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

M.A. Requirements

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

1. Selection of an M.A. advisor. This should be done as soon as possible in the student's program but by no later than the end of the first semester in residence. The department graduate secretary must be informed in writing of each student's advisor.
2. A minimum of 30 credit hours in graduate courses. Twenty-four hours must be in coursework graded A-F. Coursework must include three courses taken in the first year:
   a. 510 Method and Theory in Cultural Anthropology
   b. 560 Theory in Archaeology
   c. 590 Method and Theory in Biological Anthropology
3. Additional coursework should be selected in consultation with the student's advisor and must include one additional course from two anthropology concentrations besides the student's primary concentration. At least 20 hours of coursework must be at the 500 level or higher.
4. During the first year, comprehensive Graduate Evaluation Examinations (GEEs) are required of all M.A. students and are based on the content of the core courses. These examinations are given as the final examination in each core class (during regularly-scheduled final periods) and are graded by all faculty within the appropriate subdiscipline for each course. At the end of the first year, all M.A. students will be evaluated by the entire faculty and will either be retained or dropped from the program based on their first year's performance and GEE scores.
5. All M.A. students must take the graduate section of the visiting lecturer program. To insure compliance with this requirement, each student is required to register for one credit hour of Anthropology 501 in the Fall semester of each year and fulfill all requirements for the course defined by the instructor and on the schedule.
6. A graduate-level introductory statistics course, usually Statistics 537.
7. In the second year of the program, students pursue their concentration area and undertake thesis research. Coursework will be determined through consultation with the student's advisor and committee (composed of the advisor and at least one other member of the Anthropology faculty along with other mutually-agreed-upon members).
8. Successful completion of the thesis and final oral examination. Normally, students will complete and defend their theses during the Spring semester of their second year.
9. Two copies of the thesis are required by The Graduate School. In addition, bound copies of the thesis are to be provided to the department and to all members of the student's M.A. committee.

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

THE DOCTORAL PROGRAM

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

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

Admission to the Ph.D. program is based upon the applicant's academic record and credentials, also on fit between an individual's interest and faculty areas of research. Applicants will be admitted to the Ph.D. program unless appropriate faculty members are available to chair and serve on the doctoral committee. Doctoral program applicants must communicate directly with the potential chairperson and two additional members of the anthropology faculty who will be asked to serve on the committee.

Applicants to the Ph.D. degree program should meet the same academic standards as M.A. program applicants and furnish the same materials (see The Master's Program).

1. Acceptance of a Master's degree in anthropology; or
2. Acceptance of a Master's degree in another discipline, with the provision that the student will follow the first-year program with entering M.A. students, i.e., complete the core courses (510, 560, 590) and pass the Graduate Evaluation Examinations.

Doctoral Committee: A doctoral committee is appointed following admission to the program. In consultation with this committee, the student defines the future program of studies. When the student and committee have agreed upon the specific fields of specialized competence over which the student will be examined, a brief delineation of the fields will be presented to the department head and the student's major professor. As early as possible, but no later than a full semester after admission to candidacy, the student shall formally present a written dissertation proposal to the department head and advisor.

Residence and Coursework: Every potential Ph.D. candidate must complete two consecutive semesters of full-time residence prior to taking the doctoral comprehensive examination. The student must complete the minimum coursework requirements of The Graduate School, including at least nine hours of 500- or 600-level courses outside of anthropology, chosen in consultation with the doctoral committee, particularly the outside member who represents the cognate area. Outside coursework may be taken in a single discipline or be distributed across two or more disciplines as appropriate to the individual's program of study.

Statistics: Demonstration of competence in statistics by completing Statistics 537 and 538 with a grade of B or better is required.

Language: Students must demonstrate knowledge of one foreign language. This language should normally be French, German, Russian or Spanish, but another language may be substituted at the committee's discretion. This requirement may be met by either:

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

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

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

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

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

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

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

ACADEMIC COMMON MARKET

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

Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.
Architecture

(College of Architecture and Planning)

MAJOR

DEGREE

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

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

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

Associate Professors:
Coddington, J., M.Arch. ...................... Pennsylvania
Davis, T. K., M.Arch. .......................... Cornell
Kaplan, M., M.Arch. ........................... Harvard
Martella, W. E., B.Arch. ..................... California
Schimmenti, M. M., M.Arch. ................. Florida
vonBeulow, P., M.S. .......................... Tennessee

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

MASTER OF ARCHITECTURE PROGRAM

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

Admission Requirements

In addition to meeting the Graduate School’s minimum requirements, the following specific admission requirements must be met.

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

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

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

Degree Requirements

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

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

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

For further information, contact the School of Architecture.

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

403 Introduction to Preservation (3) History, theory, and legal aspects of architectural preservation and restoration.

404 Preservation Technology (3) Techniques of preservation: methods of analysis, history of materials and technology used in old buildings. Prereq: 403.


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

410 History and Theory of Urban Form (3) Patterns of community development. Selected historical and contemporary examples. Basic urban design issues and design processes. Approaches through lectures, readings, essays, and sketch studies. Historical change in urban form and design.

412 Non-Western & Indigenous Architecture (3) Building responsive to climate, material availability, and economic level, as designed by non-Western architects. Prehistoric and modern examples. Present and future architecture and urbanism. Fertile Crescent, Indus Valley, Mesoamerica, and Mughal architecture.

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

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

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


417 The International Style (3) Survey of architecture of early modern movement, primarily in Europe and America, 1900-1940.

419 American Architecture I (3) Development of North American architecture from arrival of immigrants in 1607 until 1866.

420 American Architecture, 1840-1940 (3) Stylistic periods from Gothic Revival through twentieth century.

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

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

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

432 Computer Applications in Design II (3) Advanced computer-aided design using three-dimensional modeling software. Design analysis using computer animation, rendering techniques, visualizations. Prereq: Computer Applications in Design I or consent of instructor. 5p

433 Computer Applications in Design III (3) Integration of three-dimensional modeling and technical analysis using computer-aided design, augmented reality, and visualizations. Introduction to computer programs. Prereq: Consent of instructor. 5p

434 Building Energy Analysis (3) Balancing heat flow through external skin of residential and commercial buildings. Local climate evaluation. Site planning, building size and orientation, window area, wall treatment, infiltration control, and other design elements.
Energy use quantification methods and economic analysis of energy efficient design features. Architectural program analysis of interior and external load dominated buildings. Prereq: 341.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

525 Special Topics in Architecture (1-3) Student-initiated course. May be repeated. Maximum 9 hrs. SNC or letter grade.

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

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

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

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

553 Advanced Topics in Architectural Technology (3) In-depth analysis and design of architectural technology. Housing, structure, enclosure, mechanical and other architectural technologies. Prereq: Consent of instructor.

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

571 Architectural Design Studio/Seminar I: Environmental Influences (3) Environmental factors influencing regional character of architecture. Examination of associated natural forces and cultural interpretation. Readings and discussions: application in design studio to specific projects. Prereq: Principles in Architectural Design. 1 hr and 5 labs.

572 Architectural Design Studio/Seminar II: Technological Traditions (3) In-depth investigations and design of architectural processes and materials, environmental controls, acoustics, and lighting. Design detailing and processes of materials assembly in construction. Development of understanding of life safety and health requirements in building, and needs of physically challenged user. Prereq: 571. 1 hr and 5 labs.


591 Foreign Study (1-9)

592 Off-Campus Study (1-9)

593 Independent Study (1-9)

Art

(College of Arts and Sciences)

MAJOR

DEGREE

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

Norman Magden, Head

Professors:

Blain, Sandra J., M.F.A. ......................... Wisconsin
Brakke, P.M., M.F.A. (Emeritus), M.S. ................ Wisconsin
Cleaver, Dale G. (Emeritus), Ph.D. ................ Chicago
Daehnert, R.H., M.F.A. ......................... Wisconsin
Darrow, J.F., Ed.D. ......................... Illinois State
Falsetti, Joseph S., M.S. ......................... Ohio State
Goldenstein, M.B., M.F.A. ................. Nebraska
Kennedy, William C., M.F.A. ............... Wisconsin
Lee, B., M.F.A. ......................... Yale
Leland, W.E., M.F.A. ......................... Tennessee
Livingston, P.R., M.F.A. ......................... Wisconsin
Magden, Norman, Case Western Reserve
Martinson, Fred, Ph.D. ....................... Chicago
Moffat, E., M.F.A. ......................... Michigan State
Moffatt, F., Ph.D. ......................... Chicago
Peacock, D., M.F.A. ......................... Iowa
Riesing, T.J., M.F.A. ......................... Nebraska
Stewart, F.C., M.F.A. ......................... Claremont
Yates, S., M.F.A. ......................... North Carolina (Greensboro)

Associate Professors:

Habel, Dorothy, Ph.D. ......................... Michigan
LeFevre, Richard, M.F.A. ................... Rochester IT
Longobardi, Pam, M.F.A. .................. Montana State
Lyon, B. (Liaison), M.F.A. .................... Arizona State
Neff, A., Ph.D. ......................... Pennsylvania
Staples, Carolyn, M.F.A. ......................... Michigan State
Wilson, D., M.F.A. ......................... California (San Diego)

Assistant Professor:

Brogden, Sally B., M.A. ........... NY State College of Ceramics (Alfred)

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

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

THE MASTER'S PROGRAM

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

1. A detailed letter of intent including statement requesting assistantship, if desired.

2. Three letters of recommendation from former professors or professionals in the field.

3. An undergraduate major in art or evidence of equivalent proficiency.

4. A portfolio to be evaluated by the faculty.

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

M.F.A. Requirements

A minimum of 60 hours is required:

1. Successful completion of 20 hours of studio in a concentration area. An inter-area program must be approved by the graduate faculty only after the second semester in residence. Ten hours of concentration must be in second year courses (512, 514, etc.)

2. A minimum of 9 hours of art history for graduate credit.

3. Eleven hours of electives which may consist of any combination of courses offered by the University for graduate credit.

4. Art 599, Project in Lieu of Thesis (20 hours). A third year of semi-independent study. Student must have completed all other coursework prior to registration.

5. A student with the permission of the area faculty can petition to take 3 hours of outside academics as a substitute for 3 hours of art history or 3 hours of concentration area. The petition to be presented to the graduate committee for final approval and should directly address the need and relevance of this substitution to the student's concentration.

Four semesters (normally the first 40 hours) beyond the Bachelor's degree are required in residence. An exception is made for working professional applicants who may complete their first 20 hours, with the permission of the faculty, on a part-time basis. Residence is defined by the Department of Art as (1) a minimum enrollment of 6 hours per semester and (2) use of Department of Art facilities so that students are available for discussion and criticism.

The candidate's committee will consist of a minimum of 3 members and a maximum of 6
members and will be appointed prior to registration for Art 599. Three members of the committee shall be as follows: one from the candidate’s concentration area who shall be the major professor; one from art history, and one from a studio discipline outside the concentration area.

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

Academic Standards

1. First-year evaluation: At the end of the first 2 semesters in residence, the student must present a portfolio for evaluation by the faculty and receive permission to continue in the program.

2. Second-year evaluation: With completion of all coursework, the student must present work for evaluation by the faculty and receive permission to register for Projects in Lieu of Thesis.

3. If, in a review by the student’s major area faculty, the student’s progress is deemed insufficient, the faculty may recommend a work period without advancement toward the degree, probation with specific goals set for a specific time, or dismissal.

ACADEMIC COMMON MARKET

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

GRADUATE MINOR IN THE HISTORY OF ART

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

Art

GRADUATE COURSES

481 Museology I: Museums, Purpose and Function (3) Development of museums of art, history, natural and applied science. (Same as Anthropology 481.)

482 Museology II: Exhibition Planning and Installation (3) Exhibition concept development and implementation. Exhibition design and installation techniques. Publicity, production, matting and framing, shipping and storage. Prereq: 481 or consent of instructor. (Same as Anthropology 482.)

484 Museology III: Field Projects (1-12) Special field projects: restoration, preservation, registration, and other related research on or off campus. Prereq: 481 and 482. May be repeated. Maximum 12 hrs. (Same as Anthropology 484.)

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

502 Registration for Use of Facilities (3-15) 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

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

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

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

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

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

Art Design/Graphic

GRADUATE COURSES


451 Advanced Graphic Design (3) Theory and techniques of visual problem-solving as applied to advanced applications of graphic design. Prereq: Intermediate Graphic Design II.


453 Advertising Illustration (3) Media and techniques as applied to advertising illustration. Prereq: Black and White Illustration and successful completion of any portfolio review.

454 Editorial Illustration (3) Media and techniques as applied to editorial illustration for books, magazines, and newspapers. Prereq: Black and White Illustration and successful completion of any portfolio review.

456 Graphic Design Practice (3-12) Practical work experience in graphic design field. Only by preregistration with department. Prereq: Senior standing and consent of instructor. May be repeated. Maximum 12 hrs.

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

550 Studies in Graphic Design/ILLUSTRATION HISTORY (3) Design and illustration ca. 1850 to present. Prereq: M.F.A. candidate or consent of department. May be repeated. Maximum 6 hrs.

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

552 Graphic Design II (2-6) May be repeated. Maximum 10 hrs.

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

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

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

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

Art History

GRADUATE COURSES

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

472 History of 20th-Century American Art (3) Development in architecture, painting, and design from 1900.

473 19th-Century American Painting (3) From West and Copley to emergence of "The Eight."
Art

GRADUATE COURSES


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

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

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

436 Video Art (3-6) Continued development of concepts and techniques for creation of video works as art form: individual projects. Prereq: Introduction to Video Art and Photography/Media Arts Portfolio Review or consent of instructor. May be repeated. Maximum 9 hrs.

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

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

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

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

431 Photography 111 (3-6) Individual development of department. Maximum 6 hrs.


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

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

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

489 Studies in Art History (3) Concentration in individually selected area. Prereq: 12 hrs of art history and consent of instructor. May be repeated. Maximum 9 hrs.

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

514 Graduate Painting II (2-6) May be repeated. Maximum 10 hrs.


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

517 Studies in Medieval Art (3) Art and architecture of Middle Ages: major monuments from Byzantium or western Europe. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

518 Studies in Italian Renaissance Art (3) Art and architecture of 14th, 15th, and/or 16th centuries in Italy. Early or High Renaissance or Mannerist periods. Prereq: M.F.A. candidate or consent of instructor. May be repeated with consent of department. Maximum 6 hrs.

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

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

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

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

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

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

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

551 Graduate Painting III (2-6) May be repeated. Maximum 10 hrs.

552 Graduate Painting IV (2-6) May be repeated. Maximum 10 hrs.

553 Graduate Painting V (2-6) May be repeated. Maximum 10 hrs.

554 Graduate Painting VI (2-6) May be repeated. Maximum 10 hrs.

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

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

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

Art Sculpture

GRADUATE COURSES

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

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

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

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

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

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

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

Arrowmont

GRADUATE COURSES

Courses listed below offered periodically only at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee. Courses may be repeated. Upon admission to the M.F.A. program at UT Knoxville, a student may apply certain graduate courses taken at Arrowmont toward the degree, subject to the approval of the student's graduate committee.

400 Special Topics (2-4) Student- or instructor-initiated course offered at convenience of department. May be repeated.
Audiology and Speech Pathology

(College of Arts and Sciences)

MAJORS DEGREES

Audiology .................................. M.A.

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

Speech Pathology ........................ M.A.

Patrick J. Carney, Head

Professors:

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

Associate Professors:

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

Assistant Professor:

Rusar, Jacki L., Ph.D. ............. Pittsburg
Swanson, Lori J., Ph.D. .......... Purdue

THE MASTER'S PROGRAM

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

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

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

Students may elect either the thesis or the non-thesis option. Students in both programs are required to take 511. The master's program with thesis will include a minimum of 30 semester hours of approved graduate credit in speech/language pathology or a minimum of 33 semester hours of approved graduate credit in audiology, including 6 hours of 500 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least two-thirds of these total hours must be at the 500 or 600 level, including no more than 6 hours of thesis and no more than 6 hours of practicum. Students in the non-thesis option program must present a total of 36 semester hours in the speech/language pathology program or 39 semester hours in the audiology program of approved graduate credit and pass a final written examination.

THE DOCTORAL PROGRAM

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

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

The program will normally consist of three or four calendar years of graduate study beyond the master's degree with the first year being devoted primarily to formal coursework and the last year to full-time research culminating in the doctoral dissertation. The total program is a minimum of 60 semester hours, including a minimum of:

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

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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

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

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


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


485 Speech and Language of the Culturally Different Child (3) Speech and language differences of children of various minority groups, of different ethnic and class memberships and from different geographic regions.

473 Audiology II (3) Basic principles of clinical audometry; pure tone, speech, masking and overview of special auditory tests. Prereq: 371.

494 Aural Habilitation/Rehabilitation of the Hearing Impaired (3) Psychosocial aspects, amplification components, characteristics, assistive devices, speech acoustics, speech perception, speech reading, parent-infant, preschool school years of children, communicative impairments/handicaps/remediation of adults, effects of aging/remediation on the elderly, and case studies. Prereq: Phonetics and Acoustics of Speech and Hearing, or equivalents or consent of instructor.

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

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

506 Neural Bases of Speech and Language (3) Structure and function of central and peripheral nervous systems, role of speech and language. Prereq: 306.

507 Anatomy and Physiology of Hearing (3) Structure and function of the peripheral and central auditory systems, and their roles in mediating auditory processes. Prereq: 473 or equivalent or consent of instructor.

511 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, fundamentals of statistics, application of statistics, and completion of a proposal and a hypothetical pilot research project.

512 Clinical Practice in Audiology (1-4) Prereq: 473 and 484. May be repeated. Maximum 9 hrs.
Aviation Systems
(UT Space Institute)

MAJOR DEGREE
Aviation Systems .............................................. M.S.

R. D. Kimberlin, Program Chair

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

Associate Professors:
Kimberlin, R. D. (Liaison), Ph.D. ...... RWTH (Germany)
Solie, U. P., Ph.D. ....................... Tennessee

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

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

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

THESIS OPTION

The thesis program involves satisfactory completion of the following requirements:

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

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

NON-THESIS OPTION

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

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

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

ACADEMIC COMMON MARKET

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

GRADUATE COURSES

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

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

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

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

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

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

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

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


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

558 Measurement Science I (3) (Same as Nuclear Engineering 588, Mechanical and Aerospace Engineering 589, Civil Engineering 586.)

559 Measurement Science II (3) (Same as Nuclear Engineering 589 and Engineering Science and Mechanics 586.)

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

MAJOR DEGREES
Biochemistry .............................................. M.S., Ph.D.

John W. Koontz, Head

Professors:
Bagby, R. M., Ph.D. ......................... Illinois
Becker, J. M., Ph.D. ....................... Cincinnati
Carlson, J. G. (Emeritus) (Distinguished Prof.), Ph.D. .... Pennsylvania
Chen, T. T., Ph.D. ......................... Florida
Churchich, Jorge E., Ph.D. ............ Sheffield
Handel, Mary Ann (Distinguished Prof.), Ph.D. .... Kansas State
Jeon, K. W., Ph.D. ......................... London
Joshi, J. G., Ph.D. ......................... Poona
Joy, D. C. (Distinguished Scientist), Ph.D. .... Oxford (UK)
Kennedy, J. R., Ph.D. ....................... Iowa
Liles, J. N. (Emeritus), Ph.D. .......... Ohio State
MacCabe, J.A, Ph.D. ....................... California (Davis)
Monty, Kenneth J., Ph.D. .............. Rochester
Roth, L. Evans, Ph.D. ..................... Chicago
Salo, T. P. (Emeritus), Ph.D. .......... Michigan
**REQUIREMENTS FOR ADMISSION**

Applicants for graduate study are expected to have a background equivalent to that required of undergraduate majors in this department. This includes a knowledge of the basic principles of biochemistry, cell biology, genetics, and physiology. Requirements for admission are:

1. One year of general biology or the equivalent.
2. A minimum of 8 semester hours of approved biology courses beyond the introductory level and including the subject areas of genetics, cell biology and physiology.
3. Two years of chemistry including one year of general chemistry and one year of introductory Organic Chemistry with laboratory.
4. At least one semester of biochemistry.
5. One year of calculus.
6. One year of physics.
7. Graduate Record Examination scores.
8. A minimum grade-point average of 3.0 out of 4.0.

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

**THE MASTER'S PROGRAM**

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

**THE DOCTORAL PROGRAM**

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

**Petitioning for Master's Degree**

Students who have passed the comprehensive examination in the Ph.D. program and have completed at least 30 hours of approved coursework for graduate credit, at least two thirds of which must be at or above the 500 level, may petition the department for award of a master's degree. The additional requirements for such a degree are:

1. The preparation of a research manuscript suitable for submission for publication in a major scientific journal and oral defense of that manuscript before an examining committee of three faculty members appointed by the head of the department, at least two of whom shall be members of the department;
2. Publication of at least one full-length paper in a major scientific journal as senior author.

**ACADEMIC COMMON MARKET**

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

**GRADUATE COURSES**

403 General Genetics Laboratory (3) Experiments designed to illustrate basic principles of inheritance; primary organism--Drosophila. Prereq: General Genetics 2 lab.

410 Cellular and Comparative Biochemistry (4) Electrophoretic behavior, chemical structure and properties of proteins; enzyme behavior and biological function; energy capture; synthetic metabolisms; nucleic acid function; protein synthesis; and biochemical genetics; regulation of biological processes. Prereq: Organic Chemistry and General Biology. 3 hrs and 1 discussion. F,Sp


421 Cell and Tissue Structure and Function (4) Study of animal cells and tissues at light and electron microscope levels. Prereq: Cell Biology. 2 hrs and 2 labs.

430 Immunology (3) (Same as Microbiology 430.)

439 Immunology Laboratory (2) (Same as Microbiology 439.)


440 Laboratory in Physiology (2) Prereq: Coreq: 440.


471-81 Biophysical Chemistry (3,3) Biophysical chemical principles with applications to biological systems. 471--

Thermodynamics; chemical equilibria; solution chemistry; transport; electrochemistry; kinetics; enzyme catalyzed reactions. 481-Elementary quantum chemistry; intermolecular light with biological molecules; optical and magnetic spectroscopy; light scattering; case studies of selected macro molecules. Prereq: Calculus, Organic Chemistry, General Biology or consent of instructor. (Same as Chemistry 471-81.) F,Sp

480 Physiology of Exercise (3) (Same as Exercise Science 480.)

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

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

511 Advanced Protein Chemistry and Cellular Biology (5) Cellular structure and function at the molecular and supramolecular level in the progression: protein structure and function; membrane structure and function; signal transduction and cell regulation; cellular organelles and membrane biogenesis; cytoskeleton and cell motility; cell-cell interactions and tissue engineering. Prereq: Prior knowledge of cell biology and biochemistry and consent of instructor. F

512 Advanced Molecular Biology (3) Regulation of nucleic acid expression and activity; nucleic acid structure and function; replication and repair of nucleic acids; gene expression; protein synthesis; post-translational/proteolytic modification; hormones, and proteins; cell cycle and cell growth. Prereq: 511 or consent of instructor. (Same as Life Sciences 512.) Sp

515 Experimental Techniques 1 (4) Modern experimental methodology and instrumentation lab; cell growth; spectrophotometry; microscopy; nuclear acid purification and analysis; protein analysis; enzyme purification; electrophoresis; computer analysis of nucleic acids; and protein sequences. Lecture on theory of laboratory to accompany two lab periods per week. Primarily for departmental graduate students. Prereq: Consent of instructor. F

516 Experimental Techniques 11 (3) Laboratory rotations. Students work in laboratory of faculty member on clearly defined project. Written proposal and oral report. Primarily for departmental graduate students. Prereq: 515. Sp

517 Physical Biochemistry (3) Physics and chemistry of biological systems and molecules. Thermodynamics; diffusion and transport; physical chemistry of biomolecules; enzyme kinetics; binding reactions; spectroscopy; electrophysiology. Prereq: 511 or consent of instructor. F

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

521 Advanced Mammalian Physiology I (4) (Same as Comparative and Experimental Medicine - Veterinary Medicine 521.)

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

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

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

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

561 Environmental Toxicology (3) Basic concepts in toxicology; molecular toxicology and detoxification; reproductive toxicology; mutagenesis, teratology, carcinogenesis, pathologic changes and environmental
Biomedical Sciences

(Office of the Vice Chancellor for Academic Affairs)

MAJOR DEGREES

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

Raymond A. Popp, Director

Professor:

Olins, Donald E., Ph.D. .......... Rockefeller
Popp, Raymond A., Ph.D. ........ University of

Research Professor:

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

Assistant Research Professor:

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

Shared faculty are drawn from the Oak Ridge National Laboratory.

The University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, located within the Biology Division of Oak Ridge National Laboratory, offers programs leading to the Master of Science and the Doctor of Philosophy. The National Laboratory is a well-known center of basic research. The school utilizes the staff and facilities of this laboratory and thus brings directly into the mainstream of full-time graduate study in the life sciences the talent and experience of that staff, as well as the most advanced research methods and technology.

