ph.D ............... Michigan State
Raymonds, John H., Ph.D ............... Wisconsin
Seatz, Lloyd F. (Emeritus), Ph.D ............... NC State
Skeld, L. N. (Emeritus), M.S ............... Kansas State
Springer, M. E. (Emeritus), Ph.D ............... California
Swingle, H. D. (Emeritus), Ph.D ............... Louisiana State

Winters, Eric (Emeritus), Ph.D ............... Illinois

Associate Professors:

Ammons, J. T., Ph.D ............... West Virginia
Dayton, D. E., Ph.D ............... NC State
Gravelle, J. G., Ph.D ............... Purdue
Krueger, W. A., Ph.D ............... Illinois
Lee, S. Y. (Adjunct), Ph.D ............... Wisconsin
Lessman, Gary M., Ph.D ............... Michigan State
Lewis, R. J., Ph.D ............... NC State
Miller, R. D., Ph.D ............... Kentucky
Reich, V. H., Ph.D ............... Iowa State
Sams, C. E., Ph.D ............... Michigan State
Tyrer, D. D., Ph.D ............... Kentucky
West, D. R., Ph.D ............... Nebraska
Wyatt, J. E., Ph.D ............... Florida

Assistant Professors:

Easington, M. E., Ph.D ............... California (Riverside)
Logan, Joanne, Ph.D ............... Nebraska
Mueller, Thomas C., Ph.D ............... Georgia
Mullen, M. D., Ph.D ............... NC State
Newton, D. (Adjunct), M.S ............... Kentucky
Wilson, G. V., Ph.D ............... Arkansas

The Department of Plant and Soil Science offers graduate programs leading to the Master of Science and the Doctor of Philosophy. Concentrations for the graduate programs are offered in soil science, plant breeding and genetics, and crop physiology and ecology. For further information, contact the department head.

THE MASTER'S PROGRAM

Thesis Option

This option requires writing a thesis based on original research. Six hours of 500-Thesis hours are required. Prior to conducting research, the student must develop a detailed written research plan. In addition to the thesis hours, a minimum of 24 hours of graduate coursework is required, of which at least 14 must be taken in courses numbered 501 and above. The student's advisory committee may require additional coursework if the student's progress or background indicates such need. Each student is required to take 1 hour of 501 and 1 hour of 503, and to present an exit seminar on the thesis research.

The student's advisory committee consists of the major professor, who acts as chairperson of the committee, and a minimum of two other faculty members. The advisory committee approves the student's research problem and coursework and conducts the final oral examination integrating the thesis and coursework.

A student having started on the thesis option is not eligible to transfer to the non-thesis option after the first semester of graduate study or after having received a Graduate Research Assistantship stipend for more than one semester. A student having
started on the non-thesis option may transfer to the thesis option upon approval by a potential major professor and the Department Head.

**Non-Thesis Option**

A student desiring the non-thesis option should declare this intention at the beginning of the first semester of graduate studies, and must deliver the written dissertation proposal, both to be conducted by the major professor and approved by the advisory committee. In lieu of thesis, students are required to complete 3 hours of 593 for satisfactory participation in a single research program for a period of 12 weeks and the writing of an original, creative, and integrative report, submitted by the student and approved by the advisory committee. In addition to the research program, a minimum of 30 hours of graduate coursework is required, of which at least 20 must be taken in courses numbered 501 or above. The student’s advisory committee may require additional coursework if the student’s progress or background indicates such need. Each student is required to take 1 hour of 501 and 2 hours of 503.

The student’s advisory committee consists of the major professor, who acts as chairperson of the committee, and a minimum of two other faculty members. The student must be approved by the advisory committee. The student must be approved to participate in a research program for 593. Students are required to take a written comprehensive examination integrating the coursework.

**THE DOCTORAL PROGRAM**

A minimum of 72 hours beyond the Bachelor’s degree, exclusive of credit for Thesis 500, is required. Of this number, 24 hours must be Doctoral Research and Dissertation 600. A minimum of 26 hours completed in courses numbered above 500 exclusive of doctoral research and dissertation, of which 6 must be in courses numbered above 600. A minimum of 9 hours of graduate course work taken during the doctoral program must be outside the department in one or more cognate areas.

The student and the major professor identify a doctoral committee composed of at least four faculty members holding the rank of assistant professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be from outside the department. The committee must approve all coursework offered toward the degree, certify the student’s mastery of the major field and any cognate areas, direct the research, and recommend the dissertation for approval and acceptance by The Graduate School.

