The Institute of Agriculture traces its history to 1869 when the University was designated as Tennessee's Federal Land-Grant Institution. Under terms of the Federal Land-Grant Act, the University was enabled to offer instruction in agriculture and the mechanic arts for the first time. Since 1869, agricultural programs at the University have been expanded to include research for the development of new knowledge and extension for dissemination of such knowledge to rural people. Thus the Institute of Agriculture has come to include the work of three main divisions: College of Agriculture, Agricultural Experiment Station, and Agricultural Extension Service.

In March 1974 the College of Veterinary Medicine was established within the Institute. The college is developing research and graduate programs in veterinary medical sciences in addition to the professional curriculum leading to the degree, Doctor of Veterinary Medicine. The first students were admitted in the fall of 1976.

Agricultural Experiment Station

D. M. Gossett, Dean
Thomas J. Whatley, Associate Dean
John I. Sewell, Assistant Dean

The Agricultural Experiment Station was established by the University’s Board of Trustees on June 8, 1882, five years before the passage of the Hatch Experiment Station Act by the U.S. Congress. The University was one of the first five institutions in the U.S. to establish an Agricultural Experiment Station. Since its beginning the Station has given first attention to investigations of concern to the agriculture of Tennessee. The investigations of the Station follow a systematic method of gaining and applying knowledge efficiently to the biological, physical, and economic phases of producing, processing, and distributing farm and forest products; to the social and economic aspects of rural living; and to consumer health and nutrition. Both farm and urban populations gain from the accomplishments of the Agricultural Experiment Station. Examples of some of these accomplishments are new and improved varieties of crops, new and better methods of controlling crop and livestock pests, more efficient production of crops and pasture through improved fertilization and mechanization, and more efficient feeding and management of livestock.

The program is designed and administered through sixteen subject matter departments located at Knoxville. A number of the staff have teaching responsibilities in addition to their research. To assist in the research program the Station supports a large number of graduate students. To serve Tennessee’s diverse agriculture, branch stations are operated at Jackson, Spring Hill, Springfield, Lewisburg, Crossville, Greeneville, and Martin. In addition, field stations are operated at Grand Junction, Milan, Wartburg, Tullahoma, and near Chattanooga. Professional and technical staff are in residence at these locations.

The UT-ERDA Comparative Animal Research Laboratory is located about twenty miles west of Knoxville near Oak Ridge, where a program of radiobiological research in the field of agriculture is carried out by the Agricultural Experiment Station under contract to the Energy Research and Development Administration. The program includes research with farm and laboratory animals, with soils, and in applied radiobiology and plant breeding.

Agricultural Extension Service

M. L. Downen, Dean
T. W. Hinton, Associate Dean
B. G. Hicks, Assistant to the Dean
Mildred F. Clarke, Assistant Dean

The Agricultural Extension Service was established in 1914. Its purpose is to extend through various educational means agricultural and home economics information to farm families and others in the state who do not have the opportunity to enroll in resident courses of instruction at colleges.

The educational program is carried on through offices in each of the ninety-five counties of the state. Education emphasis includes work in five major program areas: agricultural production, marketing of agricultural products, development and conservation of natural resources, home economics, and education of young people through 4-H Clubs. County Extension staff members working directly with local people are supported in the various information fields by a specialist staff, members of which are stationed either in Knoxville, Nashville or Jackson.

The Agricultural Extension Service operates administratively as one of three units of the Institute of Agriculture. For administration the state is divided into five districts with supervisors located in their respective districts. District headquarters are maintained in Knoxville, Chattanooga, Cookeville, Nashville, and Jackson.

The Agricultural Extension Service operates as a three-way partnership among county, state, and federal
governments. The University of Tennessee represents state and federal government and a County Agricultural Extension Committee represents county government in this partnership.

**College of Agriculture**

O. Glen Hall, Dean

Graduate programs of the College of Agriculture are designed to prepare men and women for positions of leadership in industry, state and federal government, teaching, research, and extension. The graduate student is expected to demonstrate a thorough knowledge of the subject matter in his/her specialized field of study and its relationship to the sociological, economic, and environmental impact on society. The student must demonstrate the ability to plan, conduct, analyze, and report original research. More importantly, emphasis is given to intellectual growth and to the development of scholarly habits of study, reasoning and analysis to the end that the graduate will continue to grow and develop professionally throughout his/her career.

**MASTER OF SCIENCE PROGRAMS**

Programs of graduate study leading to the Master of Science degree are offered through all departments in the College of Agriculture. The general rules of the Graduate School apply to all graduate work in this college. The graduate program may be entirely in one major subject or may include one or two minors in any of the subject matter areas related to the major.