The program of study, which incorporates a high faculty-to-student ratio, is based on intensive graduate courses supplemented by tutorial instruction, participation in a wide variety of seminars, and a heavy emphasis on communication skills, research training, and independent study. The program encourages students to pursue graduate studies to the limits of their abilities.

Each student's curriculum is planned to meet individual needs, with the aim of giving: (1) strength in the basic sciences, (2) perception of the biomedical sciences as a whole, and (3) experience and training in a chosen specialty.

The concentration areas available for master's thesis and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, genetics, cellular, developmental and mammalian genetics, and radiobiology. Included are such subjects as immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation and environmental biology, virology, developmental biology, experimental pathology, microbial and mammalian genetics, mutagenesis, structural biology, and genomic analysis.

A dissertation report of the results of original and significant scientific research. A minimum of 24 semester hours of course work is required.

1. A final oral examination on the dissertation.

2. A formal seminar presentation of the dissertation research.

ADMISSION REQUIREMENTS

A Bachelor's degree or its equivalent is required. Students with M.S., D.V.M., or M.D. degrees are also encouraged to apply. Completed applications, Graduate Record Examination scores and letters of reference should be sent to the address below. The student will need preparation in biology, calculus, physics, and organic and physical chemistry. A course in physical chemistry is offered by the school in order to meet the last requirement. It is recommended that deficiencies in preparation, as identified in the admission process, be eliminated prior to entrance.

Requests for application forms, information on admission, financial aid, and of specialization should be sent to Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Division, ORNL, Box 2009, Oak Ridge, Tennessee 37831-8077.

THE DOCTORAL PROGRAM

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

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

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

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

5. Passing both written and oral comprehensive examinations.

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

7. A final oral examination on the dissertation.

8. A formal seminar presentation of the dissertation research.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

The graduate faculty has designed a Master of Science program in Biomedical Sciences primarily to fill the need for such a degree within the Oak Ridge National Laboratories; however, a limited number of students from other institutions may be accepted if qualified and space is available. The requirements for the degree are:

1. Graduate credit or a proficiency in the following core courses or their equivalents: Biochemistry (511); Biophysical Biochemistry (514); Cell Biology (518); plus any three of the following courses: Genetics (515); Statistics for Biologists (574); or Computing for the Life Sciences (525). Additional credit may be obtained (6 to 15 hours) with electives.

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

3. For admission to candidacy: Completion of any required prerequisite courses and one semester of graduate coursework with a B average. Admission to candidacy forms must be filed at least one full semester prior to receipt of degree.
4. A master's committee of three approved faculty members upon admission to candidacy.
5. A thesis reporting results of original and significant scientific research.
6. Passing a final oral examination.

**GRADUATE COURSES**

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

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

**507 Physical Chemistry (3)** Thermo-dynamics; phase equilibria; chemical equilibrium; electro motive force; surface chemistry; electrolyte solutions; kinetics; conductance; viscosity; diffusion.

**511 Biochemistry (3)** Chemistry of carbohydrates, lipids, proteins, and coenzymes; enzyme kinetics intermediary metabolism and photosynthesis; biosynthesis of amino acids, lipids, and macromolecules. Coreq: 507.

**514 Biophysical Biochemistry (3)** Chemistry of amino acids, lipids, and coenzymes; enzyme kinetics intermediary metabolism and photosynthesis; biosynthesis of amino acids, lipids, and macromolecules. Coreq: 507.

**515 Genetics (3)** Mendelian genetics, mitosis and meiosis; transmission genetics; mapping and linkage; genetics of plant systems. Coreq: 507.

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

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

**543-44-49 Graduate Research Participation (3,6,9)** Special advanced research project not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

**551 Special Topics in Biomedical Sciences (3,3,3)** Elective tutorials or formal lectures. Potential topics: X-ray diffraction and crystallography; excited-state biophysics; physical chemistry or macromolecules; pathology; mammalian genetics coverage.

**600 Thesis**

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

**651-52-53 Advanced Topics in Biomedical Sciences (3,3,3)** Either tutorials or formal lectures. Potential topics: X-ray diffraction and crystallography; excited-state biophysics; physical chemistry or macromolecules; pathology; mammalian genetics coverage.

**660 Mammalian Genetics (3)** Known genetic variants affecting each organ system of experimental mammals, especially laboratory mice. Inheritance of phenotypical traits in rodent stocks and other laboratory animals. Prereq: 515.

**ADMISSION REQUIREMENTS**

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

1. Bachelor's degree: a B.A. or B.S. from an accredited college or university and a cumulative grade-point average of 2.5 or better (on a 4.0 scale), with evidence of ability to do work of graduate quality.
2. General botany or general biology: 8 semester hours.
3. Advanced botany or closely allied biological sciences: 8 semester hours.
4. Physical sciences: general inorganic chemistry; 8 semester hours; organic chemistry. Physics highly recommended.
5. College mathematics: 6 semester hours including 1 term of calculus. Evidence of a broad undergraduate background, an ability to do work of graduate quality, and an interest in the study of plant science are considered to be much more important than the particular courses taken as an undergraduate. Accordingly, students lacking specific prerequisite courses but otherwise qualified may be admitted to graduate studies in botany. In such cases, the deficiencies should be removed as soon as possible, typically during the first year of the student's graduate program. The determination of deficiencies and the manner in which they will be removed will be decided upon by the student's pro-tem committee during the first meeting with the student.

**THE MASTER'S PROGRAM**

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

**Thesis Option**

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

1. Satisfactory preparation of a written form and an oral defense to the student's committee of a research proposal suitable for a thesis. This must be completed before enrollment in Botany 500.
2. Successful completion of 30 hours of graduate credit, at least two-thirds of which must be at the 500 level or higher.
3. Satisfactory completion of two hours at the 600 level.
5. Presentation of a 30 minute departmental seminar.
6. Educational service in the form of teaching and/or ancillary services; consult major professor and department head.

**Non-Thesis Option**

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

**THE DOCTORAL PROGRAM**

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

1. Satisfactory presentation of a research problem by means of a written proposal and an oral defense to the student's committee. This must be completed before enrollment in Botany 500.

2. Satisfactory performance on a written comprehensive examination.

3. Presentation of one or more cognate areas outside of the department totaling 6 hours of graduate credit with at least a B average.

4. Satisfactory performance on an examination in one of the foreign languages (see Graduate Coordinator) or an A or B in French 302 or Spanish 332.

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


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

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

GRADUATE COURSES

401-02 Field Studies in Botany (1-3, 1-3) Field experience and taxonomy of special plant groups. Topics vary: Bryology, lichenology, pteridology, agrostology, mycology, phycology, aquatic vascular plants, synanthrology, woody plants, and botanical photography. May be repeated under different topics. Maximum 9 hrs.


404 Plant Molecular Biology (4) Current research in plant molecular biology: techniques and procedures. Genome structure, gene expression and regulation, transformation, transposable elements, plant development. Labs: isolation of DNA and RNA, molecular hybridization, isolation and preparation of plasmids, PCR amplification of specific genes, sequencing and transformation. Prereq: General genetics with grade of B or better and consent of instructor. 2 hrs and 4 labs.

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

451 Plant Tissue Culture (3) Methods for culture of cells, tissues, and organs: media preparation and maintenance of cultures. Prereq: 110-20 or Biology 110-20 and Chemistry 130-20 or equivalent. Recommended prereq: 310-20, 321, 412; Microbiology 310 or 319; Ornamental Horticulture and Landscape Design 320; and Plant and Soil Science 331.

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

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

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

503 Non-Thesis Research (2) Library, field, or laboratory research under supervision of staff member. Not for thesis candidates. May be repeated. Maximum 4 hrs. E

506 Phyiology (4) Comparative study of major algal phyta, both freshwater and marine: morphological, developmental, ecological, taxonomic and phylogenetic aspects. Field and laboratory studies, identification, classification, experimentation. Prereq: 310 or consent of instructor. 3 hrs and 1 lab. F, A

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

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


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

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

544 Seminar in Botany (1) Readings and discussions of current literature and/or selected topics in botanical research. May be repeated. Maximum 8 hrs. S/NC only.

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

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

582 Methods and Instrumentation in Laboratory Investigation (1) Project experience and theoretical background in various research methods, on exchange of results, adaption spectroscopy, disc electrophoresis, polyacrylamide sequencing and transformation. Prereq: General genetics with grade of B or better and consent of instructor. 2 hrs and 4 labs.

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

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

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

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

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

ASSISTANT PROFESSORS:

Moore, Barbara A., Ph.D. .................. Georgia

Jackson, Evelyn, Ph.D. .................. Ohio State

Bates, Benjamin J., Ph.D. .................. Michigan

Ziegler, Dhyana, Ph.D. .................. Southern Illinois

Assistant Professors:

Holt, Darrel W. (Emeritus), Missouri

Jackson, Evelyn, Ph.D. .................. Ohio State

Wilkinson, Jeffrey, Ph.D. .................. Georgia

The Department of Botany offers a concentration area for the master's with a major in Communications and participates in the interdisciiplinary doctoral program. See Communications for additional information.

GRADUATE COURSES

410 Electronic News Gathering (3) Writing, reporting, producing, and performing news on television. Experience as reporter/producer for television news program. Electronic news gathering equipment and techniques, video editing. Prereq: Radio-TV News 1 hr and 4 labs. E


430 Electronic Field Production (3) Principles of video production on location. Concepts relating to message design, development, and production in field: concept development, script writing, shooting graphics, sound design, lighting, and editing. Prereq: Audio/Video Production or consent of instructor. E

440 Corporate Video (3) Special requirements of business, industrial, educational, and medical uses of video. Management, budgeting, planning, producing, and evaluating projects. Prereq: Audio/Video Production or consent of instructor.


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

470 Cable Television and Emerging Technologies (3) History and structure of cable television industry. Cable regulations and programming. Entry of telephone companies in distribution video. Analysis of all relevant technologies and direct broadcast satellite, fiber optics, cable, high definition television, and others. Prereq: Introduction to Radio and Television or consent of instructor.


490 Radio & Television Management (3) Business policies and practices of cable television industry. Management, budgeting, planning, producing, and evaluating projects. Prereq: Audio/Video Production or consent of instructor.


540 International Broadcasting (3) Broadcasting systems in other countries. Analysis of international broadcasting organizations. Inter-cultural communication and international broadcasting. Development of international broadcasting and international cooperation. Prereq: Consent of instructor or admission to program.

550 Corporate Video (3) Special requirements of business, industrial, educational, and medical uses of video. Management, budgeting, planning, producing, and evaluating projects. Prereq: Audio/Video Production or consent of instructor.

560 International Broadcasting (3) Broadcasting systems in other countries. Analysis of international broadcasting organizations. Inter-cultural communication and international broadcasting. Development of international broadcasting and international cooperation. Prereq: Consent of instructor or admission to program.

570 Radio & Television Research (3) Various techniques used by stations and consultants in broadcast research. Applied audience research. Deciding which method to use, interpreting results, and applying re-
Business Administration

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state basis. The Ph.D. in Business Administration is available to residents of Alabama, Florida, or Kentucky (concentration in logistics and transportation only), or West Virginia; the MBA is available to residents of Louisiana (concentration in forest industries management or logistics and transportation), Alabama, Florida or Texas (concentration in logistics and transportation only), or West Virginia. Applications for admission to the MBA program in the College of Business Administration, and those for admission to the MBA program in the College of Law, should be submitted directly to the MBA program in the Office of Graduate Business Programs, Suite 527, Stokely Management Center, College of Business Administration, The University of Tennessee, Knoxville, TN 37996-0552.

ACADEMIC STANDARDS

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

MBA Core

The MBA core consists of two 15-hour courses, one taken each semester. The courses are taught by the MBA core faculty in an integrated fashion and through a year-long simulation requiring students to learn the functional fundamentals (accounting, finance, management, marketing) when they need to apply them to solving a specific business problem. The topics introduced within this course follow three major themes: the functional fundamentals (learned within a cross-functional framework); the role of the firm in society (with attention to stakeholder value, economics, and the ethical and legal environment of the firm); and personal and team development. Students will be exposed to the assessment and delivery of customer value, statistical process control, continuous systems improvement, and the role of quality in competitive organizations.

Students in the first-year core undertake active learning within a team-based environment. Many core requirements are experiential exercises in which self-discovery within a team setting is an important element of the learning process. Individualized support is provided for developing both written and oral communication skills.

Concentration and Electives

A concentration area may be indicated on the MBA Program Application or this declaration may be deferred until after matriculation. In any event, selection must be made no later than the fall semester after completion of the first year. Requests for changes in concentration area must be submitted for approval to the Office of Graduate Business Programs.

Programs among the 24 credit hours in the concentration/electives block, at least 9 but not more than 12 must be in one of the following concentration areas. For specific courses required in concentration areas, see the appropriate field of instruction.

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

The remaining elective courses must be in fields outside the concentration area, normally selected from MBA courses offered in other departments of the college. Courses outside the College of Business Administration as well as courses listed in the Graduate Catalog numbered below 500 may be included in this block only with written prior permission via
formal petition to the Office of Graduate Business Programs.

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

**Concentration Area:** 3 hours (provided at least 8 hours of work at this institution are included in the concentration area).

**Elective Area:** 6 hours

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

**Other Requirements**

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

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

**BUSINESS ADMINISTRATION CONCENTRATIONS**

For complete listing of MBA program requirements, see above.

**MBA Concentrations:** Global Business, New Venture Analysis and Entrepreneurship.

In recognition of the growing globalization of business activity and the importance of the international environment to successful management of every firm, the MBA program offers a concentration in global business. The concentration comprises at least two courses taken from Economics 424, Logistics 407, Management 571, and departmental special topics courses with international content; and at least one but not more than two additional courses from the previous list, or from a list of electives as approved by the Director of Graduate Business Programs. Students pursuing a concentration in global business are strongly encouraged to pursue it as a second concentration in addition to one of the traditional departmental concentrations. Students pursuing this concentration are also strongly encouraged to pursue an international or internationally related internship for the summer between their first and second years in the MBA program. Students are expected to participate in a foreign exchange or field experience if at all possible, especially for those with no previous foreign experience. Language training is advised but not required, and beginning language courses are not typically available for graduate credit.

The concentration in new venture analysis and entrepreneurship is comprised of three specifically designed courses which are interdisciplinary in nature. This concentration strives to build a strong academic foundation for both entrepreneurial and intrapreneurial activities. The new venture analysis and entrepreneurship concentration is offered in recognition of the growing trend in American business today towards new product/venture development. The new venture analysis/entrepreneurship concentration courses may be combined with two elective courses in another area (management or marketing) to achieve a dual concentration.

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

**PRE-MBA PROGRAM**

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

Admission requirements are higher than those normally expected of MBA applicants. Desired qualifications include a minimum 3.4 GPA and a GMAT score of 600 or higher. Students interested in the program are counseled initially in the Arts and Sciences Advising Center regarding admission standards and Arts and Sciences requirements. At the end of their second year, they have a conference with the Director of Graduate Business Programs and are advised of their prospects for formal admission. Students who are likely candidates are advised to take the Graduate Management Admission Test in October of the third year, and to submit an application to the MBA program. The admission decision is made by January of the third year.

Upon admission, students begin MBA coursework in the fourth year and are awarded a BA degree at the end of that year. Upon successful completion of the fifth year (minimum of 30 semester hours of graduate credit), the student receives the MBA degree.

**DUAL J.D.-MBA PROGRAM**

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

The establishment of the dual program recognizes the increasingly complex body of knowledge necessary to the creative conduct of business and business-related law practice, the complementary nature of many aspects of the graduate programs of the College of Law and the College of Business Administration, and the intellectual benefits inherent in the concurrent study of both business and business-related law. The program is designed to accommodate the interests of students who (a) contemplate a career in public service and want to acquire the skills and perspective of the lawyer and the business-oriented manager, (b) contemplate a career in business management and want to acquire the skills and perspective of a lawyer, or (c) contemplate a career as a lawyer specializing in business-related law and want to acquire the skills and perspective of the business-oriented manager.

**Admission Requirements**

Applicants for the J.D.-MBA program must make separate applications, and be competitively and independently accepted by, the College of Law for the J.D., The Graduate School and College of Business Administration for the MBA degree, and by the Dual Program Committee. Students who have been accepted by both colleges may apply for approval to pursue the dual program anytime prior to, or after, matriculation in either or both colleges. Such approval will be granted, provided that dual program studies be started prior to entry into the last 28 semester hours of J.D. coursework and prior to entry into the second year of the MBA program. Students interested in entering the dual degree program should submit a letter of application to the Dual Program Committee. Upon receipt of the application, the Dual Program Committee will determine eligibility and assign students to advisors who will be responsible for course approval and supervision of the student's progress through the dual program.

**Curriculum**

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

The College of Law will award up to 9 semester hours of credit toward the J.D. for acceptable performance in approved graduate-level courses offered by the College of Business Administration. The College of Business Administration will award up to 9 semester hours of credit toward the MBA for acceptable performance in approved courses offered in the College of Law. The approval of courses is the responsibility of the Dual Program Committee and the student's assigned advisor.

Students may begin their studies in either the J.D. or the MBA program, but may not enroll in MBA coursework while completing the first year of the law curriculum and may not enroll in J.D. coursework while completing the first year of the business curriculum. During the first year in the J.D. program, students register through the College of Law. For any term in which students take MBA courses, even though they are also taking law courses, they must register through The Graduate School. The Graduate School registration form must be approved by the Director of Graduate Business Programs.

**Awarding of Grades**

Grades for graduate business courses accepted by the College of Law and grades for law courses accepted by the College of Business Administration will be converted to
either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college in which such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for lower grades. The College of Business Administration will award a grade of Satisfactory for a law course in which the student has earned a 2.3 grade or higher and a No Credit for lower grades. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The official academic record of the student maintained by the Registrar of the University shall show the actual grade assigned by the instructor without conversion.

Approved Dual Credit
MBA courses to be counted toward the J.D. program must include 9 semester hours approved by the College of Law. Law courses to be counted toward the MBA must be selected from those approved by the Director of Graduate Business Programs.

EXECUTIVE MBA PROGRAM
The executive MBA is designed for professionals holding middle and upper level positions in organizations who wish to support their attainment of an MBA degree. The objective of the program is to provide advanced management skills to individuals who play key roles in leading their organizations.

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

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

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

For admission to this program, primary consideration is given to the applicant's work history and the recommendation from the sponsoring organization and the GMAT. There is no cut-off for either grade-point averages or GMAT scores, however, admission to the program is competitive, and applicants will be evaluated on their ability to operate on a par with other high achieving participants.

Curriculum
The program is taught by a core faculty of 10 professors assisted by other faculty on an ancillary basis. The core faculty develop the entire curriculum and teach it in an integrated, interdisciplinary manner.

The MBA program for executives is completed in three terms and requires registration for 15 hours in each term. The first term is comprised of Executive Core I and Management Project I; it includes two residence sessions. The second term is comprised of Executive Core II and Management Project II; it includes two residence sessions the first of which will be in some international venue. The third term is comprised of Executive Core III and Management Project III. It includes two residence sessions.

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

The management project is carried out as an independent project with faculty advisor. It involves the diagnosis and analysis of some significant aspect in the sponsoring organization and is based on applying major themes in the core courses. The written project and presentation to senior management and faculty serves as the comprehensive examination.

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

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

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

The Taiwan executive MBA is a three semesters of 16 credit hours each, including the same core and project courses described for the Knoxville program. Between each semester, there is a term when students are not enrolled. The program begins in the Summer term, continues in Spring semester of the following calendar year and is completed in the Fall semester of that same year. All participants begin and complete the program together.

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

Admissions Requirements for the Executive MBA in Taiwan
To be considered for admission, the applicant must have the equivalent of a U.S. bachelor's degree and 10 or more years of work experience. Applicants must submit a complete application file including the Graduate School application, official transcripts of prior college work, and the executive MBA program application with a recommendation from their company. Admission to the program is competitive. Primary consideration is given to the applicant's work history and the recommendation from the applicant's manager, and applicants will be evaluated on their ability to operate on a par with other high achieving participants.

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

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

Admission Requirements
Students seeking a Ph.D. degree must be recommended for acceptance by the College of Business Administration to The Graduate School. Actual admission is based on the applicant's overall standing compared with other applicants and with the number of vacancies in each department. The Graduate School requires the Graduate School Application, transcripts from all previous college work, and additional information from international students. The college requires the Ph.D. application, scores from the GMAT, and four written recommendations. All materials should be received by the College of Business Administration not later than March 1. Late applications are considered only if space is available.

Under exceptional circumstances, a student may be considered for acceptance into the Ph.D. program without having a master's degree. An applicant in this situation should have an outstanding undergraduate background and should represent a deep and sincere commitment to the pursuit of a career in research and instruction.
Program of Study

The Ph.D. normally requires at least three years of intensive study and research beyond the master’s degree. Typically, the first two years of a student’s program consist of coursework, writing, and research. The third year usually focuses on completion of the dissertation research and writing. It is emphasized that the Ph.D. program of study is structured for full-time students only. Upon acceptance of a student by a particular departmental faculty, the student is expected to remain in residence until the dissertation has been completed and all requirements are met for completion of the Ph.D.

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

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

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

1. Accounting
2. Finance
3. Logistics and Transportation Management
4. Marketing
5. Statistics
6. More detailed information concerning these specific areas is available by writing directly to each department chairperson and by referring to the appropriate fields of instruction.

Degree Requirements

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

1. Students must complete at least three years of full-time coursework beyond the baccalaureate degree, with two years of residence on the Knoxville campus.
2. Students are required to have a sound and broad base on which to build their Ph.D. coursework. The departmental doctoral advisor will work with the student to determine what, if any, course work need to be completed. All such work is subject to approval by the temporary doctoral advisory committee and the Director of Graduate Business Programs. Specific concentrations may have prerequisites.
3. Research Tools: A minimum of 9 semester hours of coursework in research methods must be completed. At least 6 semester hours in statistics courses beyond Statistics 531 are required. The remaining 3 semester hours may be completed in additional statistics courses (not to include Statistics 531) or in other areas such as research methodology, management science, computer science, econometrics, and psychometrics.
4. Concentrations: The concentration is the focal point of the Ph.D. program. Students are expected to master the literature and research techniques in the concentration area and to do quality research as evidenced by the preparation of an acceptable dissertation. A minimum of 12 semester hours of coursework is required, including at least 9 hours of doctoral seminars.
5. A minimum of 9 semester hours of graduate coursework is required in an area outside, but complementary to, the concentration. The student may choose the cognate from one of the following: one of the six concentration areas listed above, economics, or a related area in another school or college of the University.

Comprehensive Examinations

Comprehensive written examinations over the concentration area are required of each person seeking candidacy for the Ph.D. degree. This examination is administered in two sessions of approximately four hours each.

Students qualify in the cognate area by completing a one-session, four-hour examination or an equivalent jointly approved by the student’s major professor and the student’s advisor in the cognate area. Comprehensive examinations are generally offered during the fall and spring terms. Comprehensive examinations must be taken within five years of matriculation.

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

Doctoral Committee

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

Admission to Candidacy

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

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

Dissertation

Minimum of 24 semester hours: The student must complete a dissertation embodying the results of original research demonstrating the ability to do scholarly writing. The dissertation is reviewed by the student’s doctoral committee, which must certify its completion and acceptability after oral defense of the candidate’s research effort.

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

GRADUATE COURSES

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

505 Core II (15) Continuation of 504. Functional fundamentals through year-long case. Case-study work on organizational reaction, corporation, managing technology, ethics and social responsibility, and strategic planning. Capstone integrated business simulation. Pre: Admission permission to MBA program or consent of Director of Graduate Business Programs.

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

510 Management of Responsive Service Organizations (3) Management of organizations which respond to customer requests rather than to produce inventory of non-product economics, relationship building and management methods built on enabling, empowering, monitoring and mentoring employees to diagnose and respond to individual customer needs.

511 Executive Core I (12) Integrated semester course: two 11-day periods in residence with substantial reading, study and analyses during off-site periods. Integration of major business functions through strategic perspective. Application of functional knowledge to tactical and strategic issues. Role of firm in society as it treats economic/legal environment and develops purpose of firm as delivering value to customers and other stakeholders. Ethical issues. Personal development for leadership: individual interpersonal skills of communication, negotiation, leadership and motivation. Customer value and systems management: determination and delivery of customer value. Cases, simulations and exercises. Pre: Admission to executive program of MBA. Coreq: 561.


553 Executive Core III (12) Continuation of 552. One 11-day period and one two-week period of residence at
Graduate programs lead to the degrees of Master of Science and Doctor of Philosophy in Chemical Engineering with concentrations in chemical engineering, chemical bioengineering, advanced control systems, and polymer science and engineering.