**GRADUATE COURSES**

411 Soil Microbiology (3) Soil microbial populations and role in soil ecosystem, microbial transformation of inorganic and organic compounds, decomposition of residues, dynamics of soil microbial communities. Intro-duction to Soil Science and Introduction to Organic and Biochemistry or Organic Chemistry or consent of instructor. 2 hrs and 1 lab. F, A

412 Soil Genesis, Classification, and Mapping (3) Soil genesis and formation; observing and describing morphology of agricultural and forest soils; chemical and physical properties of soils. Two Saturday-day field trips. Prereq: 210 or consent of instructor. 2 hrs and 1 lab. Sp

413 Soil Chemistry (3) Principles concerning structure and well-written report, both to be related as exchanged, chemical equilibrium, soil acidity, oxidation-reduction, weathering, nutrient availability and waste disposal. Prereq: 311 or consent of instructor.

414 Soil, Land Use, and the Environment (3) Soil as environmental component and soil properties affecting land use. Soil as resource in development planning; consideration of nonengineering aspects of site selec-tion for land use, soil survey and resource data in land use, recognition and prevention of soil pollution. Prereq: 210 or consent of instructor. Sp, A

431 Crop Physiology and Ecology (3) Principles of plant physiology and ecology as applied to crop production. Effects of environmental factors on physiological processes. Prereq: 230, Botany 321, 2 hrs and 1 lab. F, A

432 Bioclimatology (3) Solar energy budget; interactions between global, regional and local climates and biological systems: quantification of macro- and micro-climates; microclimates and their modification; auto-mated weather station data collection and analyses; biological responses to climatic stresses; climate vari-ations and change and their effects on biological systems. Prereq: 1 yr physical or biological science, junior stand-ing. 2 hrs and 1 lab. F, A

433 Agricultural Pesticides (3) Regulation of pesticide development, manufacture, transportation, marketing and use in soil density, moisture characteristics, degradation and environmental impact of pesticides used in agriculture, forestry and related areas. Prereq: 1 yr biological sciences and one semester of inorganic chemistry. 2 hrs and 1 lab. Sp

453 Principles of Plant Breeding (3) Genetic principles and techniques used in crop improvement. Prereq: Biology 220 or equivalent. 2 hrs and 1 lab. Sp

471 Statistics for Biological Research (3) Application of statistical methods in biological research: Nota-tion, descriptive statistics, probability, distributions, confidence intervals, t- and chi-square tests, analysis of variance, mean separation procedures, linear regres-sion and correlation. Prereq: Mathematics 121 or equiva-lent. F

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

501 Seminar Preparation (1) Application of speaking, writing, and organizational skills in preparation and presen-tation of scientific material to both scientific and general audiences. Preparation of abstracts for scientific presentations. Required of all entering graduate stu-dents during their first year of graduate study. F, Sp

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

503 Seminar (1) Presentations and discussion of current scientific material. May be repeated. Maximum 3 hrs. F, Sp

511 Advanced Soil Fertility (3) Concepts of soil chem-istry as related to nutrient movement and adsorption by plant roots. Fertilizer use efficiency as measured by plant response factors. Prereq: 413. Sp, A

512 Pedology (3) Physical and chemical weathering processes, factors of soil formation, soil forming proc-esses. Prereq: 412 or consent of instructor. 2 hrs and 1 lab. F, A

514 Soil Physics (3) Physical and chemical relations-hips among solid, liquid and gaseous phases of soil system. Dynamics, interactions and interactions of phases on soil physical characteristics, aera-tion and relationship to plant growth. Prereq: 413 or consent of instructor. 2 hrs and 1 lab. F, A

530 Integrated Pest Management (3) As same Ento-mology and Plant Pathology 530.

532 Advanced Crop Ecology (3) General and specific relationships among environmental factors, crop organisms, and agricultural systems: quantification of macro- and microclimatic influences on plant responses, simulation of crop production and productivity, human cultures, and their interaction. Prereq: 471 or equivalent; 431 or equivalent. Sp, A

551 Advanced Plant Genetics (3) Discovery of genet-ics: controlling elements, induced mutations, genome organization, polyploidy, tetrasomic inheritance, extra-chromosomal inheritance, apomixis, incompatibility systems, and genetic engineering of higher plants. Prereq: Biology 220. F


571 Design and Analysis of Biological Research (3) Design of experiments and statistical techniques. Prereq: as Animal Science 737.

593 Special Problems in Plant and Soil Science (1-3) May be repeated. Maximum 6 hrs. E

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

601 Special Topics in Soil Science (1-3) Thermodynamic principles, solutions, clay structure and surface chemistry, soil mineralogy, plant mineral nutrition, soil microbiology, water movement and use by plants, soil structure, soil thermal properties, interaction in the soil-plant environment. May be repeated. Maximum 6 hrs. E

603 Special Topics in Crop Physiology and Ecology (1-3) Microclimate of agroecosystems, crop dormancy and responses to stress, physiology of crop growth and reproduction. Interactions of physiology and germination in crop production, theory and application of quantitative methods in crop physiology and ecology re-search. May be repeated. Maximum 6 hrs. E

605 Special Topics in Plant Breeding and Genetics (1-3) Genotype by environment interactions, estimation of quantitative parameters, mutations, chromosome dynamics, polyploidy, genetic engineering, interspecific hybridization, linkage, screening methods, genome or- ganization. May be repeated. Maximum 6 hrs. E

613 Advanced Soil Chemistry (3) Surface and colloidal chemistry of soil mineral and organic matter developments in an speciation, ion movement, surface charge, surface complexation and soil colloidal stability. Prereq: 413 or consent of instructor. Sp, A


633 Plant Growth Control and Herbicide Action (3) Principles of uptake, translocation, mode of action and uses of herbicides and plant growth regulators and their effects on plant morphology, metabolic systems and enzymatic activities. Practical aspects and current commercial uses of plant growth regulators. Prereq: Botany 521 and 522 or equivalent. F, A

553 Advanced Plant Breeding (4) Development and use of genetic and quantitative parameters, interbreeding, heterosis, methods of selection, in vitro breeding, interspecific hybridization, stability parameters, genetic resistance and vulnerability to pests and envi-ronmental stresses. Prereq: 453 and 571 or equivalent or consent of instructor. 3 hrs and 1 lab. Sp, A

571 Advanced Research Planning (3) Development of agricultural research proposals utilizing prescribed re-sources and emphasizing experimental design and sta-tistical techniques. Prereq: 571. Animal Science 572, Statistics 461, or equivalent. (Same as Animal Science 671.) F, A

**Political Science**

(College of Liberal Arts)

**DEGREES**

**MAJORS**

Political Science .......................... M.A., Ph.D.


**Michael Gant, Head**
THE MASTER OF PUBLIC ADMINISTRATION PROGRAM

The M.P.A. program is intended to prepare students for public service careers by acquainting them with management principles, analytical tools, and the ethical dilemmas they will face as public administrators. It consists of a total of 36 semester hours, including a core program, an elective specialization, and a recommended internship. Applicants for admission to the program must have a Bachelor's degree or its equivalent. Normally, an overall average of 3.0 and an average of 3.2 in the last two years of political science or social science courses is required. In addition, a composite score of at least 1100 on the verbal and quantitative parts of the GRE is normally required.

The M.P.A. is a non-thesis program. Specific requirements include the following:

1. Core - 21 hours
   a. General perspectives - required courses (6 hours), 550 Public Administration, 552 Organization Theory.
   b. General perspectives - elective courses (3 hours), 556 Policy Analysis; 558 The Politics of Administration.
   c. Analytical skills (6 hours), 512 Quantitative Political Analysis; 514 Research and Methodology in Public Administration.
   d. Management skills (6 hours). Choose two of the following: 560 Public Budgeting and Finance; 562 Public Management; 564 Human Resources Management in Public Organizations.
   2. Specialization - 9 hours
       A specialization is designed by the student in consultation with the coordinator of the M.P.A. program. Possible specializations include general government, budgeting and finance, planning, natural resources, program evaluation, criminal justice, public relations, personnel, and others.
   3. Recommended internship with a public agency - 6 hours.

Internships are arranged in consultation with the coordinator of the M.P.A. program.

4. A written final examination, which may be followed by an oral examination, is required.

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

The College of Law and the Department of Political Science in the College of Liberal Arts offer a coordinated dual degree program leading to the conferral 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. degree and the Department of Political Science and The Graduate School 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 the M.P.A. degree and the J.D. degree, 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 courses offered by 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) and are encouraged to take Local Government (Law 824). 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. coordinators in both academic units. In the fall of each fourth or fifth year, students are strongly encouraged to take both law and political science courses each semester.

Dual degree students who withdraw from the program before completing 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 M.P.A. course in which the student earns a grade of 2.3 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 grades assigned by the instructor without conversion.

DUAL M.S.S.W.-M.P.A. PROGRAM

The Department of Political Science and the College of Social Work offer a dual degree program leading to the conferment of both the
Master of Science in Social Work and the Master of Public Administration degrees. In this program, the M.P.A. and M.S.S.W. degrees can be earned on a full-time basis in five consecutive terms rather than seven to eight terms.

Admission

Applicants for the M.S.S.W.-M.P.A. program must be admitted to the College of Social Work and to the Department of Political Science. In addition, applications from dual degree students must be reviewed and approved by the dual degree committee that is responsible for overseeing the program. It is anticipated that some students may apply to the dual degree program before they matriculate in either the M.S.S.W. or the M.P.A. program. Students already enrolled in one program will also be permitted to apply, but must do so prior to the end of the first year of study.

Curriculum

Students in the dual degree program are required to take a set of core courses from each curriculum, but the program is designed to be flexible, providing students the opportunity to develop special areas of competence. For the dual degree program, a minimum of 65 hours are required (35 hours must be in social work and 30 hours must be in public administration). Admission to candidacy will be completed separately for each degree.

A comprehensive examination is required in each discipline for students receiving the dual degrees. A faculty committee from Public Administration and one from Social Work will write and grade the respective examination. Dual degree students who withdraw from the program before completion of the requirements for both degrees will not receive credit toward either the M.P.A. or the M.S.S.W. degree for courses taken in the other program, except as such courses qualify for credit toward a degree independent of the dual degree program.