**THE MASTER’S PROGRAM**

**Thesis Option:** The standard master’s program includes a thesis and leads to the Master of Science. Minimum departmental requirements are as follows:
1. A total of at least 21 hours in graduate coursework in chemical engineering and related areas excluding the thesis. The minimum requirements are 15 hours in chemical engineering; 3 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 3 hours chosen from either of these two categories.
3. Active participation in graduate seminars in the department. Resident students must register for ChE 501 every semester it is offered.
4. A final oral examination covering the thesis, related fields and graduate coursework.

**Non-Thesis Option:** Under certain conditions, a candidate may apply for a non-thesis program. To be eligible, a candidate must show evidence of significant professional experience after the baccalaureate degree; at least five years of industrial experience or research publications would be examples of such evidence. The departmental faculty will consider each application individually. Upon acceptance, the requirements for completion of the non-thesis option are as follows:
1. A total of at least 33 hours in graduate courses in chemical engineering and related areas. The minimum requirements are 18 hours in chemical engineering; 6 hours in other engineering, scientific, or business areas (as approved by the departmental faculty); and 9 hours chosen from either of these two categories.
2. Completion of a critical review of the literature and other sources in an area related to chemical engineering (CHE 580).
3. A written comprehensive examination over the major field and an oral examination covering the review paper and related areas.

**THE DOCTORAL PROGRAM**

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

Department requirements consist of the satisfactory completion of:
1. Graduate courses in chemical engineering, amounting to approximately 24 semester hours, at least 9 of which must be in 600 series courses.
2. Supporting courses in related scientific and engineering fields amounting to approximately 24 semester hours, subject to approval by the student’s faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.
3. The comprehensive examination, consisting of a written part and an oral part. The written part covers thermodynamics, reactor analysis, and transport phenomena and separations.
4. Active participation in graduate seminars conducted by the department. Resident students must register for ChE 501 every semester it is offered.

**GRADUATE COURSES**

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


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

461 Advanced Process Dynamics and Control (3) Process control system simulation and advanced industrial system design. Cascade, feedback, multi-variable, deadtime, adaptive, and nonlinear control system design. Both computer and laboratory work. Lab. Prereq: ChE 360.


485 Hydrocarbon Processing (3) Chemical and physical properties of petroleum and other feedstocks and those processes used in conversion of raw material into various fuels and selected chemical feedstocks. Prereq: Mass Transfer and Separation Processes. Organic Chemistry.

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

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester in which the student uses facility for which faculty-time has been assigned. May not be used toward degree requirements. May be repeated. S/NC only. E

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

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

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

(College of Arts and Sciences)

MAJOR

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

William Bull, Acting Head

Professors:

Adcock, J. L., Ph.D. ..................... Texas
Alessandratos, S. D., Ph.D. .......... California
Baker, D. C., Ph.D. ...................... Ohio State
Bartmess, J. E., Ph.D. ............... Northwestern
Bloor, J. E. (Emeritus), Ph.D. ...... Manchester
Bull, W. E., Ph.D. ...................... Illinois
Chambers, J. Q., Ph.D. ............... Kansas
Compton, R. N., Ph.D. ............... Tennessee
Cook, K. D., Ph.D. ...................... Wisconsin
Dean, J. A. (Emeritus), Ph.D. ...... Michigan
Eastham, J. F. (Emeritus), Ph.D. ... Minnesota
Grimm, F. A., Ph.D. ..................... Cornell
Guichon, G. (Distinguished Scientist), Ph.D.

Kabalka, G. W. (Distinguished Prof.), Ph.D.

Kleinfechter, D. C., Ph.D.............. Princeton
Kovac, J. D., Ph.D. ...................... Yale
Lietzke, M. H. (Emeritus), Ph.D. .... Wisconsin
Magid, L. J., Ph.D. ...................... Tennessee
Magid, R. M., Ph.D. ...................... Yale
Pagni, R. M., Ph.D. ...................... Wisconsin
Peterson, J. R., Ph.D. .................... California
Schweitzer, G. K. (Distinguished Prof.), Ph.D.

Sepaniak, M. J., Ph.D. ............... Illinois
Smith, W. T. (Emeritus), Ph.D. ...... Ohio State
VanHook, W. A., Ph.D. .............. Johns Hopkins
Wehry, E. L. (Emeritus), Ph.D. ...... Purdue
Williams, T. F. (Distinguished Prof.), Ph.D.

Wood, C., Ph.D. ......................... New York
Wunderlich, B. (Distinguished Scientist), Ph.D.

Northwestern

Associate Professors:

Barnes, C. E., Ph.D. ................. Stanford
Feigler, C. S. (Liaison), Ph.D. ...... Colorado
Lane, C. A., Ph.D. ...................... California
Schell, F. M., Ph.D. ...................... Indiana

Assistant Professor:

Dadmun, M. D., Ph.D. ............... Massachusetts
Hinde, Robert J., Ph.D. .............. Chicago
Xue, Z. B., Ph.D. ...................... California

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

THE MASTER'S PROGRAM

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

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

1. Research and a thesis to give 6 to 12 hours of graduate credit in Chemistry 501.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar. (No more than 2 hours may be applied to the course requirements.)
3. Prescribed remedial courses based on performance on entrance examinations.
4. Sufficient graduate coursework in chemistry (at the 400 level or above) and/or a related field to make an overall total of 30 hours, including one of the following sequences: 530-31-32, 550-51-52, 570-72-73, 590-94-95, or three courses from 510-11-12-20. At least 14 hours of this graduate coursework must be at the 500 level or above.
5. A final oral examination.

THE DOCTORAL PROGRAM

The department offers concentrations in eight areas for the Ph.D.: analytical chemistry, chemical physics, physical chemistry, polymer chemistry, and theoretical chemistry.

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

1. Research and a dissertation to give at least 24 hours of graduate credit in Chemistry 600. Registration must be continuous from the beginning of research.
2. Participation in seminar (Chemistry 501) during the entire period of graduate study, including the presentation of at least one seminar.
3. Prescribed remedial courses based on performance on entrance examinations.
4. Completion of the comprehensive examination series and defense of an original research proposal to give 2 hours of credit in Chemistry 601.
5. Eighteen additional hours in courses at the 500 level or above including at least one course above 601 and one of the following sequences: 510-11-12, 530-31-32, 550-51-52-53-54, 570-71-72-73, and 590-94-95.
6. A final oral examination. The Ph.D. program with concentration in chemical physics is conducted jointly with the Department of Physics. Requirements depend on the choice of the major department. Chemistry departmental requirements include passing the above degree requirements in chemistry with concentration in physical chemistry plus 6 additional hours in physics at the 500 level or above. Three of the additional physics hours can be used to satisfy the 18 hours requirement in item 5.

GRADUATE COURSES

430 Advanced Inorganic Chemistry (3) Atomic and molecular structure, band theory, descriptive chemistry of elements, kinetics and mechanism of inorganic reactions, applications of modern techniques for characterization, coordination and organometallic chemistry. Prereq: 230. Prereq or coreq: 380 or 381. 3p
The M.S. with a concentration in child development offers two tracks. Track 1 is designed to meet the needs of professionals who work in programs encompassing a variety of early childhood settings. Specializations in Track 1 consist of early childhood education, early childhood special education, early childhood administration and child development. Track 2 is designed for students seeking initial teacher licensure in early childhood education (pre-K through grade 3). Both tracks and non-thesis options are available for both tracks.

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

Track 2 - All students in the early childhood education licensure program must enroll in Human Ecology 564, 575, 591, and Holistic Teaching/Learning 505 (or equivalent CFS course). Thesis students are required to take: CFS 510 or 512; 3 hours of 500-level statistics; 3 hours of 500-level research methods; two courses selected from CFS 520, 521, 522, 530, 540, 525, 590; 6 hours of thesis credit; and an oral comprehensive examination (45 hours). Non-thesis students are required to take: CFS 510 or 512; three courses selected from CFS 520, 521, 522, 530, 540, 525, 590; 3 hours of 500-level statistical methods or interpretation of statistics and research methods; and a written comprehensive examination (36 hours).

Students in the early childhood education licensure program may choose to complete their M.S. degree requirements with a major in Child and Family Studies or Human Ecology.

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

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

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

THE PH.D. CONCENTRATION

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

Requirements include:
1. Minimum 10-13 credits in child and family studies required foundation courses: 510, 550, 570, 571 and 630 (child development area) or 634 (family studies area).
2. Minimum 12 credits in 500- and 600-level courses in child development or family studies, with at least 3 credits in 600-level courses (in addition to the required courses described in #1).
3. Minimum 6 credits in a cognate area.
4. Minimum 9 credits in graduate-level statistics; with at least 3 of those credits in a more specialized area than a sequence of survey courses.
5. Minimum 3 credits of specialized research methods.
6. Pre-doctoral research project approved by student’s committee.
8. Minimum 8 credits of electives.

ACADEMIC COMMON MARKET

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


521 Organizational Management in Early Childhood Education (3) Designing, implementing, and evaluating educational programs in early childhood education. Prereq: 510 or equivalent or consent of instructor.

522 Naturalistic Interventions for Parents and Teachers of Young Children (3) Common problems faced by parents and teachers; methods available to modify problem behavior. Prereq: 510 or equivalent or consent of instructor.

525 Seminar on Play (3) Comparison and contrast of theoretical frameworks and research methodologies on play. Developmental perspective on play.

530 Families of Handicapped Children (3) Developmental nature of family experience in caring for handicapped children, especially during infancy and early childhood. Prereq: 510 or consent of instructor.

540 Parent-Child Relations (3) Influence of parents on children, influence of children on parents, reciprocal interaction between parents and children, application of systems models, child abuse, and impact of divorce on children. Prereq: 550 or equivalent or consent of instructor.

550 Survey of Theory and Research in Family Studies (3) Use of family conceptual frameworks and application of theoretical models in research and family life programs.

551 Family in Contemporary Social Thought (3) Alternative conceptualizations of the family in current social thought. Variation of family construction by race, gender, and social class. Prereq: 550. F.A.

555 Children, Divorce and Remarriage (3) Children's and adolescents' adjustment to transitions involved in parental divorce, single-parenthood, and remarriage. F.A.

556 Marital Dyad (3) Communication, power, sexuality, marital stability, and marital satisfaction. Prereq: 550 or equivalent or consent of instructor.

558 Families in Crisis (3) Family processes during times of stress. Vulnerabilities and coping mechanisms of families. Prereq: 550 or equivalent or consent of instructor.

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

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

585 Practicum in Human Development or Family Studies II (3) School and community programs concerned with education for human development and family living. Prereq: 550 or equivalent or consent of instructor.

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

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

Civil and Environmental Engineering

(College of Engineering)

MAJORS

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

Gregory D. Reed, Head

Professors:

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

Associate Professors:

Chou, K. G., Ph.D................................. Northwestern
Hansen, J. H. (UTSI), Ph.D............................... Missouri
Miller, T. L., Ph.D................................. Tennessee
Moore, A. B., M.S................................. Tennessee
Richards, S. H., Ph.D................................. Tennessee
Robinson, K. G., Ph.D................................. VPI
Tiry, R. F. (Emeritus), B.S............................. Marquette

Assistant Professors:

Cox, C. D., Ph.D................................. Penn State
Han, L. D., Ph.D................................. California
Mauldon, M., Ph.D................................. California

The Department of Civil and Environmental Engineering offers degrees leading to the Master of Science and Doctor of Philosophy with a major in Civil Engineering and Environmental Engineering are

offered to graduates of recognized undergraduate curricula.

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

Civil Engineering

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

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

Non-Thesis Option: A minimum of 33 semester hours, including a 3-hour special problems is required. The special problem will be completed in a written report which must be approved by the student's major professor.

Environmental Engineering

For a Master of Science with a major in Environmental Engineering, normally a Bachelor's degree in a field of engineering is required. For a student who does not have an engineering background, the following minimum prerequisite courses will be required: Basic Engineering or Computer Science 101; Basic Engineering 121, 131; Engineering Science and Mechanics 231, Statistics 251; Civil Engineering 380, 385, 386; Mathematics 141, 142, 231, 241; Chemistry 120, 130. In general, these must be completed with a B average before courses for graduate credit can be taken.

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

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

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

Either option must be approved by the student's major professor. A student's program must include a minimum of 8 semester hours of advanced engineering design courses selected from a list provided by the student's committee.

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

THE DOCTORAL PROGRAM

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

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

1. A minimum of 72 semester hours beyond the Bachelor's degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 24 semester hours in 800 Doctoral Research and Dissertation will be required.

2. A minimum of 24 semester hours of graduate courses in civil engineering, exclusive of thesis or dissertation credit, at least 6 hours of which must be 900-level courses.
3. Supporting courses in related scientific and engineering fields, amounting to approximately 24 semester hours, subject to approval by the student's faculty committee. These related fields will normally include such disciplines as mechanics, chemistry, mathematics, microbiology, physics, and other engineering fields. A minimum of 9 semester hours of mathematics will be required beyond the civil engineering undergraduate requirements.

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

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

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

MINOR IN ENVIRONMENTAL POLICY

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

ACADEMIC COMMON MARKET

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

Civil Engineering

GRADUATE COURSES

406 Legal and Ethical Aspects of Engineering (2) Legal principles underlying engineering work; laws of contracts, torts, real property; problems of professional registration and ethics. Must be taken with grading option.

421 Portland Cement and Asphaltic Concrete (3) Aggregate properties and tests, tests of portland cement concrete, mix design methods for concrete and asphalt, concrete admixtures, tests of asphalt and asphalt mixes, and nondestructive testing. Prereq: 321 2 hrs and 1 lab.

451 Highway Engineering (3) Design, construction, operation, and maintenance of highway facilities; application of various engineering principles and techniques to process of planning, locating and design of highway facilities; both geometric and pavement design. Prereq: 210, 251, 325.

452 Traffic Engineering (3) Characteristics of driver, vehicle, and roadway and their interrelationships; traffic studies; basic considerations of traffic circulation and control; lighting; capacity analysis, roadway safety analysis and design. Prereq: 210, 251, 325.

453 Airport/Railroad Planning and Design (3) Airport master planning and railroad engineering. Runway configuration, airfield capacity, geometry and terminal layout and design. Railroad capacity, geometrics and systems layout and design. Prereq: 210, 251, 325.

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

472 Steel Design (3) Design of plate girders and composite beams; consideration of members subjected to combined stresses; design of typical framed building connections. Prereq: 477.

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

481 Principles of Hydrogeology (3) Same as Geology Sciences 486.

490 Water Resources Project Design (3) Coherent development of multipurpose project. Institution of framework; water law, evaluation procedures for comparing and selecting among water resources development alternatives, multi-objective planning, principles of engineering economics, benefit-cost analysis, and cost allocation methods; environmental impact assessment procedures; decisions using risk-based methods; case studies. Prereq: 390, 395.

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

495 Water Resources Development and Management (3) Principles of water resources project development and planning. Institution of framework; water law, evaluation procedures for comparing and selecting among water resources development alternatives, multi-objective planning, principles of engineering economics, benefit-cost analysis, and cost allocation methods; environmental impact assessment procedures; decisions using risk-based methods; case studies. Prereq: 390, 395.

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

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

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

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


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

532 Rock Mechanics and Rock Engineering (3) Engineering geology of various types of rock, rocks and rock masses. Discontinuity analysis, stress and strain, keyhole theory. Rehabilitation of rock slopes, underground excavations, foundations and groundwater flow. Prereq: Introduction to Soil Behavior or consent of instructor.


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

538 Finite Element Applications in Geotechnical Engineering (3) Applications of finite element method to various problems in geotechnical engineering. Conined and unconfined flow through porous media; stresses and strains in elastic halfspace; representation of nonlinear soil behavior with elastic and elasto-plastic models; soil structure interaction effects. Prereq: Introduction to Soil Behavior and 561.

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

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

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

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

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

552 Traffic Engineering-Operations (3) Signs, signals and operations; short-term operations; controllers; signal timing/phasing; one-way reversible flow; system operations; identification and correction of high-accident locations and system deficiencies. Prereq: 551 or 452.

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

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

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

556 Traffic Accident Reconstruction (3) Data collection and analysis as basis for accident prevention on control programs; road lane hardware design and crash testing. Prereq: 452 or graduate standing.

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

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

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

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

GRADUATE COURSES

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

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

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

510 Environmental Protection (3) Managing of water resources, wastewaters, air quality, solid wastes; hazardous materials; pollution prevention and control; and air and water quality management systems. Prereq: Consent of Instructor.

553 Aquatic Chemistry (3) Theoretical, applied and experimental study of aquatic systems, including the development of analytical methods for the study of aquatic quality. Prereq: Consent of instructor.

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

557 Hazardous Waste Site Remediation (3) Advanced study of processes for hazardous waste site remediation, including characterization, soil vapor extraction, soil washing, chemical decontamination, fuel cell technology, and remediation. Prereq: Consent of instructor.

590 Special Problems in Environmental Engineering (1-4) Problems and topics related to current development in field. May be repeated. Prereq: Consent of instructor.

595 Special Topics (1-4) Problems and topics related to current development in field. May be repeated. Prereq: Consent of instructor.

651 Analysis Techniques for Transportation Systems (3) Analysis of trip generation, trip distribution, mode split, and traffic assignment, employing mathematical, statistical, and computer science techniques. State of the art and new modeling techniques. Prereq: 554 or 555.

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

666 Reliability of Structural Systems (3) Development of reliability based design codes; design of structures; construction of reliable, efficient, and cost-effective structures. Prereq: Consent of instructor.

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

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

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

695 Special Topics in Environmental Engineering (1-4) Problems and topics related to current development in field. May be repeated. Prereq: Consent of instructor.
GRADUATE COURSES


400-06 Selected Readings from Greek Literature (3,3) For advanced students in Greek, plays, historical writings, poetry of ancient Greece in original Greek. Prereq: 401-402 or consent of instructor. May be repeated. Maximum 9 hrs.

414 Cicero and Techniques of Latin Prose Composition (3) For advanced students in Latin, practice in prose composition, writings of Cicero the model. Prereq: 351-52 or consent of instructor.

431-32 Selected Readings from Latin Literature (3,3) For advanced students in Latin, oratory, historical writings, poetry of ancient Rome in original Latin. Prereq: 351-362 or consent of instructor. May be repeated. Maximum 9 hrs.

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

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

651 Industrial Waste Unit Operations and Processes (3) Theoretical design and laboratory modeling of industrial waste treatment processes and operations. Prereq: 551, 553. Prereq or coreq: 552. 2 hrs and 1 lab.


653 Pollutant Fate Modeling and Risk Assessment (3) Application of scientific principles concerning movement and fate of chemicals at interfaces of air, water, and earth solids in environment. Methods of assessing risk posed by presence of those chemicals. Prereq: 551.

673 Microbial Systems Analysis (3) Same as Chemical Engineering 675.

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

The graduate courses in the Classics include the wider reading of Greek and Latin authors in a selected field, a more detailed study of one of the great genres of classical literature, and the development of background for the appreciation of Greek or Roman life and literature.

MAC 204 Introduction to Macromolecules and Biopolymers (3) Introduction to macromolecules and biopolymers with emphasis on structure, function, and interactions. Prereq: MAC 201 or equivalent.

C 691 Special Topics in Classical Civilization (1-3) Art, literature, religion, and society of Greece and Rome. May be repeated with consent of department. Maximum 9 hrs.

465 Roman Law (3) Development of Roman law through examination of cases from writing of Roman jurists, world's first legal professionals. Understanding legal institutions in relationship to Roman society. Roman property and contract law.

531 Special Topics in Latin Literature (3) Advanced study of classical or medieval Latin literature, authors selected by students and instructor. May be repeated. Maximum 9 hrs.

561 Special Topics in Classical Civilization (1-3) Advanced tutorial work in Greek and Roman authors in English translation; problems in cultures of Greece and Rome. May be repeated. Maximum 9 hrs.

Communications

(College of Communications)

MAJOR DEGREES

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

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

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

ADMISSION REQUIREMENTS

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

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

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

Students who have had no courses in their major area of concentration may expect to spend four or more full-time semesters in the program, including a media internship.
department internship may be required for those who do not have professional experience in the field they wish to study. A course in communications law is a prerequisite.

A student's internship experience requires approval by the advisor. Credit will be given through Advertising 596, Broadcasting 599, or Journalism 599. On the basis of 3 hours of credit for the equivalent of 15 weeks of full-time professional experience, this credit is to be included in the hour requirements for the M.S. program. Professional experience will be evaluated by the student's committee.

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

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

THE DOCTORAL PROGRAM

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

The program is interdisciplinary, consisting of a required core curriculum and recommended courses outside the college in the related social and behavioral sciences. The program is flexible and will accommodate a wide variety of career goals in communications. New students may be admitted to the program at any time; however, core courses begin only in the fall semester.

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

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

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

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

1. Twenty-eight hours of core courses—Communications 610, 612, 620, 640, 641; 6 hours of statistics; and three of the following courses: Communications 622, 632, 642, and 652.
2. Fifteen hours in a primary concentration (advertising, broadcasting, information sciences, journalism, public relations, or speech communication) supplementing the core. Courses may be taken in one or more of the Departments of Advertising, Broadcasting, Speech Communication, and/or the Schools of Information Sciences and Journalism.
3. Twelve hours in a secondary concentration (outside the College of Communications).
4. Nine hours in communications.
5. Twenty-four hours of dissertation. All courses require approval of the student's advising committee.

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

Candidates without prior teaching experience must register for Communications 521, Tutorial in Communications Teaching. Planned course offerings in the College of Communications for a full calendar year are available the preceding November. This information is available from the Graduate Studies Office, 426 Communications Building, 974-6651. See also courses listed under Advertising, Broadcasting, Information Sciences, Journalism, and Speech Communication.

GRADUATE COURSES

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

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

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

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

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

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

521 Tutorial in Communications Teaching (1) Experiential course teaching under guidance of instructor and program. Prereq: Consent of instructor. S/NC only. E

540 Theory for Media Management (3) Selected research hypotheses and theories in literature of mass communication, management, decision-making. Prereq: Consent of instructor. S/NC only. E

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

652 Seminar in Health Communications (3) Methods, problems, and issues of communication in health field. Media's reporting of health issues. Setting of media's "health agenda"; strategic uses of media in social marketing efforts; public communication of complex social/ medical issues. Prereq: Consent of instructor.

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

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

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

561 Seminar in Mass Communications Issues (3) Contemporary topics in communications. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. E

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

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

612 Fundamentals of Communications Research (3) Universal research process from defining ideas and problems to reporting results: Causal inference and relative strengths of various research designs. Fundamentals and specific applications of most common data analysis and measurement techniques in communications research: experimental, survey, content analysis, historical and qualitative. Prereq: Consent of instructor or admission to program. S

626 Seminar in Mass Communications Education (3) Role and scope of mass communications teaching unit, historical perspectives of curricular trends. Teaching methods and instructional objectives: classroom testing and measurement; design of professional curricula, research and extension: program evaluation; grants and contracts in research. Prereq: Consent of instructor or admission to program. S

622 Quantitative Research (3) Techniques for evaluation of research design and measurement. Survey, content analysis, and experimental techniques. Assessment of reliability and validity. Data analysis, hypotheses testing, and inference strategies. Prereq: 612, F

632 Mass Communications History and Historiography (3) Origins and development of mass media in America, Philosophes of history. Historical sources and their verifications. Synthesis and interpretation of data. Prereq: 612 or consent of instructor. S

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

641 Mass Communications Theory II (3) Selected topics in theory. Critical evaluation of extant theory, derivation of new hypotheses and advanced theory construction. Prereq: 640. Sp

642 Qualitative Research (3) Theory and application of qualitative research methods to social science and communications research. Theoretical considerations underlying qualitative research methods translated into research strategies of participant observation, life history, interviewing, archival analysis, and case studies. Prereq: 612 or consent of instructor. S

652 Mass Communications Law and Legal Research (3) Legal restrictions under which mass media operate. Finding, interpreting and analyzing sources of legal information. Prereq: 612 or consent of instructor. S

653 Seminar in Research Methods (3) Advanced topics in research design and methodology. Prereq: 612 or consent of instructor. S

652 Seminar in Research Methods (3) Advanced topics in research design and methodology. Prereq: 612 or consent of instructor. S
Comparative and Experimental Medicine

(Office of the Vice Chancellor for Academic Affairs)

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

L. N. D. Potgieter, Director
Joint Graduate Coordinating Committee:
Fuhr, J. E., Ph.D., Medical Biology
Lawler, J. E., Ph.D., Psychology
Lazzaro, C. M., D.D.S., Medical Biology
Potgieter, L. N. D. (Liaison), B.V.Sc., Ph.D., Veterinary Teaching Hospital
Slaunton, D. O., D.V.M., Ph.D., Veterinary Teaching Hospital

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

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

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

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

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

Doctor of Philosophy Degree Program
Applicants generally will be expected to have a master's degree in one of the biological sciences and a Graduate Record Examination score of at least 1,000 for the quantitative and verbal sections, or a professional degree in one of the medical sciences, (e.g., M.D., D.D.S., D.V.M.).

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

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

THE MASTER'S PROGRAM
All students must take at least 4 credit hours in 500- or 600-level courses in basic mechanisms of disease and at least 7 credit hours of 500-level biochemistry or cell biology. See listings under Biochemistry and Cellular and Molecular Biology program for information on these courses. In addition, students must complete a minimum of 8 hours of coursework in a specified discipline, 5 or more hours of electives, and 6 hours of Thesis 500.

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

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

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

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

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

Comparative and Experimental Medicine—Graduate School of Medicine

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

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

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

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

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

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

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

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

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

611 Advanced Topics in Medical Science (1-3) New developments in biological research applicable to clinical medicine. Primarily for doctoral candidates in Comparative and Experimental Medicine. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. (Same as Biochemistry and Cellular and Molecular Biology 611.) F,Sp

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

GRADUATE COURSES

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

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

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

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester when he studies in 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 Predictive Toxicology (3) Principles and techniques of predictive toxicity. Structure-activity relationships, expert systems, neural nets and molecular similarity. Sp, Fa

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

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

521 Advanced Mammalian Physiology I (4) Membrane, neuron, central nervous system, muscle, cardiovascular system, and control mechanisms. Prereq: General undergraduate anatomy and physiology and Biochemistry and Cellular and Molecular Biology 410 or equivalent or consent of instructor. Recommended: precore: Biochemistry and Cellular and Molecular Biology 419. (Same as Biochemistry and Cellular and Molecular Biology 521.) 3 hrs and 1 lab. Fa

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

536 Toxicology (2) (Same as Veterinary Medicine 536.)

537 Multi-species Medicine (4) (Same as Veterinary Medicine 537.)

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

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

551 Mammalian Organology (3) (Same as Animal Science 551.)

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

554 Comparative Hematology (3) (Same as Animal Science 554.)

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

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

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

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

604 Veterinary Pathology Seminar (1) Microscopic slides and transparencies of tissues from cases examined by pathologists, residents, and graduate students. Interpretation of observations. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. S

605 Pathobiology Seminar (1) Subjects of current interest in biomedical science. Students present one seminar per term enrolled. Prereq: Consent of instructor. May be repeated. Maximum 4 hrs. Class meets once monthly.

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

607 Diagnosis and Pathogenesis of Virus Diseases of Domestic Animals (3) Advanced study of virus diseases important to domestic animals: virus biology, pathogenesis, pathogenesis and diagnostic techniques used in virus diseases diagnosis. Prereq: Cellular and Comparative Biochemistry, and Advanced Topics in Biochemistry, Virology, and Virology Lab, or Microbiology-Veterinary Medicine 811-812. 2 hrs and 1 lab. Sp

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

609 Mechanisms of Disease (4) Advanced topics in pathobiology of mechanisms of disease: pathophysiology, cellular degeneration, inflammation, immunopathology, hemostasis. Principal biochemical and morphologic responses of various cells, tissues, and organs to injury and other metabolic derangements. Selected contemporary topics from current literature and textbooks. Prereq: Consent of instructor. Sp

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

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

652 Disorders of the Endocrine System (2) (Same as Animal Science 652.)

Comparative Medicine

See College of Veterinary Medicine and Comparative and Experimental Medicine

Computer Science

(College of Arts and Sciences)

MAJOR

DEGREES

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

Robert C. Ward, Head

Professors:

Dongiria, Jack, Ph.D. .................................... New Mexico

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

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

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

Thomason, Michael G., Ph.D. .................... Texas A&M

Associate Professor:

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

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

Assistant Professors:

Beck, Mikel, Ph.D. .................................... Cornell

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

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

Jones, Mark T., Ph.D. ............................... Duke

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

Raghavan, Padma, Ph.D. ....................... Pennsylvania State

Straight, David W., Ph.D. ....................... Texas A&M

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

Instructor:

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

THE MASTER'S PROGRAM

Two semesters of calculus plus two additional semesters of college mathematics (e.g., linear algebra, differential equations, probability) and a course in Discrete Structures and in Systems Programming are required for admission. For the master's degree, 90 semester hours of graduate credit are required, 24 of which must be 500 level or above. Computer Science 530, 540 and 540 are required for the degree. Graduate courses taken outside the department are sometimes allowed but must be approved by the Graduate Committee before enrollment.

Thesis Option

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

Non-Thesis Option

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

Master's Minor in Computer Science

The graduate minor consists of any two of the three core courses (530, 540, 560) plus an additional 3 hours of graded computer science graduate-level courses at or above the 400 level.

THE DOCTORAL PROGRAM

A student seeking admission to the Ph.D. program is expected to meet the following requirements:

1. The student should have three letters of recommendation sent directly to the department head from individuals capable of assessing the student's potential for advanced work in computer science (for example, college teachers or employers for whom the student has worked after earning a Bachelor's degree). The department reserves the right to contact these individuals or other knowledgeable people if additional information is deemed necessary or desirable.

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

Original research reported in a dissertation of high quality is emphasized. The minimum hour requirements are 24 hours of course 660 Doctoral Research and Dissertation and 24 hours of graduate courses beyond the equivalent of a master's degree (i.e., beyond 30 graduate credit hours) graded A-F. Computer Science 530, 560 and 580 are required for the degree. At least six hours of 600-level graded courses must be taken in computer science at UTK. The student's advisor and committee will establish the specific course requirements. The comprehensive examination consists of a departmental written examination and a subsequent oral examination conducted by the student's committee.

GRADUATE COURSES

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

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

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

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

471 Numerical Analysis (3) Same as Mathematics 471.

472 Numerical Algebra (3) Same as Mathematics 472.

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

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

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

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

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

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

523 Machine Learning (3) Algorithms whereby computers exhibit aspects of learning or inference about their environment. Supervised and unsupervised methods; data-driven pattern analysis; explicit and implicit structure. Prereq: 521.

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


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


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


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

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

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

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

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

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

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

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

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

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

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


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

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

600 Doctoral Research and Dissertation (3-15) Prereq: Consent of instructor. May be repeated with consent of department.

630 Advanced Topics in Computer Systems (1-5) Prereq: Consent of instructor. May be repeated with consent of department.

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

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

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

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

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

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

Counselor Education and Counseling Psychology

(College of Education)

MAJORS

DEGREES

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

M. A. Hector, Leader

Professors:

Davis, Kathleen L., Ed.D. ......................... Georgia
DeRidder, Lawrence M. (Emeritus), Ph.D..... Michigan
Dietz, Siegfried C. (Emeritus), Ed.D. ............. Arizona State
Hector, M. A. (Liaison), Ph.D. ............... Michigan State
Huck, Schuyler W., Ph.D. ..................... Northwestern
McClain, Ed W. (Emeritus), Ph.D. ............ Texas
Peterson, M. P., Ph.D. ......................... Ohio State
Poppin, William A., Ph.D. ...................... Ohio State
Thompson, C. L., Ph.D. ......................... Georgia

Associate Professor:

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

The Counselor Education and Counseling Psychology unit offers graduate programs leading to the following: Master of Science with a major in Educational Psychology, concentration in community counseling; Master of Science with a major in Guidance, concentrations in elementary guidance, secondary guidance, and school counseling; Educational Specialist with a major in Educational Psychology and Guidance, concentration in school counseling; and Doctor of Education with a major in Educational Psychology, concentration in counselor education. The unit also participates in the college-wide Ph.D. program with a major in Education. The concentration area is theories and practices of educational and personal adjustment with specializations in counselor...
education, counseling psychology, and educational psychology. See Education Under Fields of instruction for full description of all degree requirements.

Several programs in the unit are accredited. The Ed.D. counselor education concentration and the Ph.D., specialization in counselor education are accredited by the Council for Accreditation of Counseling and Related Educational Programs; counseling psychology by the American Psychological Association.

Also, the school counseling program has the approval of the National Council for Accreditation of Teacher Education. The community counseling and school counseling programs are accredited by the Council for Accreditation of Counseling and Related Educational Programs. The program in Educational Psychology has been recognized as a "Designated Program" by the American Association of State Psychology Boards and the Council for the National Register of Health Service Providers in Psychology.

For information about the various programs of study, write to the unit admissions secretary.

**ADMISSION REQUIREMENTS**

Admission requirements include up-to-date scores from the GRE, the unit admissions application form and letters of recommendation. For the doctoral program, a personal interview is also required. The application deadline for admission is February 1 for all programs. Some programs also review applications November 1.

**GRADUATE COURSES**

410 Sex Role Development: Implications for Education and Counseling (3) Theories and research concerning development, socialization, and role behavior. Prereq: 431 or equivalent. E

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

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

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

503 Problems in the Thesaurus of (2-3) May be repeated. Maximum 6 hrs. S/NC or letter grade. E

504 Special Topics (1-3) Instructor-initiated course offered at convenience of academic unit on topics of current interest. May be repeated. Maximum 16 hrs. S/NC or letter grade. E

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

520 Statistics and Research Design: Conceptual (3)
Consumer psychology: an applied course in statistical procedures and methods. E

521 Statistics and Research Design: Application (3) Data collection and analysis. Descriptive techniques, estimation, logic of hypothesis testing and selected parametric and non-parametric tests. F,Sp,F, Su

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

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

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

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

553 Career and Educational Information Systems and Resources (3) Use of print and non-print materials: computer-based systems, for career and educational planning. Prereq: 552 or consent of instructor and Internet access account.

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

555 Practicum in Counseling (3) Supervised practice and application of counseling skills with individual clients. Prereq: Admission to program, 431, 525, 551 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

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

558 Internship in School Counseling (1-6) Supervised postpracticum employment at academic unit approved site. Prereq: 550 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

559 Internship in Community Agency Counseling (1-6) Supervised postpracticum employment at community agency program, 555 and consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. E

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

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

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

585 Seminar in Gerontology (1) (Same as Human Ecology 585, Exercise Science 585, Nursing 585, Public Health 585, Psychological Counseling 585, Social Work 585, and Sociology 585.)

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

600 Doctoral Research and Dissertation (1-15) P/NP only. E

602 Directed Research (1-3) Instructor or student-initiated guided research. Prereq: 525 or 552 or equivalent. E

604 Special Topics (1-3) Instructor-initiated course offered at convenience of academic unit on top of topics. May be repeated. Maximum 16 hrs. S/NC or letter grade. E

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

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

650 Seminar in Counselor Education (1) Professional issues related to role and function of counselor educator. Prereq: Admission to doctoral degree in counselor education. May be repeated. Maximum 2 hrs. S/NC only. F

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

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

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


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

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

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

674 Practicum in Counseling Psychology (3) Supervised practice of individual counseling. Minimum 135 clock hrs required each semester. Prereq: Admission to counseling psychology doctoral program, 555, and consent of instructor. May be repeated. Maximum 6 hrs. E

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

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

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

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**Cultural Studies in Education**

(Committee of Education)

**MAJOR**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Curriculum and Instruction</th>
<th>Human Performance and Sport Studies</th>
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<tbody>
<tr>
<td>M.S.</td>
<td>M.S., Ed.D.</td>
<td>M.S., Ed.D.</td>
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<tr>
<td>Ph.D.</td>
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**Professors:**

- Allison, C. B., Ph.D. ........................................ Oklahom
- Beitel, Patricia A., Ed.D. ......................... North Carolina (Greensboro)
- Howard, Robert (Emeritus), Ph.D. .......... Ohio State
- Malik, Anand, Ed.D. ......................... Columbia
- Mead, B. J., Ph.D. ............................... Purdue
- Morgan, W. J., Ph.D. ............................. Minnesota
- Paul, Joan (Liaison), Ed.D. ................. Alabama
- Phillips, Madge M. (Emeritus), Ph.D. ...... Iowa
- Wisniewski, Richard, Ph.D. ..................... Wayne State
- Winsberg, C. A., Ph.D. ......................... Michigan
GRADUATE COURSES

500 Thesis (1-15) P/NP only. E
501 Special Project (3) Culminating experience for nonthesis major. Research study suitable for publication or practicum requiring substantial written work. Prereq: 592.
502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only. E
505 History of Olympics: Ancient and Modern (3) Examination of various aspects of ancient and modern Olympic Games. Ancient Olympic Games; modern Olympics, 1896 to date: political, social, class, gender, and economic issues that influence Games. Prereq: Consent of instructor.
514 Advanced Philosophy of Sport (3) Major philosophical theories of sport. Various conceptions of moral, aesthetic, and social-political issues. E
515 Social Theories of Sport (3) Liberal, democratic and Marxist social theories of sport. (Same as Sociology 594.)
526 Philosophy of Education (3) Truth, knowledge, and valuation in relation to work of schools. F, Su
539 Development of Education Thought (3) Historic and philosophical approach to ideas and writings of influential educators: Plato, Quintilian, Comenius, Rousseau, Pestalozzi, Froebel, Dewey. Prereq: Graduate status and consent of instructor. Sp, Su
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. Discussion of current research and methodology.
540 Foundations of Educational Policy (3) Relationship between theory, policy, and practice of educational policies that arise from philosophical and practical considerations relative to human nature, to educational purpose, to content of curriculum and to methods and techniques for conducting educational enterprise. F, Su
541 Special Topics (1-3) Advanced study in selected disciplinary or professional areas of physical education and/or sport. May be repeated. E
542 Sociological Aspects of Sport (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 attributes areas during critical developmental periods within context of perceptual-motor development theories and explanations of factors affecting motor behavior.
545 Educational Sociology (3) Sociological analysis of American education system. Controversial social issues that affect educational system and potential solutions offered by various programs. Open to juniors, seniors, and graduate students. F
546 Topics in History of Education (3) May be repeated. E
547 Topics in Philosophy of Education (3) May be repeated. F, Su
549 Topics in International Education (3) Historical, philosophical, and sociological foundations of nations and their cultures. May be repeated. E
560 Introduction to Qualitative Research in Education (3) Fundamentals of qualitative research methods and development of skills needed for qualitative research projects. Overview of qualitative research methods: ethnography, case study, historiography, biography, and life history. Historical reading and evaluation of qualitative research studies. F, Su
593 Independent Study (1-3) May be repeated. S/NC or letter grade. E
594 Supervised Reading (1-3) May be repeated. S/NC or letter grade. E
595 Special Topics (1-3) Advanced study in selected aspects of cultural studies. May be repeated. Maximum 9 hrs. S/NC or letter grade. E
600 Doctoral Research and Dissertation (3-15) P/NP only. E
601 Practicum (1-3) Intern experience in areas of major interest. May be repeated. E
603 Independent Study (1-3) May be repeated. S/NC or letter grade. E
604 Seminar in Curriculum and Instruction (1-15) P/NP only. E
605 History of Science with a major in Curriculum and Instruction, concentration in motor behavior and sociocultural foundations. The unit participates in the college-wide Ph.D. program with a major in Education. See Education under Fields of Instruction for full description of all degree requirements.

The unit derives its intellectual identity and orientation from disciplines such as anthropology, history, philosophy, psychology, and sociology, and from more specialized forms of inquiry such as ethnography, semiotics, literary theory, hermeneutics, linguistics, and feminist theory.

For further information, write the Cultural Studies in Education unit.

ECONOMY AND EVOLUTIONARY BIOLOGY (College of Arts and Sciences)

MAJOR

DEGREES

Ecology, Evolutionary and Sociobiology

A.C. Echternacht, Head
W.O. Smith, Associate Head

Professors:

Bunting, D. L., Ph.D................... Oklahoma State University
Echternacht, A. C., Ph.D............... Kansas State University
Ettnier, D. A., Ph.D. .................... Minnesota State University
Farkas, W. R., Ph.D. ..................... Duke University
Greenberg, N. B., Ph.D. ............... Rutgers University
Gross, J. L., Ph.D. ....................... Cornell University
Hallam, T. G., Ph.D. .................... University of Michigan
Harris, W. F., Ph.D. .................... University of Tennessee
Kot, M., Ph.D. ........................... University of Arizona
Maxson, L. R., Ph.D. ..................... California State University, Davis
McCormick, J. F., Ph.D. ............... Emory University
McCracken, G. F., Ph.D. ............... Cornell University
Pen, M. L., Ph.D. ....................... Pennsylvania State University
Pimm, S. L., Ph.D. ...................... New Mexico State University
Riechert, S. E., Ph.D. ................... University of Wisconsin
Saylor, G. S., Ph.D. ..................... Idaho State University
Smith, W. O., Ph.D. .................... Duke University
Stacey, G., Ph.D. ....................... University of Texas
Vaughn, G. L., Ph.D. ................... Duke University

Associate Professors:

Amundsen, C. C., Ph.D. ............... Colorado State University
Boake, C. R. B., Ph.D. .................. Cornell University
Delcourt, H., Ph.D. ..................... University of Minnesota
Delcourt, P. A., Ph.D. ................... University of Minnesota
Drake, J. A., Ph.D. ....................... Purdue University
Fox, D. J., Ph.D. ....................... Johns Hopkins University
Gittleman, J. L., Ph.D. ................. University of Sussex (UK)

Assistant Professors:

Cruz, M. B. C., Ph.D. ................. SUNY (Stony Brook)
Pigliucci, M., Ph.D. ...................... University of Connecticut
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 Ecology is available to residents of the states of Alabama or Texas. Additional information may be obtained form Admissions Specialist in the Office of Graduate Admissions and Records.

NOTE: The departmental graduate program is currently undergoing revision. During this transition, questions regarding the program should be addressed to your advisor or the department head.

GRADUATE COURSES
411-412 Minicourse in Ecology and Evolutionary Biology (2) Selected advanced topics in ecology, behavior, and evolutionary biology, concentrated in time and subject matter. Credit to be awarded for credit offered. Prereq: Consent. Maximum 4 hrs may apply toward departmental major.

415 Plant Ecology (3) Interactions between individuals, species, communities and their environments. Weekly field trips and experimental work. Credit to be awarded for credit offered. Prereq: Field Botany or equivalent.

505 Comparative Animal Behavior (3) Principles and methods of ethology, ecological, developmental, physiological and evolutionary aspects. (Same as Psychology 450.)

520 Ecology for Planners and Engineers (3) Ecological principles and effects that human-caused changes have on living organisms. Lectures and field trips. Appropriate for students in Planning and Environmental Engineering.

524 Physiological Ecology of Animals (3) Adaptive physiological response of animals to natural changes in or extremes of physical and biotic environment. Terrestrial vertebrates. Prereq: Consent. 4 hrs to complete course in major.

542 Insect Structure and Function (3) Integrated study of morphology and physiology of insects. Prereq: Comparative Invertebrate Biology. 3 hrs and lab.

544 Fresh Water Invertebrate Zoology (3) Ecology of fresh water invertebrates exclusive of insects. Prereq: Comparative Invertebrate Biology. 3 hrs lab and field study.

545 Advanced Animal Behavior (3) Second-level course in ethology, stressing evolution, genetics, physiology, ecology, and human behavior. Prereq: 450 or equivalent. (Same as Psychology 545.)

573 Population Biology (3) Genetics and ecology of natural populations of plants and animals and aspects of behavior determining population structure. Prereq: Introductory Courses in Ecology and Genetics. (Same as Botany 573.)

574 Communities and Ecosystems (3) Patterns underlying principles behind short and long term community and ecosystem organization, dynamics, energetics and nutrient cycling.

575 Ecological Genetics (3) Genetics of natural populations, using both single-locus and quantitative genetic approaches. Prereq: 573 and genetics course.
Economics

(Professional School of Business Administration)

MAJORS

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

William F. Fox, Head

Professors:
Bohm, Robert A. (liaison), Ph.D. .......... Washington (St. Louis)
Bowley, Roger L. (Emeritus), Ph.D. ...... Texas
Carroll, Sidney L., Ph.D. ....................... Harvard
Chang, Hui S., Ph.D. ................................ Vanderbilt
Clark, Don P., Ph.D. ................................ Michigan State
Cole, William E. (Emeritus), Ph.D. ........ Texas
Davidson, Paul (J. Fred Holly Chair of Excellence), Ph.D. Pennsylvania
Fox, William F., Ph.D. ......................... Ohio State
Garrison, Charles B., Ph.D. ................... Kentucky
Herzog, Henry W., Ph.D. ..................... Maryland
Jensen, Hans E. (Emeritus), Ph.D. ......... Texas
Lee, Feng-Yao, Ph.D. ............................ Michigan State
Mayhew, Anne, Ph.D. ........................... Texas
Moore, John R. (Distinguished Prof.) (Emeritus), Ph.D. ......... Cornell
Neale, Walter C. (Emeritus), Ph.D. ......... London
Russell, Milton, Ph.D. ......................... Oklahoma

Schlottman, Alan M., Ph.D. .................. Washington (St. Louis)
Spiva, George A. (Emeritus), Ph.D. ....... Texas

Associate Professors:
Gauger, Jean A., Ph.D. ....................... Iowa State
Glustoff, Errol, Ph.D. .......................... Stanford
Kahn, James R., Ph.D. .......................... Maryland
Mayo, John W., Ph.D. ............................ Washington (St. Louis)
Murray, M. N., Ph.D. ............................ Syracuse
Philips, Keith E., Ph.D. ....................... Washington

Assistant Professors:
Beserve, Peter M., Ph.D. ...................... Virginia
FARMER, Amy L., Ph.D. ....................... Duke
Rubin, Jonathan D., Ph.D. .................... California (Davis)

The Department of Economics offers graduate programs leading to the M.A. and Ph.D. The M.A. may be completed by either a thesis or non-thesis option, while the Ph.D. requires successful completion of a dissertation. Applicants to these programs should contact the Director of Graduate Studies, Department of Economics, for further information. The Department also offers an area of concentration for the MBA degree. Students interested in the MBA program should contact the Director of Graduate Business Programs, College of Business Administration.

ACADEMIC STANDARDS

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

STUDENT'S RIGHT TO PETITION

Graduate students in good academic standing have the right to petition the department for modification of departmental degree requirements and redress of grievances. Petitions must be in writing and addressed to the Director of Graduate Studies.

THE MASTER'S PROGRAM

Admission to the M.A. program is based on undergraduate academic performance and on scores from the general portion of the GRE. The student may choose either the thesis or non-thesis option.

The non-thesis option requires 30 hours of coursework at the 400 level or above. Of these, at least 24 hours (at least 18 hours of which are in economics) must be taken at the 500 level or above. Of the minimum of 18 hours in economics at the 500 level or above, 12 hours must consist of 511, 512, and 513, and the remaining 6 hours must be in one field of economics. Of the 30 hours, a maximum of 9 hours in courses approved by the department may be taken in fields other than economics. Students electing the non-thesis option are required to pass a final comprehensive examination.

The thesis option requires 30 hours of coursework at the 400 level or above, including at least 24 hours at the 500 level or above, 6 hours of which may be thesis hours. Of the remaining 18 hours at the 500 level or above, at least 15 hours must be in economics and must include 511, 512, 513, and 514. A maximum of 6 hours may be in an area other than economics.

THE DOCTORAL PROGRAM

Admission to the Ph.D. program is based on promise of outstanding scholarship as demonstrated by previous academic performance, by scores achieved on the general portion of the GRE, and by recommendations. The program requires a minimum of 48 hours of coursework beyond the bachelor's degree or 24 hours beyond the master's degree, at least 24 hours of 600 Doctoral Research and Dissertation, and successful completion of the following:

1. Students are required to complete the following core requirements:
   a. Economic Theory: Microeconomic theory and macroeconomic theory by a qualifying exam taken not later than the beginning of the fourth semester of study.
   b. History of Economics: Completion of 515 or 615 with a grade of B or better, or by qualifying examination.
   c. Quantitative Methods: Completion of 581, 582 and one additional course in quantitative methods approved by the department with grades of B or better, or by qualifying examination.
   Students failing a qualifying examination must retake the examination the next time offered. A qualifying examination may be taken a third time only with approval of the department. Failing a qualifying examination for a third time will result in dismissal from the doctoral program.

2. Students are required to demonstrate competence by comprehensive examination in at least two fields of specialization in economics.

3. Students failing a comprehensive examination must retake the examination the next time offered. A comprehensive examination in a specific field may be a third time only with approval of the department.

4. Students are required to complete with a grade of B or better two elective courses in economics during the 500 level or above, outside the core subject areas and outside the fields of specialization.