Financial Aid

Students may apply for financial aid to both the College of Social Work and the Department of Political Science. Normally, students will not receive funding from both programs concurrently.

THE DOCTORAL PROGRAM

The Ph.D. program prepares students for careers in college teaching, as well as careers in other occupations related to service in the public or private sectors. Applicants for admission to the program should normally have completed a Master's degree in political science or a related field with a 3.0 GPA (3.5 for international students) and have earned a composite score of at least 1100 on the verbal and quantitative parts of the Graduate Record Examination.

Students admitted to the program must complete 78 hours of course work beyond the Bachelor's degree, must successfully pass written and oral comprehensive examinations in three broad subfields of political science, and must pass a final oral examination on the dissertation.

In addition, students must satisfy a research tool requirement. This requirement may be satisfied either by demonstrating competency in one foreign language, or by completing 12 hours of coursework, numbered 500 or above, in empirical methodology.

In addition to the total hours required for the degree, the following requirements must also be met:

1. At least 63 hours must be in political science courses.
2. At least 48 hours in political science courses must be in courses numbered 500 or above.
3. Completion of Political Science 510 and 512.
4. At least 6 hours must be earned in political science courses numbered above 600, exclusive of dissertation hours.
5. A total of 24 hours must be earned by writing the dissertation.

GRADUATE COURSES

410 Special Topics in Political Science (3) May be repeated with consent of department. Maximum 6 hrs.
420 Political Attitudes and Opinions (3) Nature, formation, development, and dissemination of politically relevant attitudes and opinions in American political system.
421 Political Parties and Interest Groups (3) Examination of role of political parties and organized groups in American politics and government.
422 Political Campaigns and Elections (3) Analysis of nature of campaigns and elections in American political process.
430 United States Constitutional Law: Sources of Power and Restraint (3) Analytical study of judicial review, constitutional powers of President and Congress, federalism, sources of regulatory authority, and constitutional protection of political and economic rights.
451 U.S. Constitutional Law: Civil Rights and Liberties (3) Analysis of current issues in civil rights and liberties including: first amendment freedoms, equal protection, privacy and rights of accused.
440 Public Management and Human Resources (3) Mobilization and management of technical and human resources in pursuit of public sector organization goals.
441 Budgetary Process and Financial Management (3) Fiscal planning, budget and expenditure processes in government, their policy and administrative implications.
442 Administrative Law (3) Legal dimensions of administrative power and procedure, and constitutional controls over administrators.
452 Black African Politics (3) Recent evolution and current political environment of Black African nations. (Same as Afro-American Studies 452.)
454 Government and Politics of China and Japan (3) Examination of the political setting, structure and political processes in China and Japan.
455 Latin American Government and Politics II (3) Selected topics on Latin American political dynamics, consideration of leading theoretical explanations. (Same as Latin American Studies 455.)
459 Government and Politics of the Soviet Union (3) Origins and development of Soviet political system, and study of selected policy areas.
460 Revolution (3) Examination of characteristics, theories, and consequences of revolution with particular focus on left-wing revolutions and movements.
461 Policy Making in Democracies (3) Comparative approach to theory and process of making public policy.
463 Contemporary Middle East Politics (3) Governments and movements in Middle East, their characteristics, bases, and interrelationships.
469 Soviet Foreign Policy (3) Overview of Soviet international behavior since 1917 and examination of selected problems of Soviet foreign policy post World War II.
470 International Law (3) Nature and development of international law and its impact on the evolution of interna
tional law in context of international conflict.
475 Ancient and Medieval Political Thought (3) Survey of major western political thinkers from Socrates to Marsilio of Padua.
476 Modern Political Thought (3) Survey of major western political thinkers from Machiavelli to Marx.
500 Thesis (1-15) P/NP only. E
502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
510 Scope and Methods in Political Science (3) Procedures of analysis in political science.
512 Quantitative Political Analysis (3) Methods and techniques in quantitative political analysis: univariate and bivariate statistics.
513 Quantitative Political Analysis (3) Methods and techniques in quantitative political analysis: multivariate model building.
514 Research and Methodology in Public Administration (3) Basic principles and techniques of research in public administration: measurement, analysis, and reporting of data.
520 Political Theory (3) Survey of major ideas, thinkers and works of Western political theory.
530 Topics in American Government and Politics (3) Survey of literature, approaches to research and analysis, critical examination of major works, and overviews of research in various subfields. May be repeated with consent of department. Maximum 9 hrs.
538 Urban Politics and Administration (3) American urban structures and public policies. May be repeated with consent of department. Maximum 9 hrs.
540 Public Law (3) Selective examination of published research and current approaches in subfields of constitutional law, judicial process, and judicial behavior. May be repeated with consent of department. Maximum 9 hrs.
548 Law and the Administrative Process (3) Constitutional position, decisional processes, regulation and management: limitations on governmental action; questions of structure, role, and administrative choice. May be repeated with consent of department. Maximum 9 hrs.
550 Public Administration (3) Overview of public administration theory and function.
552 Organization Theory (3) Appraisal of major theories of organization and their applicability to public sector.
556 Policy Analysis (3) Role of administrators in policy analysis and decision making. May be repeated with consent of department. Maximum 9 hrs.
558 The Politics of Administration (2) Examination of public administration in context of American political system, policy making and political roles of public administrators and agencies. May be repeated with consent of department. Maximum 9 hrs.
560 Public Budgeting and Finance (3) Technical and political aspects of planning, preparing and adopting government budgets. Management implications of revenue collection, debt management, treasury function, accounting, internal auditing, purchasing risk management, and post-auditing.
562 Public Management (3) Interpersonal and leadership skills, techniques and methods for planning, decision making, and implementation of management strategies in public sector. May be repeated with consent of department. Maximum 9 hrs.
566 Ethics, Values, and Morality in Public Administration (3) Moral-ethical-value dilemmas confronting administrators in American political system.
659 Internship in Public Administration (3-9) Open to students approved in internship programs. May be repeated with consent of department. Maximum 9 hrs. S/N only.