5. Students are required to complete a doctoral dissertation and to defend it successfully before the faculty.

MINOR IN ENVIRONMENTAL POLICY

The program is designed to give master's level graduate students an opportunity to develop an interdisciplinary specialization in environmental policy. While administered through the Economics Department, the program is coordinated by a committee of representatives from the following participating departments: Agricultural Economics and Rural Sociology; Civil and Environmental Engineering; Ecology and Evolutionary Biology; Economics; Forestry, Wildlife and Fisheries; Geography; Management; Political Science; and Sociology. Students may request admission to the minor following admission to the master's program in one of the participating departments. Students in good standing in these programs may apply for admission to the minor in environmental policy. The coordinating committee will consider the admission of interested students. Applicants should have a background in both natural and social sciences.
evidenced by prior coursework or experience. One course in environmental studies from the student’s major discipline and one course in quantitative methods are required. These requirements may be fulfilled before or after admission to the minor. All students admitted to the minor will be required to register for at least three hours of Economics 570, Environmental Policy Research Workshop, and to complete successfully the following:
1. Ecology and Evolutionary Biology 520 or Plant and Soil Sciences 414 or Geography 433 or an equivalent course approved by the coordinating committee.
2. Six hours of coursework outside the minor’s discipline approved by the coordinating committee.

BUSINESS ADMINISTRATION

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

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

GRADUATE COURSES

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

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

415 History of Economics (3) (Same as History 415.)

424 Political Economy of World Development (3) Topics vary: Latin America, Asia, Soviet Union and Eastern Europe. Analysis of major economic strategies, policies, and problems. Prereq: 201. This course includes a major writing requirement. May be repeated when topic varies. Maximum 9 hrs.


462 Economics of Resources and Environmental Policy (3) Economic analysis of environmental policy and allocation of resources. Benefits and costs of development of natural resources and impact on environment. Major writing requirement. Prereq: 201.

471 Public Finance: Optimal Government Functions and Expenditure Analysis (3) Problems of collective consumption, external effects, public investment, social decision making. Major writing requirement. Prereq: 201.

472 Public Finance: Taxation and Intergovernmental Relations (3) Analysis of individual taxes and of tax systems, non-tax sources of revenue, fiscal federalism. Major writing requirement. Prereq: 201.

482 Introduction to Mathematical Economics (3) Application of basic mathematical tools: calculus, matrix algebra, etc. to major topics of economic theory. Prereq: Intermediate Microeconomics with B or better and Calculus.

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

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

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

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


525 Economic History of Europe (3) Nature and functioning of economic systems and policies in history of Western civilization. Major issues of method and interpretation. Prereq: Graduate standing in economics or consent of instructor.

526 Economic History of the U.S. (3) Interpretation of American economic structure and policies from colonial times. Prereq: Graduate standing in economics or consent of instructor.

537 Managing in a Regulated Economy (3) Economic effects of antitrust and public utility, international and environmental regulation on business. Development of decision-making skills in area of governmental-business relations.

552 Labor Relations and Collective Bargaining (3) (Same as Management 522.)

577 Environmental Economics and Policy Management (3) Interdisciplinary perspective on goals of sustaining economic development and environmental quality. Development of decision-making tools and conflict resolution.


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

613 Advanced Macroeconomic Theory (3) Prereq: 514 or equivalent.


623 Economic Development: Theories and Policies (3) Principal theories explaining economic behavior in developing countries and policies and strategies used to promote development. Prereq: Undergraduate degree in economics or consent of instructor.

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


642 Labor History and Legislation (3) Development of organized labor as important economic and political force in industrial democracies. A survey of main issues and times to present. Evolution of legal status of labor unions and of individual workers vis-a-vis their employers.

651 Monetary Theory (3) Study of money, credit, and liquidity as related to real output determination, interest rates, employment, and prices. Prereq: 513.


651 Regional and Urban Location and Development Theory (3) Theory of industrial and agricultural location and human migration. Economic basis for land use patterns, central places, and urban form. Spatial inequalities and urban problems. National policies for regional and urban assistance.

652 Methods of Regional and Urban Analysis (3) Theory of regional/urban economic structure and growth. Regional income and product accounts, shift and share analysis, economic base studies, and regional input-output models. Theory and problem solution.


672 Public Finance: Taxation and Intergovernmental Relations (3) Theories of taxation; tax incidence and tax efficiency; policy analysis of U.S. tax structure at federal, state, and local levels. Theories of fiscal federalism and intergovernmental relations.

677 Environmental and Natural Resource Economics (3) Alternative paradigms for allocating and valuing environmental resources. Exploration of issues related to market failure and differences between renewable and nonrenewable resources.

678 Economics of Environmental Policy (3) Topics in environmental policy analysis. Consideration of alternative policy instruments, defining policy objectives and role of risk in decision-making process.

681-82 Econometric Methods (3, 3) Theory and techniques of statistical testing of economic hypotheses and construction and estimation of econometric models. Review of classical least squares regression model, and approaches to simultaneous equation models with applications to current economic research. Prereq: 582 or equivalent.

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

Education

(College of Education)

MAJORS

DEGREES

College Student Personnel .................................................. M.S.

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

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

Educational Psychology ........................................ M.S., Ed.D.

Educational Psychology and Guidance .... Ed.S.

Guidance ....................... M.S.

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

Leadership Studies in Education ........................................... M.S., Ed.D.

Rehabilitation Counseling ................................................. M.S.

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

The College of Education offers the Master of Science, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees in cooperation with eleven individual units:
Counselor Education and Counseling Psychology
Cultural Studies in Education
Education in the Sciences, Mathematics, Research and Technology
Exercise Sciences
Holistic Teaching/Learning
Inclusive Early Childhood Education
Language, Communication, and Humanities Education
Leadership Studies in Education
Psychoeducational Studies
Rehabilitation, Deafness, and Human Services
Sport and Physical Activity

The College also offers an extended teacher preparation program with majors in Curriculum and Instruction and in Special Education. The program features a professional year internship with accompanying coursework.

TEACHER LICENSURE

For teacher licensure, a student must complete the 24 hours associated with the professional year as follows:

**Fall Semester**
- 575 Internship: 4 hrs
- 574 Analysis of Teaching for Professional Development: 2 hrs

**Spring Semester**
- 576 Internship: 8 hrs
- 591 Clinical Studies: 4 hrs
- TOTAL: 24 hrs

To receive graduate credit, a student must be admitted to The Graduate School prior to the completion of the first semester of internship and register as a graduate student. If a master's degree is desired with a major in Curriculum and Instruction or Special Education, a student must be admitted to the program prior to completion of the first semester of internship. See the individual Track 2 program descriptions below for complete details.

THE MASTER'S PROGRAMS

College Student Personnel

This program under the unit of Leadership Studies is designed for individuals interested in entering the field of student personnel administration in colleges and universities and in community or junior colleges. The program has both a thesis and non-thesis option. A minimum of 36 hours, which includes 6 hours of practicum experience, is required in either option, with a minimum of 12 hours in Higher Education courses.

Curriculum and Instruction

Two tracks for the master's degree with a major in Curriculum and Instruction are offered. Track 1 is for students who are already certified to teach in a curriculum and instruction disciplinary area or those who are seeking a master's degree without certification. Track 2 is for students seeking initial licensure. Thesis and non-thesis options are available for both tracks.

**Track 1**
- Concentrations are available in social foundations and cultural studies in education under Cultural Studies in Education; curriculum, elementary education, instructional media and technology, mathematics education, and science education under Education in the Sciences, Mathematics, Research, and Technology; elementary education, reading education, educational science education, and Holistic Teaching/Learning; elementary education under Inclusive Early Childhood Education; and art education, English education, foreign language education, and reading education under Language, Communication, and Humanities Education.

**Track 2**
- Concentrations are available in elementary teaching and in secondary teaching under Education in the Sciences, Mathematics, Research, and Technology; elementary teaching under Cultural Studies in Education, and under Inclusive Early Childhood Education; and art education and secondary teaching under Language, Communication, and Humanities Education.

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

**Educational Psychology**

Admission requirements include up-to-date scores from the GRE, the unit admissions application form and letters of recommendation. All programs include thesis and non-thesis options. Under Counselor Education and Counseling Psychology, a major in Educational Psychology, concentration in community counseling, requires 60 hours plus supervised practicum and internship experiences working with clients. Under Psychoeducational Studies, the major in Educational Psychology, concentrations in adult education, educational psychology, and individual and collaborative learning, requires 36 hours. The concentration in adult education requires a minimum of 12 hours in Adult Education courses.

A final examination is required of all master's degree students.

**Guidance**

Admission requirements include up-to-date scores from the GRE, an internship application form and letters of recommendation. The program includes a thesis and non-thesis options. Under Counselor Education and Counseling Psychology, a major in Guidance, concentrations in educational psychology, school counseling, and secondary guidance, requires 38 hours and supervised practicum and internship experiences working with clients. A final examination is required.

**Human Performance and Sport Studies**

Concentrations are available in motor behavior and sociocultural foundations under Cultural Studies in Education; exercise science under Exercise Science; and sport administration under Sport and Physical Activity. Both thesis and non-thesis options are available. The non-thesis option requires 32 hours, including a project, and a course in research design or an approved specialized research class. The thesis option requires the completion of 36 hours, including 6 hours of Thesis 500. Both options require a minimum of 12 hours of Sport Studies, Exercise Science, or Sport Management courses.

**Leadership Studies in Education**

The master's degree program under Leadership Studies in Education offers a concentration in educational administration and supervision, requiring a minimum of 33 credit hours including 8 hours of Thesis 500 for the thesis option and 36 hours for the non-thesis option.

The concentration in educational administration and supervision consists of a minimum of 18 hours of course work in Educational Administration and Supervision. A final oral examination is required for the thesis option, with a written exam at the option of the committee. A final written comprehensive examination is required for the non-thesis option, with an oral exam at the option of the committee. Students entering either of these options must complete the introductory core consisting of Educational Administration and Supervision 513, 515, 516, and 535 or a demonstrated computer proficiency. The courses are prerequisites to other courses in the unit.

**Rehabilitation Counseling**

The program under Rehabilitation and Deafness prepares professional counselors for successful practice in public and private rehabilitation programs. Rehabilitation counselors assist individuals with disabilities to achieve their optimal level of functioning in living, learning, and working environments. Rehabilitation counselors work primarily with youth and adults who have congenital or acquired physical, intellectual, or emotional disabilities. Clinical practice offers students an opportunity to emphasize skill development for specific or general disability caseloads. The program is fully accredited by the Council on Rehabilitation Education, Inc. and requires 54 semester hours, including internship. A minimum of 12 hours of Rehabilitation and Deafness courses is required. Thesis and non-thesis options are available. Graduates are employed by federal and state governments, hospitals, private industry, and a variety of community agencies.

**Special Education**

Two tracks are offered for the master's degree with a major in Special Education. Track 1 is for students who are already licensed to teach in special education or a related field or those who are seeking a master's degree without teacher licensure. Track 2 is for students seeking initial licensure. Thesis and non-thesis options are available for both tracks.
Concentrations for both tracks are offered in general special education under Holistic Teaching/Learning, early childhood special education under Inclusive Early Childhood Education; and hearing impaired under Rehabilitation and Deaf.

Track 1 - Coursework may apply toward State of Tennessee endorsements (add-on certification in specific licensure areas). The non-thesis option requires 36 hours, including a minimum of 18 in the specific discipline, and a final written and oral comprehensive examination. The thesis option requires 39 hours, including 6 hours of Thesis, and a minimum of 12 hours in the discipline.

Track 2 - The requirements are the same as those for Teacher Licensure plus 12 hours in the academic discipline as approved by the student’s committee, for a total of 36 hours. The thesis option requires 6 additional hours of Thesis for a total of 42 hours.

Students completing a program of study in the general special education concentration area are qualified as teachers and/or consultants in a variety of special education programs providing services to people certified as mentally retarded, learning disabled, emotionally disturbed, gifted, physically disabled, multiply disabled, and socially or emotionally disturbed. General special education majors, in conjunction with their committees, select one or more specializations for their program of study. Six to nine hours of coursework in the designated area should be taken. Approved specializations include affective/motivational approaches, assessment/diagnosis, cognitive education, early childhood, gifted education, rehabilitation, and/or technology. Students also may select a cognate of three to six hours of coursework taken outside the unit.

Students completing a program of study in the education of the hearing impaired concentration area are qualified to teach in public or residential schools for the hearing impaired. Graduates are eligible for both Council on Education of the Deaf (CED) certification and Tennessee state certification. Internships (student teaching) may be completed at the Tennessee School for the Deaf, in mainstream programs in the state or in programs for the hearing impaired in North Carolina, Kentucky, Georgia, Virginia and the District of Columbia.

THE SPECIALIST IN EDUCATION PROGRAMS

Curriculum and Instruction
The Educational Specialist degree program with a major in Curriculum and Instruction encompasses concentrations in curriculum, elementary education, instructional media and technology, mathematics education, and science education under Education in the Sciences, Mathematics, Research, and Technology; in elementary education, reading education, and science education under Education in the Sciences, Mathematics, Research, and Technology; in elementary education, reading education, and science education under Education in the Sciences, Mathematics, Research, and Technology; and in special education under Holistic Teaching/Learning, in elementary education under Inclusive Early Childhood Education; and in early childhood education, reading education, and science education under Language, Communication, and Humanities Education.

Refer to Degree Requirements under The Graduate School for complete program requirements.

Educational Psychology and Guidance
Under Counselor Education and Counseling Psychology, the minimum number of hours required for the concentration in counselor education is 79. Under Psychoeducational Studies, the minimum number of hours required is 89. Refer to Degree Requirements for on-campus continuous enrollment in Leadership Studies for complete program requirements.

Leadership Studies in Education
Leadership Studies offers the specialist degree with a concentration in educational administration and supervision. A minimum of 60 hours beyond the baccalaureate degree is required. The thesis option requires 6 hours of Thesis, and the non-thesis option requires 6 hours of Thesis. Both options include 6 hours of Thesis.

Refer to Degree Requirements under The Graduate School for complete program requirements.

Leadership Studies in Education
Leadership Studies offers the specialist degree with a concentration in educational administration and supervision. A minimum of 60 hours beyond the baccalaureate degree is required. The thesis option requires 6 hours of Thesis, and the non-thesis option requires 6 hours of Thesis. Both options include 6 hours of Thesis.

THE DOCTOR OF PHILOSOPHY PROGRAM

Curriculum and Instruction
The Ed.D. program with a major in Curriculum and Instruction requires a year-long practicum in elementary education, under Language, Communication, and Humanities Education, with concentrations in English education, foreign language education, and reading education. Please contact the appropriate unit for further information.

Educational Psychology
Under Counselor Education and Counseling Psychology, the minimum number of hours required for the concentration in educational psychology is 79. Under Psychoeducational Studies, the minimum number of hours required is 89. Refer to Degree Requirements for on-campus continuous enrollment in Leadership Studies for complete program requirements.

The concentration in educational psychology requires a year-long practicum sequence and the equivalent of a year’s full-time work as an intern in an appropriate counseling setting. It also requires supervised practicum experience in classroom teaching. Coursework in statistics and research design is a requirement for all concentrations/programs. All doctoral students take written comprehensive examinations in the program concentration, supporting specialization and cognate areas. The guidelines for each program concentration may be consulted for further requirements.

Leadership Studies in Education
For the Ed.D. program under Leadership Studies, with concentrations in educational administration and supervision and in higher education, the minimum hours are determined by the student’s doctoral committee. Six to 9 hours must be in a cognate area within the college and 6-9 hours outside the college unless the student has a master’s degree in a field outside the College of Education. Two consecutive semesters of 60 must be taken during residence. An internship is highly recommended but not required. A foreign language requirement is at the discretion of the committee. A written comprehensive examination is given as well as an oral exam over the dissertation.

The Leadership Studies unit offers an alternative approach to residence for the Doctor of Education degree. This alternative residence involves, among other requirements, a two-year, on-campus, continuous enrollment in Leadership Studies. Interested students should contact the unit for further information.

Leadership Studies also offers an Ed.D. concentration for practicing school administrators. Please contact the unit for further information.

Human Performance and Sport Studies
The Doctor of Education with a major in Human Performance and Sport Studies is available under Cultural Studies in Education with concentrations in motor behavior and sociocultural foundations (history, philosophy, sociology); under Exercise Science with a concentration in exercise science (exercise physiology/fitness, kinesiology/sports medicine). Please contact the appropriate unit for further information.

THE DOCTOR OF PHILOSOPHY PROGRAM

The intercollegiate Ph.D. program with a major in Education provides seventeen concentrations. The units participating in the Ph.D. program are Counselor Education and Counseling Psychology; Cultural Studies in Education; Education in the Sciences, Mathematics, Research, and Technology; Exercise Science; Holistic Teaching/Learning; Inclusive Early Childhood Education; Language, Communication, and Humanities Education; Leadership Studies in Education; Psychoeducational Studies; and Rehabilitation, Deafness, and Human Services.

The program requirements are:

Requirements: Minimum Hours
Research Area 15
Foreign or Computer Language (demonstrate proficiency) 6
General Core Requirements
Option A
History and philosophy of education (both areas must be represented) 4
Learning theory and curriculum (both areas must be represented) 4
Administrative/Leadership theory 2
sequence and the equivalent of a year’s full-time work as an intern in an appropriate counseling setting. The concentration in educational psychology also requires a supervised practicum experience in classroom teaching. Under Psychoeducational Studies, the following minimum number of hours is required in each program: educational psychology, 92; school psychology, 97.

The guidelines for each program may be consulted for further requirements.

MINOR IN GERONTOLOGY

Graduate students in the units of Counselor Education and Counseling Psychology, Exercise Science, or Psychoeducational Studies, may pursue a specialized minor in gerontology. This interunit/interdisciplinary minor gives the student an opportunity for combining the knowledge about aging in American society with his/her major concentration. Please refer to Human Ecology for specific requirements.

ACADEMIC COMMON MARKET

An agreement among southern states for sharing graduate programs allows legal residents of some states to enroll in certain programs at UT Knoxville on an in-state tuition basis. The M.S. program in Curriculum and Instruction (concentration in foreign language education-Track 1 only) is available to residents of the state of Maryland. The Ph.D. program in Education is available to residents of the state of Arkansas and Georgia (concentration in motor behavior only). The Ph.D. program in Human Performance and Sport Studies is available to residents of Arkansas, Georgia, or South Carolina. The M.S. program in Human Performance and Sport Studies is available to residents of the state of South Carolina or Virginia (concentration in exercise and sport studies). The M.S. program in Special Education is available to residents of Alabama, Arkansas, Georgia, or South Carolina.

The guidelines for each program may be consulted for further requirements. May be repeated. Maximum 6 hrs. S/NC only. E

562 Direction and Supervision of Student Teaching

Roles and responsibilities of cooperating teachers and student teacher; objectives and policies of student teaching program; elements of clinical supervision; overview of research. F, Su

568 Teacher-Parent-Community Relations

Techniques for effective relations between parents and teachers; examination of roles and expectations; parental involvement; volunteer programs; influence of community on instructional process. Prereq: Consent of instructor. F, Su
The graduate programs offered within this unit lead to the Master of Science, the Specialist in Education, and the Doctor of Education, all with majors in Curriculum and Instruction. The unit also participates in the college-wide Ph.D. program with a major in Education. See Education under Fields of Instruction for full description of all degree requirements.

This unit is composed of four areas of focus: teacher education, which includes the advancement of science and mathematics education, educational research and statistics, instructional media and technology, and curriculum studies. All four areas will contribute to the preparation and advanced education of mathematics and science teachers at the elementary, secondary, and college levels. In addition each area will be responsible for the continued advancement of its discipline, and the education of students in other units needing or wanting coursework in their disciplines.

For further information, write the Education in the Sciences, Mathematics, Research, and Technology unit.

Graduate Courses

475 Utilization of Instructional Media (3) Basic concepts of communication and instructional development for improving instruction through use of media. (Same as Information Sciences 475.) F

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

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

496 Teaching Science Grades 7-12 (3) Methods, recent trends in science and environmental education programs for secondary schools. Prerequisite: Admission to teacher education. F

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

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


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

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

522 Programs and Materials in Elementary School Mathematics (3) Examination, development and use of materials for creating an active learning environment for learning mathematics in elementary and middle schools. Prerequisite: 3 credits in mathematics or consent of instructor. F

530 Teaching Mathematics to Young Children: K-4 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. For those with little or no preparation in teaching elementary school mathematics. F

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

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

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

543 Teaching Mathematics in Middle Schools: 5-8 (3) Unit planning, daily planning, grouping and other strategies of teaching mathematics. For those with little preparation in teaching middle school mathematics. E

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

558 Curriculum Planning and Development (3) Foundations and principles of curriculum planning and development. Historical analysis of curriculum theory, principles of planning and development, and classroom applications for improved learning. E

560 Student Assessment (3) Processes for assessing and reporting student achievement and use of available assessment data. Methods of assessment other than tests and measurements: portfolios, performance tasks, exhibitions. F

561 Educational Statistics (3) Applications of descriptive and inferential statistical techniques to educational and instructional problems. Use of electronic calculators in educational research. Prerequisite: One year of college mathematics, an elementary course in statistics, or consent of instructor. F

565 Instructional Trends and Issues in Science Education (3) Analysis of current trends in science instruction, instructional issues facing elementary, secondary, and community college science teachers, and application of learning theory to teaching biological, physical, and environmental sciences. Prerequisite: 486, 422, or equivalent. F

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

569 Advanced Production of Audiovisual Software (3) Hand and mechanical lettering, flat picture mounting, lantern slide production, audio production. TV studio orientation, sync-taping, multi-screen presentations, and printing techniques. (Same as Information Sciences 569.) Sp, Su

577 Introduction to Data Processing in Curriculum and Instruction (3) Analysis of computer applications in educational computing and data processing. Curricular, instructional, research, and classroom management applications from microcomputers to super computers. Prerequisite: Consent of instructor. F

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

581 Seminar in Mathematics Education (3) Current issues influencing instruction in mathematics in schools, elementary through college, related teaching methodologies. Opportunities for work on special problems. Prerequisite: Undergraduate course in teaching of mathematics. Su

582 Teaching Enrichment Mathematics in Middle and Junior High Schools (3) Topics to enrich middle school and junior high mathematics. Geometrical, statistical, and problem solving activities. Special attention to metric system. Opportunities for individual projects. Prerequisite: 561. Su

583 Teaching Mathematics in Senior High Schools and Community Colleges (3) Topics appropriate for high school and community/junior college mathematics curriculum. Special problems related to enrichment, prob-

586 Teaching Probability & Statistics (3) Teaching of probability and statistics in schools, elementary through college. Prerequisites and statistical experiments, demonstrations, and applications. Prerequisite: 581. F

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

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

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

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

596 Curricular Trends and Issues in Science Education (3) Analysis of elementary and secondary curricular, physical, and environmental sciences. Impact of current learning theories on future curriculum development projects. Prerequisite: 486, 422, or equivalent. Prerequisite or corequisite: 565 or consent of instructor. E

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

604 Seminar in Curriculum and Instruction (1) Required for those with cumulative GPA of 3.5 or above. F

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

628 Advanced Studies in Science Education (3) Analysis of current research in science education and implications for research for classroom practice. Prerequisite: 596. May be repeated. Maximum 6 hrs.

669 Instructional Media Research (3) Identification, location, and collection of developmental and experimental research and reference materials. Application of research. F

671 Advanced Educational Statistics (3) Applications of parametric and non-parametric statistical inference to educational and instructional problems. Use of microcomputers in educational research. Prerequisite: 561, Sp, Su

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

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

676 Curriculum Theory (3) Influential curriculum theories and approaches, implications for structure and design of educational programs. Nature and function of theory, theory building activities. Prerequisite: Consent of instructor. E

683 Advanced Studies in Elementary School Mathematics (3) Research in elementary school mathematics. Prerequisite: Graduate course in mathematics education or consent of instructor. Sp

689 Internship (1-3) Experiences in application of principles and practices of curriculum development and instructional improvement. Prerequisites and conditions of instructor. May be repeated. Maximum 9 hrs. S/NC only. E

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

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

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

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

(College of Engineering)

MAJOR DEGREES

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

R. C. Gonzalez, Head

Professors:
Alexeff, Igor, Ph. D.., Wisconsin
Bailey, J. Milton, Ph. D. .................. Georgia Tech
Birdwell, J. Douglas, Ph. D. .......... MIT
Bishop, Asa O., Jr., Ph. D. ............... Clemson
Bielock, T. Vaughn, Ph. D. ............... Tennessee
Bodenheimer, Robert E., Ph. D. ....... North Carolina
Bourquin, Donald W., Ph. D. ............ Vanderbilt
Green, Walter L., Ph. D. .................. Florida
Hung, James C. (Distinguished Prof.), Ph. D. .... New York
Kennedy, Eldredge J., Ph. D. ............ Tennessee
Lawler, Jack S. (Liaison), Ph. D. ...... Michigan State
Leffell, Will O. (Emeritus), M.S. ...... Tennessee
Neff, Herbert P., Ph. D. ................. Auburn
Pace, Marshall O., Ph. D. ............... Georgia Tech
Pierce, J. Frank (Distinguished Prof.) (Emeritus), Ph. D. .... Pittsburgh
Pujol, Alfonso Jr. (UTSI), Ph. D. ...... Vanderbilt
Roberts, M. J., Ph. D. .................... Tennessee
Rochella, Robert W. (Emeritus), Ph. D. .... Maryland
Roth, J. Reece, Ph. D. .................... Cornell
Symonds, Frederick W., Ph. D. ....... Nottingham
Tillman, James D. (Emeritus), Ph. D. .... Auburn
Trivedi, Mohan M., Ph. D. ............. Utah State
Weaver, Charles H. (Emeritus), PE, Ph. D. .... Wisconsin

Associate Professors:
Abidi, M. A., Ph. D. ...................... Tennessee
Bomar, Bruce W. (UTSI), Ph. D. ...... Tennessee
Crilly, Paul B., Ph. D. ................. New Mexico State
Joseph, Roy D. (UTSI), Ph. D. .... Case Western
Koch, Daniel, Ph. D. ..................... Missouri (Rolla)
Rochelle, James M., Ph. D. ............. Tennessee
Rosenberg, David, Ph. D. ............. New York
Wallers, J. Wayne, Ph. D. ............. Tennessee

Assistant Professors:
Smith, L. Montgomery (UTSI), Ph. D. ................................ North Carolina
Whitaker, Ross T., Ph. D. ............... North Carolina

The Electrical Engineering Department has a graduate committee to administer, promote, and advance the general well-being of the graduate program. The Department of Electrical Engineering and the Department of Nuclear Engineering jointly offer a master's degree program in the field of fusion energy. Students may have the opportunity to do their master's thesis at the Fusion Energy Division of the Oak Ridge National Laboratory or at the Plasma Science Laboratory, affiliated with the Electrical Engineering Department. A limited number of Graduate Research Assistantships are available at each location. Further information about this program is available from the department.