570 Comparative Government and Politics (3) Selected topics in modern governments. May be repeated with consent of department. Maximum 9 hrs.

573 The Politics of Development (3) Selected topics dealing with political problems of less developed countries. May be repeated with consent of department. Maximum 9 hrs.

574 Area Seminar in Comparative Government and Politics (3) Selected topics in area studies: African, Latin America, Middle East, Soviet Union and Eastern Europe or Western Europe. May be repeated with consent of department. Maximum 9 hrs.

580 International Politics (3) Survey of literature and major aspects of international politics. May be repeated with consent of department. Maximum 9 hrs.

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

593 Independent Study (1-15) See page 31.

595 Readings and Special Problems in Political Science (1-3) Frequent consent of instructor may be repeated. Maximum 15 hrs.

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

610 Special Topics in Empirical Theory and Methodology (3) Advanced methods and procedures of analysis in political science. May be repeated with consent of department. Maximum 9 hrs.

620 Special Topics in Political Theory (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hrs.

628 Topics in Political Theory (3) Selected issues and problems in normative political theory. Specific content determined by instructor. May be repeated with consent of instructor. Maximum 9 hrs.

631 Topics in Parties and Elections (3) Analysis of party systems and electoral behavior. May be repeated with consent of department. Maximum 9 hrs.

634 Topics in American National Institutions (3) Deals with congress, executive or elected officials. May be repeated with consent of department. Maximum 9 hrs.

636 Comparative State Politics (3) Government and the political processes of fifty states: general and particular characteristics. May be repeated with consent of department. Maximum 9 hrs.

640 Special Topics in U.S. Constitutional Law (3) Systematic analysis of published research and judicial decision: development of constitutional law as major component of public policy. May be repeated with consent of department. Maximum 9 hrs.

642 The Politics of Criminal Justice (3) Selective examination of contemporary problems of research and public policy formulation: criminal process; law enforcement administration; criminal court administration; and prison administration. May be repeated with consent of department. Maximum 9 hrs.

654 Contemporary Public Policies (3) Problems in one or more public policy areas from political and administrative perspectives. Topics selected by instructor. May be repeated with consent of department. Maximum 9 hrs.

667 Comparative Public Administration (3) Comparative analysis of public organizations and public policies in selected countries. May be repeated with consent of department. Maximum 9 hrs.

668 Special Topics in Public Administration (3) Analysis of selected issues and problems in public administration. May be repeated. Maximum 9 hrs.

670 Special Topics in Comparative Government and Politics (3) Research into selected topics. May be repeated with consent of department. Maximum 9 hrs.

692 Theory and Analysis of U.S. Foreign Policy Processes (3) Theoretical approaches to decision making in foreign policy area and analysis of policy-making process. May be repeated with consent of department. Maximum 9 hrs.

688 Special Topics in International Politics (3) Selected issues and problems in international politics. Specific content determined by instructor. May be repeated with consent of instructor. Maximum 9 hrs.

THE DOCTORAL PROGRAM

A student with a B.A. or B.S. may apply to the Department of Psychology for admission to the doctoral program with a concentration in general psychology or clinical psychology. The doctoral program with a concentration in political psychology offers a professional program in political psychology, with application made through the Department of Management.

Departmental Requirements

All students in the doctoral program in psychology must obtain a score of at least 630 on the GRE in psychology by the end of the first year, and all students must pass the departmental general psychology examination (a comprehensive, two-day essay exam, offered twice each year) by the end of the second year. In addition, each student must pass the doctoral comprehensive examination, complete an acceptable doctoral dissertation, and conduct a satisfactory oral defense of the dissertation. All doctoral students must complete a minimum of 78 hours of graduate-level courses, including courses required by their program; at least 6 hours in programs outside of psychology; and at least 24 hours of dissertation research (Psychology 600).