THE MASTER'S PROGRAM

Graduate work leading to the Master of Science with a major in Electrical Engineering may be completed during one academic year of full-time study, or the degree may be obtained in two or three years of study in the evening.

Admission Requirements

Students applying for admission to the Master of Science program and who hold a B.S. in Electrical Engineering are considered for admission on an individual basis. The minimum expectation is an undergraduate cumulative grade-point average of 3.0 out of 4.0 and a GPA of 3.0 for the senior year. All applicants whose native language is not English, including those who have earned degrees at U.S. institutions, must score at least 550 on the TOEFL exam to be considered for admission to this program.

Students who hold the B.S. or B.A. in a field other than electrical engineering are also expected to have a minimum cumulative grade-point average of 3.0 and a minimum senior year average of 3.0 in that field. Students should have been exposed to undergraduate courses in mathematics consisting of mathematics courses of 400 level or higher which have been approved by the Electrical Engineering Graduate Committee. All 12 semester hours of 500 level work in another area of electrical engineering courses and 6 semester hours of 500-level work in one area of mathematical sciences may be included in the degree requirements of the student's major area. The 500-level work in electrical engineering courses must include at least 6 hours in the student's major area.

Master's Degree Requirements

Specific degree requirements which must be met include:
1. Electrical Engineering 503 and 504.
2. Six semester hours of graduate credit in mathematics consisting of mathematics courses of 400 level or higher which have been approved by the Electrical Engineering Graduate Committee.
3. An additional 12 semester hours of 500-level work in electrical engineering courses or 6 semester hours of 500-level work in one area of electrical engineering courses and 6 semester hours of 500-level work in another area of electrical engineering courses and 6 semester hours of 500-level work in one area of mathematics may be included in the degree requirements of the student's major area.
5. A final oral examination covering the thesis and related coursework.

THE DOCTORAL PROGRAM

The Ph.D. with a major in Electrical Engineering may be pursued in the concentration areas of circuit theory, computers, electronics, communication theory, electromagnetic theory, plasma engineering, power systems, solid-state electronics, and control systems. Applicants must submit scores on the General Graduate Record Exam. A TOEFL score of 550 is required for non-native speakers of English, including those who have earned degrees at U.S. institutions. Specific departmental requirements for the Ph.D. include the following:
1. A Master of Science or Master of Engineering degree.
   a. A minimum of 24 semester hours of work in electrical engineering courses at the 500 and 600 levels.
   b. A minimum of 9 semester hours of 600-level coursework. At least 3 semester hours of this work must be in an area other than the student's major area.
   c. A minimum of 12 hours of mathematics courses approved by the Electrical Engineering Graduate Committee.
3. Admission to the Ph.D. program is based on an individual basis. The minimum expectation is an undergraduate cumulative grade-point average of 3.0 and a minimum senior year average of 3.0 in that field. These students should have been exposed to undergraduate courses in mathematics consisting of mathematics courses of 400 level or higher which have been approved by the Electrical Engineering Graduate Committee.
4. Satisfactory performance on both a qualifying and comprehensive examination. The qualifying examination is prepared by the Electrical Engineering faculty and consists of a 3-hour written examination in each of four areas. Areas (1) mathematics and transform methods, and (2) basic electrical network analysis, are usually chosen from topics covered in the Electrical Engineering courses. Areas (3) and (4) are chosen from topics covered in the graduate courses. The qualifying examination is normally taken after the completion of 24 hours of graduate coursework or immediately after completion of a master's degree. A minimum of 18 hours of graduate coursework must be completed after the student has taken the qualifying examination the first time. A comprehensive examination is required by the Graduate School. In this department the comprehensive exam is administered by the student's committee; the exam results are reported to the graduate committee for approval; and the exam is filed in the department. The comprehensive exam is given in the student's dissertation work. The student's committee may require additional written sections. The student must demonstrate a mastery of the dissertation topic, ability to think analytically and creatively, and skill in using academic resources, and ability to complete the dissertation successfully.
5. Participation in departmental seminars.

Many of the electrical engineering courses are offered in the evening. Engineers working in industry are encouraged to participate in the department's graduate program. Departmental graduate programs are also available at the Space Institute, Tullahoma.
Departmental actions regarding a graduate student may be appealed in writing, first to the Graduate Committee and then to the Department Faculty.

**GRADUATE COURSES**

Note: Courses required in the Electrical Engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. programs. Prerequisite courses may be used toward a graduate degree in Electrical Engineering except when required by the program.

400 Senior Design (5) Major design project focusing attention on professional practice, accumulated background of course work, and recent developments in a field. Prerequisites: Completion of required junior EE courses.

411 Digital Signal Processing and Filter Design (3) Discrete-time signals and systems, sampling, discrete Fourier transforms, analog filter characteristics, nonrecursive and recursive filter design, and CAD tools for filter design: experiments and projects. Prerequisites: Frequency-Domain Analysis of Signals and Noise, Linear Systems Analysis, Systems and Power Lab.

412 Linear Control System Design (4) Classical and modern techniques for design and compensation of linear feedback control systems: Bode design, root locus design, state variable pole placement design. Prerequisite: 411.

413 Electric Energy Systems (3) Structure and operation of electric generating stations: load flow, economic load dispatch, control; reliability, economic and environmental aspects; system stability; protection. Prerequisite: Transient Analysis, Electric Energy System Components, Systems and Power Lab.

414 Power Systems Operations and Planning (4) Dynamic phenomena in power systems. Transient stability and severe faults, power flow, operating reserves, economic dispatch, automatic generation control, volt-var control, load management, cogeneration and other topics of contemporary concern. Prerequisite: 421.

415 Power System Protection (3) Principles of electromechanical and electronic protection of power systems, fault analysis, overcurrent and differential protection, power system disturbances, protection of power electronic devices. Prerequisite: 413.

416 Power System Operations and Planning (4) Dynamic phenomena in power systems. Transient stability and severe faults, power flow, operating reserves, economic dispatch, automatic generation control, volt-var control, load management, cogeneration and other topics of contemporary concern. Prerequisite: 421.

417 Introduction to Pattern Recognition (3) Design of learning and adaptive machines. Elementary decision theory, perceptron algorithm, Bayes classification rule, learning algorithms, optimization techniques, clustering, decision trees, nearest neighbor, adaptive classifiers. Prerequisite: Senior standing. Non-majors may require consent of instructor.

418 Introduction to Digital Image Processing (3) Basic principles for digitalizing, storing, processing, and displaying images. Computational procedures for image enhancement, restoration, coding, and segmentation. Prerequisite: Senior standing. Non-majors may require consent of instructor.

419 Digital Communication (3) Discrete Fourier transforms, binary and analog digital communication, digital communication in the presence of noise, matched filtering and equalization, introduction to information theory. Prerequisites: Analog Communication Amplitude and Frequency Modulation.

422 Communication System Design (4) Application of communication theory to system design. Development of communication system specifications. System simulation utilizing graphic language, hardware and software design and simulation. Construction and performance evaluation of a complete analog or digital transmission system. Prerequisites: 411.

424 Microwave Circuits and Electronics (3) Scattered wave description of circuits, isolators, amplifiers, couplers and power dividers, circulators, phase shifters, loading and interconnection of systems. Power generation and amplification of microwave tubes (buncher and junction devices). Microwave switching, filtering and multiplexing devices. Transmission line and waveguide components. Projects. Prerequisite: Senior standing.

425 Microprocessors and Microcontrollers in Electrical Engineering (3) Project-oriented: microcomputer kit with monitor program and development system with microprocessors, compiler, and simulation software. Chip design and computer-aided design. Prerequisites: Introduction to Logic Design of Digital Systems.


427 Physics of Fusion Energy (3) High-temperature plasma physics relevant to fusion plasmas, as well as fusion reactors, and engineering and physics constraints on fusion reactor devices. Prerequisite: Senior standing. Non-majors require consent of instructor. (Same as Nuclear Engineering 463.)

428 Fusion Technology (4) Principles and phenomenology of tokamak reactors, advanced magnetic confinement concepts, and fusion energy systems and components. Design project integrating material from 463 and 467. Prerequisite: 427 and 467 or equivalent. (Same as Nuclear Engineering 464.)

429 Principles of Industrial Plasma Engineering (3) Principles of industrial plasma processing relevant to industrial applications of plasmas. Basic principles of kinetic theory, plasma diagnostics, and plasma physics; sources of electrons, ions, and radicals; electrical discharges and sources; RF plasmas and plasma sources. Prerequisite: Senior standing.

430 Principles of Plasma Science and Engineering (3) Principles of plasma physics and engineering relevant to industrial applications of plasmas. Basic principles of kinetic theory, plasma diagnostics, and plasma physics; sources of electrons, ions, and radicals; electrical discharges and sources; RF plasmas and plasma sources. Prerequisite: Senior standing.


432 Electronic Amplifiers (4) Feedback amplifier principles; wideband linear amplifier design; low-noise preamplifiers; audio power amplifier design; linear and regulated power supply design and switching regulator design. Introduction to radio frequency amplifier design; oscillator principles. Laboratory experiments and design projects. Prerequisite: 431.

433 Fabrication and Design Concepts for Integrated Circuits (3) Basic fabrication of active and passive components for monolithic integrated circuits: characteristics of bipolar, MOS and JFET transistors in typical analog and digital integrated circuits; standard digital logic families including TTL, ECL, Schottky, NMOS, CMOS and GaAs gates and arrays; design concepts for op amp, comparator, reference, switch, oscillator, and other basic circuits. Basic principles for hybrid ICs, and surface mount components. Design projects. Prerequisite: Electronic Circuits.

441 Digital Communication (3) Discrete Fourier transforms, binary and analog digital communication, digital communication in the presence of noise, matched filtering and equalization, introduction to information theory. Prerequisites: Analog Communication Amplitude and Frequency Modulation.

442 Communication System Design (4) Application of communication theory to system design. Development of communication system specifications. System simulation utilizing graphic language, hardware and software design and simulation. Construction and performance evaluation of a complete analog or digital transmission system. Prerequisite: 411.

443 Antennas and Propagation (3) Linear antennas, arrays, open simple antennas, Antenna gain, impedance, communication link parameters. Wave propagation in earth's atmosphere, earth's troposphere and ionosphere. Reflections from earth, effects on link reliability. Prerequisite: Transient Analysis, Fields, Analog Communication Amplitude and Frequency Modulation.

444 Microwave Circuits and Electronics (3) Scattered wave description of circuits, isolators, amplifiers, couplers and power dividers, circulators, phase shifters, loading and interconnection of systems. Power generation and amplification of microwave tubes (buncher and junction devices). Microwave switching, filtering and multiplexing devices. Transmission line and waveguide components. Projects. Prerequisite: Senior standing.

445 Electro-Acoustics (3) Wave equation for sound, radiation from pistons, transmission from loudspeakers, horns, speaker systems, phonograph recording and reproduction, tape recording and reproduction, noise reduction systems, digital recording. Prerequisite: Senior standing.

446 Engineering for Diabetes 3-5th graders (3) Principles and applications of diabetes technology, including medications, insulin pumps, and continuous glucose monitoring systems. Prerequisite: Consent of instructor.
vector form with application to large scale power systems. Prereq: 421 or equivalent.

522 Power Systems Analysis II (3) Operation and control of interconnected power systems, transient and dynamic stability. Formulating and solving problems in matrix-vector form with application to large scale power systems. Prereq: 521.

523 Power Electronics and Drives (3) Forced commutation inverters, thyristors, inverters, inverters' drive system modeling, vector and scalar control of induction machines, parameters, variations, control principles of synchronous machine.


525 Advanced Electrical Machines I (3) Fundamental processes of electromechanical energy conversion; application in conventional devices. Differential equations for rotating machinery. Prereq: 422 or equivalent.

531 Analog Electronic Circuits I (3) Physical operation of modern electronic devices: semiconductor devices; diodes, bipolar transistors, J-FETs, and MOS-FETs. Small-signal equivalent circuits and noise models of active devices. Project laboratory. Prereq: 431, 432, 433, or consent of instructor.


545 Introductory Microwave Networks and Components (3) Scattering and transfer representation for multipole, material and bilateral microwave and millimeter wave devices. Component and system parameter measurement by modern network analyzers. Electronic oscillators and amplifiers, frequency sweep oscillators, transient time devices, parametric devices, mixers, switches. Prereq: 511.


552 Digital System Design II (3) State identification and structure realizations of sequential machines. Digital design techniques in microprogramming and interrupt control. Prereq: 551.

561 Plasma Diagnostics I (3) Principles of active, passive, perturbing and nonperturbing diagnostic methods used in low temperature plasmas, and high temperature plasmas of interest in fusion research. Laboratory safety, data reduction and presentation, microprocessor based data handling and analysis, and reduction of time series data. Prereq: 461, 485, or consent of instructor. (Same as Nuclear Engineering 561.)

562 Plasma Diagnostics II (3) Laboratory instruction in operation of plasma diagnostic instruments in plasma science laboratory, experience with high voltage, vacuum, RF, and digital data handling techniques. Prereq: 561.

565 Industrial Plasma Engineering I (3) Low temperature plasma physics relevant to industrial applications: kinetic theory, particle dynamics in electric and magnetic fields, gas-phase discharges, and electron, ion, and plasma sources. Prereq: Graduate standing or consent of instructor.

566 Industrial Plasma Engineering II (3) Continuation of 565 in industrial applications: ion implantation, plasma deposition and etching, space propulsion systems, plasma chemistry, plasma lighting devices, insulating dielectrics and breakdown, materials processing with plasma arcs, and related topics. Prereq: 565 or consent of instructor.

571 Pattern Recognition (3) Decision-theoretic and structural approaches to pattern recognition. Deterministic and statistical decision rules; feature extraction and representation, system and semantic methods. Prereq: 471 or consent of instructor.


573 Vision and Sensing for Robotics and Automation I (3) Acquisition, processing, integration, and interpretation of a wide range of vision and non-vision sensing modalities as applied to autonomous and teleoperated robotic systems. Prereq: Consent of instructor.

574 Vision and Sensing for Robotics and Automation II (3) Aspects of robot programming and motion using various sensors. Selected topics from current literature. Prereq: Consent of instructor.


589 Graduate Seminar I (3) Topics of interest discussed in weekly seminar. May be repeated. Maximum 6 hrs. S/NC or letter grade.

599 Special Topics (1-3) May be repeated. Maximum 9 hrs.

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


614 Optimal Control (3) Deterministic and stochastic dynamic programming in continuous and discrete time, minimum principle and maximum principle, computational methods in optimal control. Prereq: 511.

617 Special Topics in Systems Theory I (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 503 and consent of instructor.

618 Special Topics in Systems Theory II (3) Topics of current interest to students and faculty: large scale systems, model order reduction, algebraic and geometric system theories, and advanced design methods. Prereq: 517.

623 Advanced Power Electronics and Drives (3) Phase-controlled cycloconverters, cycloconverter-fed ac drives, resonant converters, vector and scalar control of synchronous machines, static Kramer drives, static Scherbius drives, VSCF generation, modern control theory in ac drives.

624 Electrical Insulation (3) Principles, testing, and case studies. Basic principles of electrical insulation, charging and breakdown in vacuum, gas, liquid, solid, and composite insulation systems. Testing with low-voltage instrumentation, pulse height analysis, optics, acoustics, and bridges; associated statistics and distributed parameter effects. Case studies drawn from active research, power systems, electronic circuits and devices, shielding, and stress grading. Prereq: 503, 504, consent of instructor.

631 Advanced Topics in Electronic Instrumentation I (3) Based on particular interests of students. Fundamental physical processes in instrumentation transducers: thermoelectric, magnetoelastic, electromechanical and optical devices. Prereq: 531-32 and consent of instructor.

632 Advanced Topics in Electronic Instrumentation II (3) Physical operation of modern discrete, monolithic, and hybrid electronic structures and their application in signal processors, analog, digital, telecommunication, and microwave devices. Prereq: 631.

643 Detection and Estimation Theory (3) Detection theory; coding theory; system identification. Signals with unknown parameters; optimal filter synthesis; adaptive systems; sequential detection; suboptimal detection. Prereq: 504 or consent of instructor.

644 Coding and Information Theory (3) Structure of algebraic and number-theoretic codes, error-correcting codes, decoding methods. Identification schemes: deterministic, stochastic, and hierarchical methods. Prereq: 643.

651 Computer-Aided Design of VLSI Systems I (3) Fundamentals of design of modern electronic devices; computer architecture, VLSI design, algorithmic state machines; partitioning, hierarchical design methodologies. Prereq: 531-2 or consent of instructor.

652 Computer-Aided Design of VLSI Systems II (3) Computer-aided design tools; design and implementation of full custom very large scale integrated (VLSI) circuits; design for testability; testing of fabricated chips. Prereq: 651.

653 Advanced Plasma Physics I (3) Basic concepts of high-temperature plasmas, plasma physics, magnetohydrodynamics and kinetic descriptions of plasma, plasma transport, plasma waves, equilibria, and stability. Prereq: Physics 541-2, 541-3 or 565-4, or consent of instructor. (Same as Physics 663.)


671 Image Processing and Robotics I (3) Three-dimensional scene modeling and recognition, multi-sensor systems. Prereq: 572 or 573 or consent of instructor.

672 Image Processing and Robotics II (3) Stereovision, shape theory. Prereq: 671.

673 Image Processing and Robotics III (3) Time-varying imagery, path planning and navigation. Prereq: 672.

681-82 Quantum Electronics (3, 3) Prereq: Consent of instructor.

691 Advanced Graduate Seminar I (3) Research in department. May be repeated. S/NC or letter grade.

692 Special Topics (1-3) Advanced topics of current interest to Ph.D. students in Electrical Engineering. May be repeated. Maximum 9 hrs.

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**Engineering Science**

*See Mechanical and Aerospace Engineering and Engineering Science*

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**English**

*(College of Arts and Sciences)*

**MAJOR**

<table>
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<tr>
<th>DEGREES</th>
<th>English</th>
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<tr>
<td>M.A., Ph.D.</td>
<td>D. Allen Carroll, Head</td>
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</tbody>
</table>
Professors:

Adams, Percy G. (Emeritus), Ph.D. ............ Texas
Bratton, Edward W., Ph.D. ......................... Illinois
Carroll, D. Allen, Ph.D. ......................... North Carolina
Cox, Don R., Ph.D. .................................. Missouri
Curry, Kenneth (Emeritus), Ph.D. ............ Yale
Drake, Robert Y., Jr., Ph.D. ..................... Yale
Ensor, Allen R., Ph.D. ............................. Indiana
Finneran, Richard J. (Hodges Chair of Excellence), Ph.D. ........ North Carolina
Fisher, John H. (Emeritus), Ph.D., Pennsylvania
Goslee, David F., Ph.D. ............................ Yale
Goslee, Nancy M. (Distinguished Prof.), Ph.D. ..... Duke
Heffernan, Thomas J., Ph.D. ...................... Cambridge
Kallet, Marilyn, Ph.D. ................................ Rutgers
Keene, Michael Ph.D. ................................ Texas
Kelly, Richard M. (Lindsay Young Prof.), Ph.D. .... Penn State
Leggett, B. J. (Distinguished Prof.), Ph.D. .......... Florida
Leki, Ilona, Ph.D. ................................... Illinois
Lofaro, Michael A., Ph.D. ......................... Maryland
Maland, Charles J. (Lindsay Young Prof.), Ph.D. ....... Michigan
Penner, A. Richard, Ph.D. .......................... Colorado
Reese, Jack E. (Univ. Prof.), Ph.D. .......... Kentucky
Sanders, Norman J. (Lindsay Young Prof.), Ph.D. .... Pennsylvania
Schneider, Daniel J. (Emeritus), Ph.D. ............... Northwestern
Scour, Dorothy M., Ph.D. .......................... North Carolina
Shurr, William (Emeritus), Ph.D., North Carolina
Stewart, Bain T. (Emeritus), Ph.D., Northwestern
Thomas, Joyce Carol, MA. ...................... Stanford
Truem, Joseph B., Jr., Ph.D. ..................... Princeton
Weir, Allen, M.F.A. ................................. Bowling Green
Wheeler, Thomas V., Ph.D. ....................... North Carolina
White, Jon M. (Emeritus), M.A. .................. Cambridge
Wright, Nathalia (Emeritus), Ph.D. .............. Yale

Associate Professors:

Atwill, Janet, Ph.D. ................................... Purdue
Bensel-Myers, Linda D., Ph.D. ................... Oregon
Andras, Bethany K., Ph.D. ....................... Arkansas
Dunn, Allen, Ph.D. .................................. Washington
Gamer, Stanton B., Jr., Ph.D. .................... Princeton
Gill, J. E., Ph.D. .................................... North Carolina
Hutchinson, George, Ph.D. ....................... Indiana
Jennings, La Vinia, Ph.D. .......................... North Carolina
Papke, Mary E., Ph.D. ............................... McGill
Robinson, Frank K., Ph.D. ......................... Texas
Smith, Arthur, Ph.D. ................................ Houston
Stillman, Robert, Ph.D. ............................. Pennsylvania
Zomchick, John (Liaison), Ph.D. ............... Columbia

Assistant Professors:

Bhatt, Rakesh, Ph.D. ............................... Illinois
Hammond, Patay G., M.A. ........................ Tennessee
Hirst, Rusaell, Ph.D. ............................... Rensselaer
Howes, Laura L., Ph.D. ............................ Columbia
Mostern, Kenneth, Ph.D. ........................ Berkeley
Voss, Randi G., Ph.D. .............................. Texas

The Department of English offers the Master of Arts and the Doctor of Philosophy degrees with a major in English. Thesis and non-thesis options are available for the M.A. as well as a special concentration in writing. Detailed information about the master’s and doctoral programs, and about individual graduate courses, may be obtained by writing the Director of Graduate Studies in English, 306 McClung Tower. A prospective student must contact the department to receive the proper information and forms with which to apply. The Department of English does not accept students in non-degree or provisional status. A student who wishes to enter the department must apply in degree-seeking status for his/her application to receive consideration for admission to any graduate program in English.

THE MASTER’S PROGRAM

Requirements

Coursework: A minimum of 24 semester hours in English beyond the B.A. to include 6 hours at the 600 level; 12 additional hours at the 500-600 level (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 6 hours for graduate credit at any level, including the 400 level. In this coursework, students must maintain at least a 3.0 GPA.

Non-Thesis Option: Six hours of additional courses at the 500-600 level, making a total of 30 hours of required coursework.

Language Requirement: Evidence of proficiency in one foreign language, to be fulfilled in one of the following ways:

1. Completion of the second year of a language at college level with a grade of C or better.
2. Completion of French 302 or German 332 at UT Knoxville with a grade of B or better.
3. Passing of the regular Ph.D. foreign language examination as currently administered at UT Knoxville.

Final Examination: A candidate presenting a thesis must pass a one-hour oral examination; a candidate presenting a creative project must pass a ninety-minute oral examination. The examination consists of a short thesis defense, but chiefly of questions covering the general history of English and American literature, not merely the coursework taken. A reading list of primary works designed to help the student prepare for these questions is available in the office of the Director of Graduate Studies in English.

A non-thesis student must pass a written examination, followed by a one-hour oral examination, both consisting of the same sort of questions as the examination taken by the thesis student.