General Psychology

This program allows students to select from a variety of specializations oriented toward careers in research and teaching in psychology in academic, institutional, or industrial settings. The program is highly flexible and individualized and seeks to provide a professional apprenticeship. Specializations include behavioral medicine and health psychology, child and adolescent development, cognitive and symbolic processes, cardiac and cardiovascular, cognitive-existential phenomenology, psychometrics, psychophysiology, social psychology, and others. Requirements of the program are as follows:

1. Statistics 537-38, or equivalent, and two additional courses numbered above 500 in research methodology, quantitative methods, statistics, or psychometrics.

2. Competence in general psychology, demonstrated by passing Comprehensive Examination 513 (Foundations of Psychology) or Psychology 420 (History and Systems of Psychology) or equivalent, plus at least one course or sequence of two or more courses in four categories in the following list. (This requirement may be met by passing approved written examinations.)

a. Biological psychology: 461-69 Physiological Psychology and Laboratory; 526 Neuroanatomy; 527 Behavioral Neurology.


409 Group Facilitation (2) Study of theory and techniques through supervised experience in small groups. Prereq: 359 and consent of instructor. May be repeated. Maximum 6 hrs.


424 Psychology and the Law (3) Psychological aspects of legal systems. Prereq: 110 or equivalent. Upper-division standing and consent of instructor.


434 Psychology of Gender (3) Biological, psychological, and social factors in gender. Importance of gender roles and stereotypes for behavior and experience. Prereq: 110 or equivalent. 210, 220. (Same as Women's Studies 434.)

440 Organizational Psychology (3) Social-psycho logical analysis of organizational behavior and group processes; role-theory and systems theory. Prereq: 360.


450 Comparative Animal Behavior (3) (Same as Zoology 450.)

459 Comparative Animal Behavior Laboratory (3) Coreq: 450. (Same as Zoology 459.)

461 Physiological Psychology (3) Nervous system and physiological correlates of behavior: Biological basis of emotion, learning, memory and stress. Prereq: 110 or equivalent, 210, and 1 yr of biology or zoology introductory surveys or equivalents.

469 Laboratory in Physiological Psychology (3) Laboratory course in physiological and psychological correlates of behavior. Coreq: 461.

470 Theories of Personality (3) Survey of major theories of human personality and their development. Prereq: 220 and 300 or 330.

480 Theories of Learning (3) Classical and current approaches to learning and cognition. Prereq: 310.

482 Topics in Psychology (3) Intensive analysis of special topics: Afro-American psychology or evaluation of programs in community. Prereq: Biological Basis of Behavior or Behavior and Experience: Humanistic Psychology and at least 9 hrs in 300-level courses. Recommended prereq: Statistics in Psychology, Methods of Research in Psychology. May be repeated. Maximum 6 hrs.

489 Supervised Research (1-9) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs in 398, 489, 491, 492, and 493 combined may apply toward undergraduate major.

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when he/she is using 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 Research Design (3) Techniques for planning and conducting research in controlled and natural settings: experiments, quasi-experiments, observational studies, surveys, and program evaluations. Development of questions and hypotheses for study. Design of studies to maximize validity. Prereq: Consent of instructor.

508 Readings and Special Issues in Psychology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 8 hrs.

509 Research Practicum (1-3) Required of first-year graduate students in psychology. May be repeated. Maximum 9 hrs. S/NC only.

510 Topics in Psychology (3) Intensive examination of selected issues in psychology. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

511 Developmental Psychology (3) Normal processes of human socialization, physical, cognitive, and emotional development from conception through infancy, childhood, and adolescence. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

512 Life-Span Development (3) Theories and research concerning normal human development throughout life, adulthood and old age. Prereq: Consent of instructor.

513 Foundations of Psychology: Biological Factors, Perception, Learning, Thinking, Motivation (4) Intensive survey of the major topics in Psychology. Prereq: Consent of instructor.

516 Colloquium in Ethology (1) Current research and theory. May be repeated. Maximum 9 hrs. (Same as Zoology 516.) S/NC only.

517-18 Proseminar in Industrial and Organizational Psychology (3,3) (Same as Management 567-68.)

520 Interventions for Behavioral Change (3) Principles and techniques for planning, implementing, and evaluating interventions from social learning theory. Interventions by people in community: teachers or supervisors. Token economies and strategies for self-control. Prereq: Consent of instructor.

525 Laboratory Techniques and Instrumentation (3) Procedures for laboratory research involving human and nonhuman animals: techniques for collecting, transforming, storing, and retrieving data using microcomputers. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

526 General Vertebrate Neuroanatomy (3) Lecture and laboratory. Structure and function of central and peripheral nervous system. Prereq: 461, 469, or equivalent and consent of instructor. (Same as Zoology 526.)