Residence Requirement: There is no residence requirement for the M.A., but students should attempt to pursue a full-time program whenever possible.

WRITING CONCENTRATION

The master’s program with writing concentration is intended for those students who plan to do free-lance writing, specialize in teaching writing courses at the college level, or work as professional writers in business or industry.

Requirements

The requirements for the writing concentration are the same as those for the thesis option above with the following exceptions:

Coursework: Writing students may substitute two 400-level writing courses for two

500-level level courses. Students must take at least 9 hours in writing and in literature, the remaining 6 to be selected from any English courses at the proper level. Of the courses in writing, at least 3 hours must be taken at the 500 level; additional 500-level hours are strongly recommended.

Writing Projects: One of the following writing projects for six hours of credit:

1. A thesis, using research to analyze some aspect of writing or rhetorical theory.
2. A creative project, such as a collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose.

The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and the project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be from the literature faculty.

Final Examination: The reading list may be modified by the M.A. examining committee, meeting as a body with the student, to reflect the candidate’s particular writing emphasis. However, most of the oral examination should focus on the literature outlined in the original reading list.

THE DOCTORAL PROGRAM

Requirements

A student must successfully complete a program of study, normally 8 semesters as outlined below, approved by the candidate’s committee or the Director of Graduate Studies in English.

Coursework: At least 51 semester hours beyond the B.A. to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 12 hours at the 600 level; at least 15 semester hours at the 500 level or above (Only 3 hours of 593 Independent Study may be applied toward the M.A.).

2. A creative project, such as a collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose.

The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and the project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be from the literature faculty.

Final Examination: The reading list may be modified by the M.A. examining committee, meeting as a body with the student, to reflect the candidate’s particular writing emphasis. However, most of the oral examination should focus on the literature outlined in the original reading list.

THE DOCTORAL PROGRAM

Requirements

A student must successfully complete a program of study, normally 8 semesters as outlined below, approved by the candidate’s committee or the Director of Graduate Studies in English.

Coursework: At least 51 semester hours beyond the B.A. to include at least 21 semester hours at the 600 level; at least 15 semester hours at the 500 level or above (Only 3 hours of 593 Independent Study may be applied toward the M.A.); and 12 hours at the 600 level; at least 15 semester hours at the 500 level or above (Only 3 hours of 593 Independent Study may be applied toward the M.A.).

2. A creative project, such as a collection of poems or short stories, a short novel, a play, or a creative work of non-fiction prose.

The nature and length of each project will be determined by the Director of Graduate Studies after consulting with the student and the project director. In addition to the director, two other English Department faculty members will supervise and approve the project; at least one should be from the literature faculty.

Final Examination: The reading list may be modified by the M.A. examining committee, meeting as a body with the student, to reflect the candidate’s particular writing emphasis. However, most of the oral examination should focus on the literature outlined in the original reading list.

THE DOCTORAL PROGRAM
3. One modern language approved by the Director of Graduate Studies in English, or intensive study of the English language. This requirement must be fulfilled by completion of (a), (b), or (c) in option 1. for one foreign language; and completion of 6 semester hours in English language courses with grades of B or better, at least three of which must be from English 508 or 509 History of the English Language (offered in alternate years only). For the other 3 hours, the student may either complete the history of the language sequence or choose one other course in language taught in the Department of English at the 500 or 600 level and approved by the Director of Graduate Studies in English. These courses will not count toward the minimum number of courses for the Ph.D., and anyone electing this language option may not take the comprehensive examination in linguistics.

Examinations: (1) A 4-hour qualifying examination taken before the end of the first year of Ph.D. coursework; this examination is given three times a year, with the MA written examination. (2) A comprehensive written examination which may be divided as the department directs; see the English Department graduate bulletin for details. The comprehensive examination is given twice a year, normally in February and September. Before a student may take it, he/she must have completed all coursework required. A student must also have met all requirements for foreign languages before beginning the first part of the examination.

DissertationDefense: A one-hour examination on the dissertation and other related areas.

Residence Requirement: Two consecutive semesters as a full-time student. For students not on teaching assistantships, full-time consists of 9 or more hours of coursework and/or dissertation hours each semester. For students on assistantships, full-time consists of at least 6 hours of courses and/or dissertation hours and 3 hours of teaching each semester.

GRADUATE COURSES

Note: Students enrolling in English graduate courses must first register in the office of the Director of Graduate Studies in 306 McCullough Tower.

401 Medieval Literature (3) Reading and analysis of selected medieval literary masterpieces in modern English.

402 Chaucer (3) Reading and analysis of Canterbury Tales and Troilus and Criseyde in Middle English.

404 Shakespeare I: Early Plays (3) Shakespeare's dramatic achievement before 1601. Reading and discussion of selected plays from romantic comedies, including Twelfth Night; English histories, including Henry IV, and early tragedy, including Hamlet.

405 Shakespeare II: Later Plays (3) Shakespeare's dramatic achievement between 1601 and 1613. Reading and discussion of selected plays from romantic comedies, including Much Ado About Nothing, problem plays, including Measure for Measure, and dramatic romances, including The Tempest.

406 Renaissance Drama (3) English theatre between 1580 and 1640 through reading of representative plays by Shakespeare's contemporaries: Marlowe, Webster, Jonson.

409 Spenser and his Contemporaries (3) Principal achievements in prose and poetry of sixteenth century authors; Spenser, Wyatt, Marlowe, More, Sidney, and Bacon.

410 Milton, Donne and their Contemporaries (3) Principal achievements in prose and poetry of first two-thirds of seventeenth century: poetry of Milton, Donne, Marvell, and prose of Browne, Bacon, Walton.

411 Literature of Restoration and Early Eighteenth Century: Dryden to Pope (3) Survey of English literature and culture from 1680 to 1740.

412 Literature of Later Eighteenth Century: Johnson to Burns (3) Survey of English literature and culture from 1740 to 1800.

413 Restoration and Eighteenth-Century Genres and Models (3) A major genre or literary mode: drama, novel, poetry, non-fiction prose, satire, romance, or epic, written between 1660 and 1780. May be repeated. May be taken for graduate credit.

414 Romantic Poetry and Prose I (3) Wordworth, Coleridge, and Blake; readings from Lamb, De Quincey, and other prose writers.

415 Romantic Poetry and Prose II (3) Keats, Shelley, and Byron; readings from Hazlitt, Peacock, and other prose writers.

416 Victorian Poetry and Prose I (3) Tennyson, Pre-Raphaelites, Carlyle, Newman, and Mill.

419 Victorian Poetry and Prose II (3) Browning, Arnold, Hopkins, Hardy, Ruskin, Darwin, and Wilde.

420 The Nineteenth-Century British Novel (3) Scott to Hardy.

421 Modern British Novel (3) Lawrence, Joyce, and Woolf.

422 Women Writers in Britain (3) Literary consciousness and works of women writers in Britain, Topics vary: Marie de France, Margery Kempe, Aemilia Lanyer, Elizabeth Cary, Aphra Behn, Frances Burney, Mary Wollstonecraft, Mary Shelley, George Elliot, Virginia Woolf, and Doris Lessing. May be repeated. Maximum 6 hrs. (Same as Women's Studies 425.)

431 Colonial, Federal, and Early National American Literature (3) From Columbus to Washington Irving.

432 American Romanticism and Transcendentalism (3)

433 American Realism and Naturalism (3)

434 Modern American Literature (3) World War I to present.

435 American Novel before 1900 (3) From earliest sentimental novels through Brown and Cooper, and major figures to 1900; Hawthorne, Melville, Stowe, Clemence, and James.


437 Southern Literature (3) Southern writing from colonial period into twentieth century: frontier humorists, local color writers, and Southern literary renaissance.

438 American Humor (3) Early nineteenth century into twentieth century: Mark Twain.

439 Topics in Black Literature (3) Contents vary: particular genre, authors, or theories from 1865 to present; Langston Hughes and Harlem Renaissance, Richard Wright and Giovanni Boccaccio; writings by black women, international Black literature in English, and Black American autobiography.

440 Modern British and American Poetry (3) From Yeats and Frost to Auden, Stevens, and more recent poets.

441 Modern British and American Drama (3) O'Neill's works as precursors to modern dramatists: Williams, Miller, Allen, and representatives of Black theater, Bullins and Baraka.

443 Continental Drama (3) Selection of plays in English translation by major European writers from late Renaissance to present; twentieth-century achievement.

444 Twentieth-Century International Novel (3) Joyce, Camus, Kolkwitz, and Nabokov.

455 Persuasive Writing (3) Persuasive strategies in both student and professional writing. Practice in mastering effective logical and emotional appeals.

456 Technical Editing (3) Editing technical material for publication. Principles of style, format, graphics, layout, and production management. Prereq: 455 and 459, or consent of instructor.

457 Advanced Technical and Professional Writing I (3) For students planning careers in industry, education, and government who need technical writing skills. Writing of instruction, process descriptions, sets of instructions, definitions of mechanisms, recommendation reports, abstracts, proposals, and major reports. Prereq: Junior standing in student's major or consent of instructor.

458 Writing for Publication (3) Principles and practices of writing for publication. Dissertation, theses, articles, and reports in science and technology. Prereq: 459 or consent of instructor.

459 Advanced Poetry Writing (3) Further development of skills acquired in basic writing poetry course. Prereq: 464 or consent of instructor.

460 Fiction Writing (3) Further development of skills acquired in basic writing fiction course. Prereq: 465 or consent of instructor.

461 Sociolinguistics (3) Study of language in relation to society. Empirical and theoretical focus. Large-scale units: tribes, nations, social groups. Prereq: 371 or 372 or Linguistics 200 or consent of instructor. (Same as Linguistics 471 and Sociology 471.)

462 American English (3) Phonological, morphological, and syntactic characteristics of major social and regional varieties of American English: origins, functions, and implications for cultural pluralism. Prereq: 371 or 372 or Linguistics 200; or consent of instructor. (Same as Linguistics 472.)

463 Teaching English as a Second or Foreign Language (3) Grammatical structures of English: particular grammatical difficulties of non-native learners of English. Teaching grammatical structures of English. Teaching grammar and phonology to non-native speakers: contrastive analysis of English with other languages. Prereq: Sec. of year of foreign language. (Same as Linguistics 474.)

464 Teaching English as a Second or Foreign Language II (3) Second language acquisition theory. Issues in teaching four language skills to learners of English. Prereq: 371 or 372 or Linguistics 200; or consent of instructor. (Same as Linguistics 475.)

465 Second Language Acquisition (3) Theoretical models of research; differences between first and second language acquisition; effect of age, cognitive factors in second language acquisition; learner variability and sociocultural variations for second language instruction. (Same as Linguistics 476.)

466 Second Language Acquisition (3) Theoretical models of research; differences between first and second language acquisition; effect of age, cognitive factors in second language acquisition; learner variability and sociocultural variations for second language instruction. (Same as Linguistics 476.)

467 Literary Criticism (3) Historical survey of major works of literary criticism.


469 Studies in Folklore (3) Topics vary. May be repeated with different topic. Maximum 6 hrs.

470 Major Authors (3) Content varies. Concentrated study of at least one of most influential writers in British or American literary history; e.g., Donne, Tennyson, Jane Austen, Whitman, Faulkner, Baldwin or Lawrence.

471 Special Topics in Literature (3) Topics vary. May be repeated. Maximum 6 hrs.

472 Special Topics in Writing (3) Original writing integrated with reading, usually taught by professional author. Topics vary. May be repeated. Maximum 6 hrs.

473 Special Topics in Language (3) Topics vary. May be repeated. Maximum 6 hrs with consent of department. (Same as Linguistics 486.)

474 Special Topics in Criticism (3) Content varies. Theoretical and practical approaches to British and American literature. May be repeated with consent of department. Maximum 6 hrs.

475 Special Topics in Film (3) Content varies. Particularly directors, film genres, national cinema movements, or...
other topics. May be repeated with consent of department. Maximum 6 hrs. (Same as Cinema Studies 485.)

495 Introduction to Rhetoric and Composition (3) Historical, theoretical, and empirical modes of inquiry in rhetoric and composition and implications for teaching of composition.

496 Rhetoric of Legal Discourse (Application of basic principles of legal analysis to legal materials; issue identification and argument through written position papers, briefs, and memoranda. Critical reading and discussion. Introduction to research techniques. No prior legal knowledge necessary. 3)

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

505 Teaching Freshman Composition (3) Introduction to teaching Freshman English through study of various techniques and philosophies of composition. Required of all first-year teaching associates.

506 Introduction to Literary Research (3) Critical examination of aims of English studies, profession of English teacher, theory of literature, and methods of research; collecting of information, evaluation of material, and transmitting of results of scholarship.

507 Applied Criticism: The Rhetoric of Literary Forms (3) Study and application of ways in which major critics have analyzed form in poetry and prose fiction.

508 History of the English Language I (3) Phonological, morphological, and syntactic development of English language: Old and Middle English. F,A

509 History of the English Language II (3) Phonological, morphological, and syntactic development of the English language with concentration on developments after 1500, especially in American English. Sp,A

513-14 Readings in Medieval Literature (3,3) Reading and analysis of selected masterpieces of Old and Middle English literature and their Continental sources in Modern English.

520-21 Readings and Analysis in Selected Areas of Sixteenth- and Seventeenth-Century Prose, Poetry, and Drama (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

530-31 Readings in English Literature of the Restoration and Eighteenth Century (3,3) Topics vary: genre, poetry, prose, drama, or period. Restoration, early eighteenth century, late eighteenth century.

540-41 Readings in English Literature of the Nineteenth Century I and II (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

550-51 Readings in American Literature from the Colonial Period to the Present (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

552 Readings in Black American Literature (3) Content varies: genre, theme, literary movement, or other coherent emphasis.

555-56 Readings in Twentieth-Century Literature (3,3) Content varies: genre, theme, literary movement, or other coherent emphasis.

576 Introduction to Contemporary Criticism (3) Introductory survey of twentieth-century literary criticism from New Criticism to present.

580 Fiction Writing (3) Advanced fiction projects under supervision of instructor and time for independent study. Prereq: Enrollment in creative writing program. E

581 Colloquium in Poetry Writing (3) Major poetic project or continuation of project begun in 463. Individual consultation with instructor supplemented by readings in contemporary poetry and theory. Prereq: 463 or consent of instructor.

582 Special Topics in Writing (1-3) Topics vary. May be repeated. Maximum 6 hrs. Enrollment by consent of director of graduate studies only.

585 Issues in Invention, Style, and Audience (3) Theoretical perspectives on contemporary research in rhetoric and composition.

586 History of Rhetoric I (3) Survey of rhetoric from Sophocles to Ramanus.

587 History of Rhetoric II (3) Survey of rhetoric from Bacon to present.

588 Readings in Applied Rhetoric (3) Content varies: Writing across curriculum, writing centers, technical communication, text linguistics.

590 Topics in Critical Theory (3) Topics vary.

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

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

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

594 Film History, Rhetoric, and Analysis (3) Film as narrative art form: historical development of film; the "rhetoric" of film; critical approaches to film study: genre, author, formalist, and historical. Critical analysis of individual films.

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

601 Studies in Old English Language and Literature (3) Old English grammar with readings in prose and poetry. F,A

611 Studies in Beowulf (3) Translation and critical study of Beowulf. Prereq: English 610 or consent of instructor. Sp,A

620 Studies in Medieval English Literature (3) Seminar in literature and literary genres of Medieval English literature, read in Old and Middle English. Subject matter varies from year to year.

621 Studies in Chaucer (3) Seminar in text, interpretation, and criticism of Chaucer's writings. Prereq: Previous course in Chaucer.


640-41 Studies in Restoration and Eighteenth-Century Literature (3,3) Topics vary: Swift, satire, restoration literature, Johnson and Boswell, Addison and Steele, restoration drama, Dryden.

650 Studies in English Romanticism (3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.

651-52 Studies in Victorian Literature (3,3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.

660-61-62 Studies in American Literature (3,3) Southern literature before 1850, frontier, regionalism, women's literature, Irving, Cooper, Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, Dickinson, James, and Twain.

670-71-72 Studies in Twentieth-Century Literature (3,3) Seminar content varies: particular literary figure or figures, genres, theme, or other coherent focus.

680 Topics in English Language (3) May be repeated with consent of director of graduate studies. Maximum 9 hrs.

682 Studies in Rhetoric and Composition (3) Content varies: Advanced work in theory and/or history of rhetoric and composition. Issues in invention, textuality, literarity, historiography, style and ethics.


686 Studies in Creative Writing (3) Content varies: Connection between theory and practice in writing.

688 Studies in Literary Criticism (3) Content varies: Advanced work in theory and history of literary criticism.

690 Special Topics (3) Content varies: History of Ideas, humor, biography, autobiography, extraliterary disciplines.

694 Studies in Film (3) Content varies. Advanced work in film history and analyses.

## Entomology and Plant Pathology

### Entomology and Plant Pathology

**College of Agricultural and Natural Resources**

**MAJOR**

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

Carroll J. Southard, Head

**Professors:**

B. Bernard, Ernest C., Ph.D. .................. Georgia

Gerhardt, R. (Liason), Ph.D. ............... NC State

Hilly, James W. (Emeritus), Ph.D. ........... Ohio State

Johnson, W. (Emeritus), Ph.D. ............... NC State

Jenson, D. (Emeritus), Ph.D. ............... NC State

**Associate Professors:**

Grant, Jerome F., Ph.D. ..................... Clemson

Gwinn, Kimberly D., Ph.D. ................... NC State

Reddick, Bradford B., Ph.D. ............... Clemson

Windham, Mark T., Ph.D. .................... NC State

**Assistant Professor:**

Owley, Bonnie H., Ph.D. ..................... NC State

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

**THE MASTER'S PROGRAM**

**Admission Requirements**

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

**Degree Requirements**

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

GRADUATE COURSES

410 Diseases and Insects of Ornamental Plants (2) Symptoms, identification and management of diseases and insect pests that affect plants in greenhouse, nursery, and landscape environments. Prereq: Plant Pathology or Economic Entomology or consent of instructor. Sp.

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

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 Plant Disease Fungi (4) Morphology, taxonomy, biology, and genetics of plant-pathogenic fungi. Isolation and identification of plant-pathogenic fungi. Prereq: 313 or consent of instructor. 2 hrs and 2 labs. (Same as Ornamental Horticulture and Landscape Design 511.) F, A

512 Soilborne Plant Pathogens (3) Causal agents; host-parasite-soil interactions; epidemiology, and biological, cultural, and chemical control. Prereq: Plant Pathology or consent of instructor. 2 hrs and 1 lab. F, A

514 Bacterial Plant Diseases (4) Morphology, taxonomy, ecology, physiology, and genetics of bacterial plant pathogens; infection and disease development, pathogenesis and resistance; diagnosis, detection, effect of environment, and management of bacterial diseases; beneficial plant-bacterial interactions. Prereq: Plant Pathology or consent of instructor. 2 hrs and 1 lab. F, A

515 Physiology of Plant Disease (3) Biochemical and physiological events in host-pathogen interactions, Mechanisms of disease resistance. Prereq: Introductory plant physiology or pathology, or consent of instructor. F

520 Plant Parasitic Nematodes (4) Morphology, taxonomy, ecology, and management of plant parasitic nematodes. Prereq: Plant Parasite Pathology or consent of instructor. 6 hrs and 2 labs. Sp.

521 Plant Virology (3) Symptoms, epidemiology, and management of virus infection: structure, morphology, replication, transmission, purification, characterization, and classification of plant viruses; serology; plant-pathogenic viroids, mycoplasmas, and spiroplasmas. Prereq: 313 or consent of instructor. 2 hrs and 1 lab. Sp.

523 Field Crop and Vegetable Insects (2) Identification, biology, and management of insects affecting commercial vegetable and home garden crops. Prereq: 321 or basic entomology course. 1 hr and 1 lab. F, A

525 Medical and Veterinary Entomology (3) Morphology, taxonomy, biology, and control of arthropod parasites and vectors of diseases in humans and animals. Ecology and behavior of vectors in relation to pathogen transmission and control. Prereq: 321 or 325, or consent of instructor. 2 hrs and 1 lab. Sp.

530 Integrated Pest Management (3) Principles and application of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic threshold levels. Prereq: 321 or consent of instructor. (Same as Plant and Soil Science 530.) F, A

531 Special Problems in Entomology (1-3) Comprehensive individual study of current problems. May be repeated. Maximum 6 hrs. E

532 Special Problems in Plant Pathology (1-4) Comprehensive individual study of current problems. May be repeated. Maximum 6 hrs. E

533 Concentrated Study in Entomology (1-3) Selected subjects in entomology for advanced students, concentrated in time and subject matter. Prereq: 321 or basic entomology course. May be repeated. Maximum 8 hrs. F, Sp.

541 Seminar (1) Review of literature and current research in entomology and plant pathology. May be repeated. Maximum 2 hrs. E

Environmental Engineering

See Civil Engineering

Exercise Science

(College of Education)

MAJORS DEGREES

Education ........................................ Ph.D.

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

E. Howley, Leader

Professors:

Capen, Edward K. (Emeritus), Ph.D. .................. Iowa

Howley, Edward T., Ph.D. ......................... Wisconsin

Kozar, Andrew J. (University Prof.), Ph.D. ...... Michigan

Kliemohn, W. P., Ph.D. ......................... Iowa

Rookett, Ian R. H., Ph.D. ....................... Brown

Welch, Hugh (Emeritus), Ph.D. ................... Florida

Associate Professor:

Bassett, David R., Jr., Ph.D. ....................... Wisconsin

Thompson, Dixie, Ph.D. ......................... Virginia

Zhang, Songping, Ph.D. ......................... Oregon

The Exercise Science unit offers graduate programs leading to the Master of Science with a major in Human Performance and Sport Studies, concentration in exercise science (exercise physiology/fitness, kinesiology/sports medicine); Doctor of Education with a major in Human Performance and Sport Studies; and the Doctor of Philosophy with a major in Education. See Education Under Fields of Instruction for full description of all degree requirements. Specific questions about these programs should be directed to the leader of the unit.

ADMISSION REQUIREMENTS

Applicants are required to complete the unit application which will be sent to all persons upon their initial inquiry about the program. This is in addition to The Graduate School application.

The following retention policy applies to all graduate students seeking a degree in the Exercise Science unit:

1. Graduate students are required to maintain an overall GPA of 3.0.
2. Any student who falls below this standard will be advised in writing by the unit leader 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 ASSISTANTS

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, Exercise Science Unit, The University of Tennessee, Knoxville, TN 37996-2700.
varieties of activities aimed at improved fitness. Prereq: 480 and 414. (Same as Public Health 569.)

570 Cardiac Rehabilitation Practicum (1-3) Supervised experience in hospital-based exercise programs for participants with cardiac and/or pulmonary disorders. Use of telemetry monitoring, leading safe exercise regimens, counseling participants on safe exercise guidelines. Presenting educational class on topic applicable to participants. Prereq: 480 and 567. Coreq: 569.


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

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

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

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

661 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.

664 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.

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

BUSINESS ADMINISTRATION CONCENTRATIONS

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

MBA Concentration: Finance.

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

Minimum course requirements are three courses: 510 (6 hours), plus two from the following: 512, 522, 532, 551, and 581.

Ph.D. Concentration: Finance.

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

GRADUATE COURSES

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

510 Contemporary Concepts and Methods in Finance (3) Strategic issues and broad-based valuation concepts in finance; integrative approach in investments, corporate finance and institutions areas. Prereq: Business Administration 504 and 505 or consent of instructor.

512 Problems in Financial Management (3) Readings and cases that apply finance theory to real-world investment, financing, and asset management problems. Prereq: Business Administration 504 and 505 or consent of instructor.

522 Portfolio Analysis and Management (3) Portfolio theory and evidence of behavior of security returns with view to determining national investment policy. Statistical analysis of risk and return of portfolios, portfolio evaluation and revision, capital market theory, and extensions of portfolio analysis. Prereq: Business Administration 504 and 505 or consent of instructor.

532 Financial Institutions (3) Analysis of management policies of financial institutions, asset, liability, and capital management. Legal, economic and regulatory environment and implications for management, Financial institution structure and competition and changing trends in U.S. financial system. Prereq: Business Administration 504 and 505 or consent of instructor.

551 Financial Management of a New Enterprise (3) Financial issues associated with formation, control, and long-term planning of new enterprise. Acquisition of venture capital. Prereq: Business Administration 504 and 505 or consent of instructor.

581 Real Estate Investment and Finance (3) Financial and market analysis used to make real estate investment decisions. Effects of variety of financing options on rate of return on income-producing properties. Effect of various financing options on consumer's decisions to purchase, relationship between primary and secondary mortgage markets and impact of those markets on cost and availability of funds for real estate lending. Effects of government intervention (taxation, subsidization, and regulation) in both real estate and mortgage markets. Prereq: Business Administration 504 and 505 or consent of instructor.