528 College Teaching in Psychology (3) Concepts, techniques, and materials for teaching psychology at college and/or university level. Supervised practice. Prereq: Consent of instructor. S/NC only.


545 Advanced Animal Behavior (3) (Same as Zoology 545.)

546 Ethological Psychology (3) Basic ethology and comparative psychology of behaviors of nonhuman animals. Prereq: Consent of instructor.

549 Internship in School Psychology (1-6) (Same as Educational and Counseling Psychology 549.)

550 Social Psychology (3) Survey of theory and research concerning interpersonal interaction and individual behavior in social context. Prereq: Consent of instructor.

555 Psychometrics (3) Basic concepts: factor analysis, scaling, test theories, probability models and their applications, computerized adaptive testing and other topics. Prereq: Statistics 537-538 or equivalent. May be repeated. Maximum 6 hrs.


557 Applied Psychological Measurement (3) Issues and techniques in applying psychological measurement in organizational, clinical, and community research. Prereq: Statistics 537-538 or equivalent and consent of instructor. May be repeated. Maximum 6 hrs.

560 Psychology of Learning (3) Review of current evidence from research involving human and/or nonhuman animals. Prereq: 400 and consent of instructor. May be repeated. Maximum 6 hrs.
570 Personality: Theory and Research (3) Advanced survey of psychodynamic and neo-Freudian approaches to personality; related research. Prereq: 470 or equivalent.

571 Personality: Theory and Research II (3) Advanced survey of behavioral and humanistic approaches to personality; related research. Prereq: 470 or equivalent.

572 Descriptive Psychopathology (2) Diagnostic criteria of the DSM-III. Examples from written case-histories and recorded interviews. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

573 Dynamics of Psychopathology (3) Psychoanalytic view of the causes and symptoms of major psychoses, neuroses, and adjustment disorders. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

574 Atypical Development in Childhood (3) Research on etiologies of atypical patterns of development in infancy and childhood. Prereq: 511 and consent of instructor. May be repeated. Maximum 6 hrs.

576 Object Relations (3) European and American conceptions of normal and psychopathological development of object relations. Significance for psychoanalytic and psychodynamic therapy. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

578 Clinical Aspects of Human Sexuality (3) Variation in human sexual behavior. Theories of etiology, treatment. Prereq: Consent of instructor.

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

591 Foreign Study (1-15) See page 31.

592 Off-Campus Study (1-15) See page 31.

594 Psychological Assessment I (3) Basic concepts and techniques of adult assessment: intelligence tests and personality tests. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

595 Psychological Assessment II (3) Basic concepts and techniques of adult assessment, intelligence tests and personality tests. Prereq: Admission to doctoral program in clinical psychology and 594 or consent of instructor.

596 Laboratory in Psychological Assessment (1) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. Coreq: 594 or 595. May be repeated. Maximum 12 hrs.

597 Evaluation of Development in Childhood (3) Structured and projective tests and interview techniques for evaluation of intellectual, personality, and social development in childhood. Prereq: 511 and admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 12 hrs.

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

601 Seminar in Psychology (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

605 Seminar in Research and Quantitative Methods (3) Prereq: 505, Statistics 537-538 or equivalent, or consent of instructor. May be repeated. Maximum 12 hrs.

610 Seminar in Applied Psychology (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

611 Seminar in Developmental Psychology (3) Prereq: 511 and consent of instructor. May be repeated. Maximum 12 hrs.

613 Seminar in Existential-Phenomenological Psychology (3) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

614 Seminar in Behavioral Neuroscience (3) Prereq: 461, 468, and consent of instructor. May be repeated. Maximum 12 hrs.


620 Seminar in Social and Organizational Psychology (3) Prereq: 440 or 550 and consent of instructor. May be repeated. Maximum 12 hrs.

622 Seminar in Comparative and Ethological Psychology (3) Prereq: 540 or consent of instructor. May be repeated. Maximum 12 hrs.

623 Seminar in Methods of Naturalistic Research (3) Prereq: 546 or consent of instructor. May be repeated. Maximum 12 hrs.

624 Seminar in Psychometrics (3) Prereq: 555 or consent of instructor. May be repeated. Maximum 9 hrs.

625 Seminar in Organizational Psychology (3) (Same as Management 665.)

626 Seminar in Industrial Psychology (3) (Same as Management 626.)

627 Seminar in Applied Industrial Psychology (3) (Same as Management 627.)

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

638 Current Topics in Industrial/Organizational Psychology (3) (Same as Management 638.)

661 Advanced Psychometrics (3) Construction and standardization of psychological tests, questionnaires, rating scales; theory of errors of measurement; factor analysis, scaling, equating, and development of norms; latent trait models; factor analysis; and other topics. Prereq: 555 or consent of instructor. Maximum 9 hrs.