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

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

641 Seminar in Finance I: Capital Markets (3) Capital markets, capital market imperfections, and market dynamics, interest rate theory and term structure of interest rates, utility theory, state preference theory, mean-variance, capital asset pricing, efficient set theorems, interest rate theory, financial market micro structure.

642 Seminar in Finance II: Theory of the Firm (3) Financial theory of firm and financial decision making under conditions of uncertainty, equilibrium models of firm. Option pricing, agency theory, capital structure, economics of information, and dividend policy.

651 Advanced Seminar in Finance I (3) Recent theoretical and empirical developments in micro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

652 Advanced Seminar in Finance II (3) Recent theoretical and empirical developments in macro-finance literature. Topics vary. May be repeated. Maximum 6 hrs.

Food Science and Technology

(Conal College of Agricultural Sciences and Natural Resources)

MAJOR DEGREES

Food Science and Technology ........ M.S., Ph.D.

Clark J. Brekke, Head

Professors:
Brekke, C. J., Ph.D........................... Wisconsin
Collins, J. L., Ph.D............................ Maryland
Draughon, F. A., Ph.D...................... Georgia
Jaynes, H. O. (Emeritus), Ph.D.............. Illinois
Maltoni, S. L., Ph.D........................... Tennessee
Miles, J. T. (Emeritus), Ph.D................ Wisconsin
Overcash, W. W. (Emeritus), Ph.D........ Iowa State
Penfield, M. P. (Liaison), Ph.D............... Tennessee

Assistant Professors:
Christen, G. E., Ph.D........................ Missouri
Lovey, H. D., Ph.D........................... Kansas State
Mount, J. R., Ph.D............................ Ohio State

The Department of Food Science and Technology offers the Master of Science and Doctor of Philosophy degrees. Students in the doctoral program may choose research in the concentration area of food products, food chemistry, food microbiology, or sensory evaluation of foods. Commodity interests (meats, dairy, fruits, vegetables, bakery products) can be emphasized in any of the areas by careful selection of courses and the research topic. Minors are available in cognate fields. For detailed information, contact the department head.

Graduate School rating forms or letters of recommendation from at least three people are required. Respondents should be familiar with the applicant's scholastic ability and professional potential.

THE MASTER'S PROGRAM

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

Thesis Option

1. Prior to research for the thesis, the student must develop a detailed written research plan. Registration for 6 hours of 500 Thesis is required.
2. In addition to the thesis requirement, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student’s committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student’s progress or background indicates such need.

3. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate in discussions during their master’s program. Completion of 510 or equivalent is also required.

4. An oral, final examination covering the thesis and coursework is required.

Non-Thesis Option

1. In lieu of a thesis, students are required to complete a problem in cooperation with their employer (company or governmental agency) and their faculty committee. Students working on a problem must register for 6 hours of 503. In addition to the requirement for 6 hours of 503, a minimum of 24 semester hours of graduate coursework is required. This work must be approved by the student’s committee and a minimum of 14 hours must be courses numbered above 500. The committee may require additional coursework if the student’s progress or background indicates such need.

2. All students are required to take 2 hours of 501 Seminar in their program and are expected to attend this course and participate in discussions during their master’s program. Completion of 510 or equivalent is also required.

4. Students will be required to take a written comprehensive examination covering their coursework. In addition, an oral, final examination covering the problem and coursework is required. The oral examination will be held on the Knoxville campus.

THE DOCTORAL PROGRAM

1. Completion of a master’s degree in the field, or a closely related field, or passing a special qualifying examination is required for admission. Scores on the GRE aptitude test are also required.

2. A dissertation is required for the Ph.D. degree. Each student must develop a detailed written plan for the dissertation research. A minimum of 72 hours beyond the Bachelor’s degree, excluding credit for the master’s thesis, is required. Of this, 24 semester hours must be 600 Doctoral Research and Dissertation.

4. At least 24 hours of coursework numbered above 500 are required exclusive of doctoral research and dissertation. At least 6 of the 24 hours must be courses numbered above 600.

5. A minimum of 6 hours of courses for graduate credit must be taken outside the Department of Food Science and Technology. All candidates must complete 601 (2 hrs.) and are expected to attend 601 during their Ph.D. program.

7. Each candidate must pass both written and oral comprehensive examinations prior to admission to candidacy. Major professors will advise candidates on competencies expected. A final oral examination is required that includes a defense of the dissertation and subject matter that the student’s committee considers appropriate.

GRADUATE COURSES

430 Sensory Evaluation of Food (3) Principles and methods of sensory evaluation of foods. Prereq: Basic statistics, 2 hrs and 1 lab. F

452 Science of Dairy Foods (3) Science and technology of processing of milk and its products. Prereq: Food Laws and Regulations, Food Chemistry, Food Microbiology and Lab, and Food Preservation or consent of instructor. 2 hrs and 1 lab. Sp

460 Meat Science (3) Carcass characteristics of meat animals, muscle structure and composition, cut identification, curing, freezing and cookery. Prereq: Food Industry or consent of instructor. Sp

469 Meat Science Lab (1) Slaughter and processing methods for beef, pork, lamb and poultry. Coreq: 460. Sp

470 Food Crop Products (3) Food products from plants: types, manufacturing systems, quality attributes and utility. Prereq: Food Preservation and 3 hrs biological science or consent of instructor.

480 Cereal Science and Bakery Products (3) Chemistry and technology of processing cereal grains, interactions of ingredients during production and storage of baked products. Prereq: Food Laws and Regulations, Food Chemistry, and Food Preservation or consent of instructor. 2 hrs and 1 lab. Sp, A

495 Food Processing System Analysis and Evaluation (3) Design and evaluation of food processing operations to produce safe and acceptable quality food products. Prereq: Food Chemistry, Food Microbiology, Food Preservation or consent of instructor. Sp

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

501 Seminar (1) Individual reports and discussion on topics from current literature. May be repeated. Maximum 3 hrs. F, Sp

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

503 Problems in Lieu of Thesis (2-3) May be repeated. S/NC only. E

510 Instrumental Analysis of Food (3) Modern instrumental methods for control of food manufacturing processes. Prereq: Food Chemistry, 2 hrs and 1 lab. F

511 Color and Flavor of Foods (3) Chemical basis of measurements, and reactions involved in color and flavor changes in foods. Manufacture and application of materials used to modify color and flavor. Prereq: Food Chemistry, 2 hrs and 1 lab. F

520 Food and Industrial Fermentations (3) Microbiology, biochemistry and technology of food-related fermentations involving dairy products, meat, cereals, fruits and vegetables. Production of food ingredients and by-product utilization. Prereq: Food Microbiology and Lab, Food Preservation, Biochemistry and Cellular and Molecular Biology 410 or equivalent. 2 hrs and 1 lab. Sp, A

521 Advanced Food Microbiology (3) Microorganisms in foods, their identification, characterization and relationships to food processing. Isolation of microorganisms from foods and plant equipment. Prereq: Food Microbiology and Lab, 1 lab and 2 hrs. Sp, A

540 Food Product Development (3) Art, science and technology of developing and marketing new food products. Prereq: Food Preservation 2 hrs and 1 lab. Sp, A

560 Advanced Meat Science (3) Physical and chemical changes that occur in conversion of muscle to meat; effect of postmortem treatments on meat quality, composition and availability; packaging, preservation and quality control. Prereq: 460. 2 hrs and 1 lab. Sp, A

580 Oilseed Products (3) Chemistry and technology of foods and food ingredients produced from oilseeds. Prereq: Food Chemistry or equivalent. 2 hrs and 1 lab. Sp, A

580 Special Topics in Food Technology and Science (1-3) Critical reviews of current research and production concerns of food industry. May be repeated. Maximum 9 hrs. F, Sp

593 Directed Studies (1-3) Research on non-thesis topics chosen by student and major professor. Supervised experience in food industry or governmental laboratories. May be repeated. Maximum 6 hrs. E

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

601 Seminar (1) Reports and directed discussion on research topics from current literature. May be repeated. Maximum 3 hrs. F, Sp

620 Food Toxicology (3) Basic and applied concepts in food toxicology; toxicological aspects of processed foods. Mode of action, prevention and control of food contaminants in food supply. Prereq: Food Chemistry, 521, or consent of instructor. Sp, A

640 Advanced Food Processing (3) Role of processing treatments in modification of food properties; texture, flavor and color characteristics. Prereq: Food Preservation, 510, 511 or consent of instructor. Sp, A

Forestry, Wildlife and Fisheries

(College of Agricultural Sciences and Natural Resources)

MAJORS DEGREES

Forestry........................................ M.S.
Wildlife and Fisheries Science ............ M.S.

George M. Hopper, Head

Professors:
Barrett, J. W. (Emeritus), Ph.D. .......... Syracuse
Buckner, E. R. (Distinguished Prof.), Ph.D. ............ NC State
Core, H. A. (Emeritus), Ph.D. .......... Syracuse
Deardon, B. L., Ph.D. .............. Colorado State
Dimmick, R. W., Ph.D. .......... Wyoming
Hill, T. K., Ph.D. .......... Auburn
Hopper, G. M., Ph.D. ................. VPI
McCree, C. E. (Adjunct), D.F. .... Duke
Ostermeier, D. M., Ph.D. .......... Syracuse
Pellon, M. R., Ph.D. .......... Georgia
Rennie, J. C., Ph.D. .......... NC State
Schneider, G. Ph.D. .......... Michigan State
Sharp, J. B. (Emeritus), D.P.A. ...... Harvard
Smalley, G. (Adjunct), Ph.D. ...... Tennessee
Strange, R. J., Ph.D. .......... Oregon State
Stumbo, D. A. (Emeritus), Ph.D. ...... Minnesota
Thor, E. (Emeritus), Ph.D. .......... NC State
Wilson, J. L., Ph.D. .......... Tennessee

Associate Professors:
Buckley, E. R. (Distinguished Prof.), Ph.D. ............ Duke
King, M. M., Ph.D. .......... Utah State
Nook, S. C. (Adjunct), Ph.D. .......... Cornell
Schlababum, S. E., Ph.D. .......... Colorado State
Smith, K. G. (Adjunct), Ph.D. ......... Utah State
Wells, G. R. (Liaison), D.F. .......... Duke
Winstonfor, P. M., Ph.D. .......... Iowa State

Assistant Professors:
Buehrer, D. A., Ph.D. .......... VPI
Clark, J. D. (Adjunct), Ph.D. .......... Arkansas
Fly, J. M., Ph.D. .......... Michigan
Smith, E. R. (Adjunct), Ph.D. .......... Tennessee
VanMiegroet, H. (Adjunct), Ph.D. ...... Washington
Walder, T. A. (Adjunct), Ph.D. .......... Tennessee

Graduate study leading to the Master of Science with majors in Forestry and in Wildlife...
and Fisheries Science is offered by the Department of Forestry, Wildlife and Fisheries. The Master of Business Administration, with a concentration in forest industries management, is available for qualified students. This degree program is offered by the College of Business Administration with participation by the Department of Forestry, Wildlife and Fisheries. The Doctor of Philosophy with a specialization in forest biology, wildlife science, or fisheries science can be achieved through the University’s Department of Ecology and Evolutionary Biology.

A joint program between the department and Knoxville College leading to a specialized B.S. in Biology provides for Beville College graduates for graduate programs in natural resources.

THE MASTER’S PROGRAMS

Both thesis and non-thesis options are available for the major in Forestry; a thesis is required in Wildlife and Fisheries Science. For admission, the student must have a Bachelor’s degree from an accredited institution in forestry, wildlife, fisheries, or other natural resource area. Applicants must also have taken the general Graduate Record Examination (GRE). Graduate School rating forms or letters of recommendation from three individuals familiar with the applicant’s academic ability are required. The department also has an application that must be submitted at the time of application to The Graduate School.

Thesis Option

1. Prior to research for the thesis, the student is required to develop a detailed written research proposal. Registration for 6 hours of Thesis (Forestry 500 or Wildlife and Fisheries Science 500) is required.

2. A graduate committee of no fewer than 3 faculty members must be selected by the second semester of residence. At least one member shall be from outside the department. In addition to the thesis requirement, a minimum of 24 hours of graduate coursework is required. This work must be approved by the student’s committee and no more than 10 hours of the minimum 30 can be below the 500 level. The committee may require additional coursework if the student’s progress or background indicates such need.

3. All students are required to include Forestry 512 or Wildlife and Fisheries Science 512, Seminar, in their programs. This is required of each graduate student in residence fall semester.

4. An oral examination covering the thesis coursework is required.

Non-Thesis Option (Forestry only)

1. Thirty-five hours of graduate coursework of which 23 must be at the 500 level or above is required.

2. A graduate committee of no fewer than 3 faculty members will be selected. At least one member shall be from outside the department. The committee will meet and schedule the student’s program during the first semester in residence.

3. Three hours of Forestry 511 are required.

4. Nine hours of coursework in the department must be at the 500 level or above, exclusive of Forestry 511.

5. Final comprehensive written and oral examinations shall be taken upon completion of no fewer than 28 hours of approved study.

A concentration in managing natural resource organizations is available under the non-thesis option with a major in Forestry. The minimum core requirements include: Forestry 511, 570, and six additional hours of Forestry courses to be selected in consultation with the student’s committee; Political Science 564, Management 504, and Planning 560. Fourteen hours of elective coursework are selected with the faculty advisor.

MINOR IN ENVIRONMENTAL POLICY

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

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 Forestry is available to residents of states of the Southern Association of Graduate Schools. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

Forestry

GRADUATE COURSES

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

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

433 Wood Adhesives and Glued Wood Products (2) Theory and practice of adhesive bonding of wood; design of composite wood products; laboratory manufacturing and testing of adhesives; adhesive bond strength and glued-wood performance; field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. 1 hr and 2 labs. F

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

435 Wood Drying and Preserving (2) Discussion of wood-drying equipment and techniques. Introduction to commercial wood drying equipment and practices. Proper use, specification, and disposal of preservative treated wood. Day field trips. Prereq: Wood Properties and Uses and Wood Identification, or consent of instructor. F

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

502 Registration for Use of Facilities (3-15) Required for the student not previously 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

511 Problem Analysis in Forest Resources (3) Problem identification, analysis and solution in forest resource management. Identity, analyze and prepare written report. Topics and report must have approval of graduate committee. Available only to students in non-thesis option for M.S. in Forestry. E

512 Seminar (1) Current developments in forestry. Required of all graduate students in residence fall. May be repeated. Maximum 2 hrs. S/N/C only. F

520 Advanced Forest Tree Biology (3) Growth, reproduction, and physiology of trees; forest ecology; variability and taxonomy of forest trees. Prereq: Graduate standing in forestry or biological science, or consent of instructor. F

530 Advanced Forest Resource Management (3) Analyzing forest management problems as exemplified in public agencies and private firms. Forest organization and computerized regulation systems; financial and operational planning tools, as applied to forest resource management. Prereq: Senior level forest management or consent of instructor. Sp

540 Genetics in Forestry (3) Genetic improvement of forest trees, selection of superior genotypes; field testing for genetic variability; tree breeding; development of seed orchards; hybridization; tree cytology and tissue culture; use of biochemical variation; planning and conducting forest genetics research. Prereq: Silvicultural methods and Biology 520 or consent of instructor. Sp

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

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

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

585 Advanced Forest Biometry (3) Application of sampling techniques to forest inventory; fixed and variable plot sampling; list sampling; Poisson sampling; regression estimators; multistage and multistage sampling. Growth and yield predictors for even-aged and uneven-aged forests. Prereq: Land Measurement Techniques and Forest Resource Inventory or consent of instructor. F

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

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

Forestry, Wildlife & Fisheries

GRADUATE COURSES

410 Wildlife Habitat Evaluation and Management (3) Ecological relationships between wildlife and habitat. Evaluation, modeling, and management of wildlife habitat. Effects of land-use practices on wildlife habitat. Weekends and evenings. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. Applicable to majors in Forestry and Wildlife and Fisheries Science. 2 hrs and 1 lab. F

416 Planning and Management of Forest, Wildlife and Fisheries Resources (3) Integrated forest and wildlife resource management. Linkage of land management plans and analyzing cases studies including conflict resolution. Applicable to majors in Forestry and Wildlife and Fisheries Science. Prereq: Senior standing 1 hr and 2 labs. F

525 Management of Forestry, Wildlife and Fisheries Resources (2) Current technologies and management
Wildlife and Fisheries Science

GRADUATE COURSES

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

441 Fisheries Techniques (2) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques; age determination and incremental growth analysis; stream assessment; equipment and instrumentation usage and maintenance; safety in sampling methods. Weekend field trip. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

442 Fisheries Techniques (2) Active and passive sampling techniques for fish and aquatic organisms; population estimation methods; fish handling and transport; food habits analysis; marking and tagging techniques; age determination and incremental growth analysis; stream assessment; equipment and instrumentation usage and maintenance; safety in sampling methods. Weekend field trip. Prereq: Principles of Wildlife and Fisheries Management or consent of instructor. 1 hr and 1 lab or field. F

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

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

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

490 Ethics in Wildlife and Fisheries Management (1) Ethical bases for decision-making and application of methodologies in practice of wildlife and fisheries management. Seminars by ethicists, wildlife and fisheries scientists and managers, and forestors to acquaint students with diverse perspective of ethical behavior in practices of wildlife and fisheries management. Lectures, panel discussions, and case studies. Team taught. Prereq: Senior standing. 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 be repeated toward degree requirements. May be repeated. SANC only. E


French

See Romance Languages

Geography

(College of Arts and Sciences)

MAJOR

DEGREES

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

Carol Harden, Head

Professors:


Associate Professors:

Brinkman, Leonard W., Jr., Ph.D. ..... Wisconsin

Harden, Carol P., Ph.D. .......... Colorado

Horn, Sally P., Ph.D. .......... California

Rehder, John B., Ph.D. ......... Louisiana State

Assistant Professors:

Orvis, Kenneth H., Ph.D. ............

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

THE MASTER'S PROGRAM

The department offers the thesis and non-thesis options for the Master of Science. Both options require a minimum of 30 semester hours beyond the completion of a sound undergraduate major program. At least two-thirds of the total hours in the degree program must be at or above the 500 level and include 501 (at each offering during residency), 504 and 3 semester hours at the 600 level. In the thesis option, 6 hours must be Thesis 500. A final examination is required in both programs.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is granted only to those who demonstrate proficiency in conducting independent research. Students must have a broad foundation and understanding of the discipline; those should have been achieved in a comprehensive master's program. Course requirements for the degree shall be determined by the student's faculty committee in accordance with specific interests and needs. The program must have at least two special fields; and an oral examination on the dissertation and on the dissertation proposal. Also required is a final oral examination on the dissertation and on other aspects of the program as determined by the student's doctoral committee.

MINOR IN ENVIRONMENTAL POLICY

The department participates in a program designed to give master's level graduate students an opportunity to develop an interdisciplinary specialization in environmental policy. See Economics for program description.
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 Geography is available to residents of the states of Alabama, Arkansas, Mississippi, Virginia, and West Virginia. The master's program is also available to residents of Texas. Additional information may be obtained from the Admissions Specialist in the Office of Graduate Admissions and Records.

GRADUATE COURSES

411 Computer Mapping and Geographic Information Systems (3) Concepts, management, and presentation of digital data for spatial analysis: cartographic data structures. Prereq: 310 and knowledge of computer language or consent of instructor. 2 hrs and 1 1/2 hr lab.

412 Cartography (3) Cartographic techniques applied to design, compilation, and reproduction of maps and other graphics. Prereq: 310 or consent of instructor. 2 hrs and 1 1/2 hr lab.

413 Remote Sensing: Types and Applications (3) Principles and uses of remote sensing imagery, digital data, and spectral data: geographic interpretation and mapping techniques. Prereq: 310 or consent of instructor. 414 Quantitative Methods in Geography (3) Geographical application of statistical techniques, point pattern analysis, and analysis of areal units. Prereq: Mathematics 115 or two semesters of calculus or consent of instructor.

421 Geography of Folk Societies (3) Geographical study of folk culture, traditional material culture, and rural settlement, examples from eastern North America and selected foreign areas. Prereq: 101-02 or 320 or consent of instructor.

425 Historical Geography of the United States (3) Survey of changing human geography of the United States during four centuries of settlement and development. Changing population patterns, development of agricultural and urban regions, and effects of urban-industrial development. Prereq: 361 or consent of instructor.

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

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

435 Biogeography (3) Changing distribution patterns of plants and animals on variety of spatial and temporal scales. Effects of continental drift, Pleistocene climatic change, and changing landforms. A study of earth biota. Prereq: Geography of the Natural Environment or consent of instructor.

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

439 Plant Geography of North America (3) Characteristics and distribution of major plant communities of Canada, the U.S., Mexico, and Central America. Relationships to climates, soil, fire, and human disturbance. Long-term history and future prospects. Prereq: Coursework in geography or botany or consent of instructor.

441 Urban Geography (3) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities. Prereq: 101-02 or 141 or 340 or consent of instructor. (Same as Urban Studies 441.)

443 Rural Geography (3) Geographical appraisal of rural areas of United States: small towns and urban fringes. Problems and potentials of rural America. Prereq: 101-02 or 141 or 340 or consent of instructor.

445 Geography of Resources (3) Study of factors related to variations in resource availability from time to time and place to place: energy and metallic resources. Prereq: 101-02 or 141 or 340 or consent of instructor.

449 Geography of Transportation (3) Examination of transportation systems, their effects on trade patterns, land use, location of problems, and development. Prereq: 141 or 340 or consent of instructor.

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

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

501 Colloquium in Geography (1) Discussion of departmental research, current research literature, and some general topics. Registration required of resident graduate students only. Maximum 8 h. May be repeated toward graduation degree. E

502 Registration for Use of Facilities (3-15) Required for the student not otherwise registered during any semester who uses University facilities and/or must be completed. Maximum 6 hrs. May be repeated toward degree requirements. May be repeated. S/NC only.

504 Research Design (3) Geographical research methods and selection of topics and development of research design through field work and final report.

505 Directed Research (2-6) Research on problems as defined by individual students. Prereq: Written consent of instructor and department prior to registration. Maximum 8 hrs. May be repeated with consent of instructor. Maximum 6 hrs. S/NC or letter grade.

506 Directed Readings (2-6) Readings on topics of interest as defined by individual students. Prereq: Written consent of instructor and department prior to registration. Maximum 6 hrs. May be repeated with consent of instructor. Maximum 4 hrs. S/NC or letter grade.

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

512 Topics in Cartography (2-3) Trends, concepts, problems, and methods in cartography. Prereq: 411 and 412 or consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs. S/NC or letter grade.

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

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

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

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

521 Topics in Cultural Geography (3) Examination of trends, problems, and methods in cultural geography. Prereq: 421 or consent of instructor. May be repeated with consent of instructor. Maximum 8 hrs.

533 Topics in Physical Geography (3) Examination of trends, problems, and methods in physical geography. Prereq: 433 or 434 or consent of instructor. May be repeated with consent of instructor. Maximum 8 hrs.

535 Topics in Biogeography (3) Examination of trends, problems, and methods in biogeography. Prereq: 435 or consent of instructor. May be repeated with consent of instructor. Maximum 8 hrs.

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

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

550 Regional Geomorphology (3) (Same as Geology 550.)

577 Biological Conservation (3) Analytical treatment of policies, politics, and forms of biological conservation as practiced in U.S. and abroad. Prereq: Consent of instructor.

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

593 Independent Study (1-15) Prereq: Written consent of department. Prereq: Consent of instructor. May be repeated with consent of instructor. Maximum 6 hrs.

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

609 Seminar in Geography (2-3) Topics vary. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

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

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

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

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

649 Seminar in Geography of Transportation (3) Prereq: 449 or consent of instructor. May be repeated. Maximum 6 hrs.

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

673 Seminar in Geography of Latin America (3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

677 Seminar in Biological Conservation (3) Conduct of original research. Prereq: 577 or consent of instructor. May be repeated. Maximum 6 hrs.

Geological Sciences

(CE College of Arts and Sciences)

MAJOR

DEGREES

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

Harry Y. McSween, Head

Professors:

Broadhead, Thomas W., Ph.D. .................... Iowa

Driese, Steven G., Ph.D. ......................... Wisconsin

Dubno, William M., Ph.D. ..................... Bristol

Hatcher, Robert D., Jr. (Distinguished Scientist), Ph.D. .......... Tennessee

Kopp, Otto C., Ph.D. ................................. California

Lubatka, Theodore C., Ph.D. ............... Columbia

McLaughlin, Robert E. (Emeritus), Ph.D. .......... Texas

May, William J., Ph.D. .............................. Harvard

McSween, Harry Y., Ph.D. ...................... Harvard

Labotka, Theodore C., Ph.D. ............... California

Kopp, Otto C., Ph.D. ................................. Tennessee

Ph.D. ................................................... California

Ph.D. ................................................... Columbia

Ph.D. ................................................... Texas

Ph.D. ................................................... Harvard