668 Seminar in Psychopathology (3) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 12 hrs.

670 Psychodynamic Psychotherapy I (3) Theories and principles. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

671 Psychodynamic Psychotherapy II (3) Theories and principles. Prereq: Admission to doctoral program in clinical psychology or 670 or consent of instructor.

673 Laboratory in Psychotherapy (2) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. Coreq: 670 or 671. May be repeated. Maximum 6 hrs. S/N only.

674 Group Psychotherapy (3) Theory and practice. Prereq: Admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 6 hrs.

675 Inference in Psychotherapy (3) Uses of actuarial data for assessment of strategies and tactics in psychotherapy. Prereq: Admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 12 hrs.

676 Laboratory in Psychotherapy (2) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. Coreq: 670 or 671. May be repeated. Maximum 6 hrs. S/N only.

679 Hypnosis and Imagery (3) Demonstration and practice of hypnotic induction. Survey of clinical applications of hypnosis and imagery. Prereq: Admission to doctoral program in clinical psychology or consent of instructor.

680 Seminar in Psychotherapy (3) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 12 hrs.

681 Seminar in Assessment (3) Prereq: Admission to doctoral program in clinical psychology or consent of instructor. May be repeated. Maximum 12 hrs.

683 Seminar in Behavioral Medicine (3) Current research and theory concerning relationships between behavior and health. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

684 Neuropsychology (3) Investigation of brain-behavior relationships in adults and children. Introduction to administration of REITAN neuropsychological screening battery. Luria battery and assessment of brain dysfunction. Prereq: Consent of instructor.

685 Psychopharmacology (2) Connections between pharmacology and psychology. Prereq: Consent of instructor.
The Department of Romance Languages offers two advanced degrees: the Master of Arts in French and in Spanish and the Doctor of Philosophy in Modern Foreign Languages. Inquiries should be addressed to the head of the department. The head, through the coordinators of Spanish and French, will make available further departmental requirements, regulations, and materials not listed below.

THE MASTER'S PROGRAM

Thesis Option
1. Completion of a minimum of 24 semester hours in coursework plus at least 6 hours in course 500, Thesis. In French, 501 is required; in Spanish, 550. 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 501 (French) or 550 (Spanish). 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 into this program. Both graduates of first concentration and second concentrations by taking a test in each language. The test will include reading, writing, listening, and speaking, and should be completed by the time the student reaches 40 hours of study beyond the Bachelor's degree, at least 12 of which must be at the 500 or 600 level.
3. A written examination covering the coursework and selected items from a master reading list.
4. A final oral examination to discuss the papers (French M.A. only).

THE DOCTORAL PROGRAM

The Ph.D. in Modern Foreign Languages is offered jointly by the Department of Germanic and Slavic Languages and the Department of Romance Languages and requires advanced training in at least two foreign languages.

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.

Requirements for the Ph.D.
Candidates must complete a minimum of 63 semester hours of course work beyond the Bachelor's degree in addition to 24 hours of doctoral research and dissertation. The program consists of a first concentration, a second concentration, and a cognate field:
1. First Concentration: French, German, or Spanish. It consists of a minimum of 39 semester hours beyond the Bachelor's degree, distributed as follows:
   - A minimum of 21 hours at the 500 level (exclusive of thesis hours) including French 584 (3), German 560 (3), or Spanish 550 (3).
   - German 512 (3), French 512 (3), or Spanish 512 (3).
   - At least 12 hours at the 600 level (exclusive of dissertation hours).
2. Second Concentration: French, German, Italian, Russian, or Spanish (different from the first concentration). It consists of at least 15 hours of courses beyond the Bachelor's degree, at least 12 of which must be at the 500 or 600 level.
3. Cognate Field: Six hours must be in graduate courses numbered 400 and above in a field outside the department of the first concentration but related to the student's principal area of research. If the cognate field is yet a third foreign language, a reading proficiency exam will be administered after completion of the 6 cogitate hours by the language section concerned.
4. Additional Requirements: A student must demonstrate competence in languages of both his/her first and second concentrations by taking a test in each language. The test will include reading, writing, listening, and speaking, and should be completed by the time the student reaches 40 hours of study beyond the Bachelor's degree. Standardized measures that may be used for this purpose include applicable portions of either the National Teachers Examination, the MLA Examination for Teachers and Advanced Students, or the proficiency standards of the United States Foreign Service Institute (FSI).

If the student has not chosen a third language as his or her cognate area, basic competence (determined by a reading examination with translation into English administered by the department concerned) in a third language is required. If the student's first and second languages are Romance languages, the third language should be chosen from another language family.

A comprehensive examination on the language and literature of the first and second concentrations must be passed before the student may be advanced to candidacy. The candidate is required to defend his/her dissertation in an oral examination. Central emphasis is put on the doctoral dissertation as a final test of the candidate's scholarly qualifications.

Graduate Teaching Assistants in the program should have the opportunity and will be strongly encouraged to instruct at least two foreign languages, subject to staffing needs.