Both majors and minors are available in Agricultural Biology, Agricultural Economics, Agricultural Engineering, Agricultural Extension Education, Agricultural Mechanization, Animal Science, Food Technology and Science, Ornamental Horticulture and Landscape Design, and Plant and Soil Science. Majors only are available in Forestry and Wildlife and Fisheries Science, and minors are available in General Agriculture and Rural Sociology. The minor in General Agriculture requires 18 hours of course work. A complete listing of majors is shown on pages 8-9.

For admission to a graduate degree program, the student must have a satisfactory academic average and have completed the substantial requirements for an undergraduate major in his/her field of study or have completed sufficient undergraduate work in related areas to satisfy the department that he/she can successfully pursue graduate study in the chosen field. Prerequisite courses may be required when the student's preparation is deemed to be inadequate.

Each program of course work and thesis research is planned by the major professor and Master's committee in consultation with the student, and will depend upon the student's background, interests, and professional objectives. For example, a student majoring in Agricultural Biology may pursue work with an emphasis either in the area of plant pathology or economic entomology.

Normally, graduate programs will include a thesis requirement. There are, however, two exceptions.

In a program involving a major and two minors, or one involving a minor in General Agriculture, the research requirement may be met by three special problems in lieu of thesis. This program is provided to meet the needs of those working in fields of agriculture where general training is suitable rather than the more specialized subject-matter programs which usually characterize graduate study. The special problems in lieu of thesis must represent at least two of the fields of study selected. A student should have completed at least 6 hours of graduate work in a subject before pursuing a special problem in lieu of thesis in that field. Problems in lieu of thesis will be written to meet normal thesis standards of quality.

A non-thesis option is offered in the Department of Agricultural Economics and Rural Sociology in addition to the thesis option and has the following minimum requirements:

- 48 hours of course work of which 24 hours must be at the 5000-level.
- 18 hours in agricultural economics.
- 9 hours of economic theory.
- 6 hours in quantitative methods in agricultural economics, statistics, or mathematical economics.
- Final comprehensive written and oral examination.

**DOCTORAL PROGRAMS**

Graduate study programs leading to the Doctor of Philosophy degree in Animal Science, Agricultural Economics, Agricultural Engineering, and Plant and Soil Science are offered in the College. General Graduate School requirements relative to admission, faculty advisory committees, residence, grades, research, and admission to candidacy for degree apply to all doctoral programs. Special departmental requirements are listed in the following paragraphs.

**Agricultural Economics**

Subject Area Requirements: All candidates pursuing the Doctor of Philosophy degree will be required to demonstrate their competence in examinations in the following areas:

A. A major area of concentration to be selected from the following:

1. General agricultural economics
2. Agricultural marketing and price analysis
3. Farm management and production economics
4. Economics of agricultural development

B. The Core Areas:

- 1. Agricultural economics
- 2. Economic theory
- 3. Mathematical and quantitative methods in agricultural economics

Course Requirements: A minimum of 108 quarter hours credit beyond Bachelor's degree, exclusive of credit for Master's research, is required in the doctoral program. Of this total, 36 hours in doctoral research and dissertation are required. At least 50 hours of course work shall be in agricultural economics and 15 hours in economics. Excluding the dissertation, a minimum of 21 hours in agricultural economics and 36 hours in agricultural economics and economics combined must be in courses numbered 5000 and above.

**Agricultural Engineering**

Candidates pursuing the Doctor of Philosophy degree in Agricultural Engineering may specialize in one of the following areas:

1. Agricultural power and machinery
2. Soil and water conservation engineering
3. Agricultural structures
4. Electric power and processing

Supporting studies are required in related biological, physical, and engineering sciences and mathematics fundamental to the training of the candidate.

Additional course requirements for the degree are:

1. Minimum of 108 quarter hours credit beyond the Bachelor's degree, exclusive of the credit for the Master's thesis. Of this number, students are required to complete a minimum of 36 quarter hours in 6000 Doctoral Research and Dissertation.
2. A minimum of 30 quarter hours credit will be in courses numbered 5000 and 6000, exclusive of Doctoral Research and Dissertation.
3. The program of each candidate shall consist of a major and supporting studies in one or more additional areas. The major shall consist of a minimum of 24 quarter hours exclusive of research and dissertation. A minimum of 24 quarter hours shall be taken in departments outside of the Department of Agricultural Engineering.

The specific program of a candidate for the degree of Doctor of Philosophy in Agricultural Engineering will depend upon the interest and previous training of the candidate. Each candidate will be under the immediate supervision of a faculty advisory committee in planning his/her program. The major professor will serve as chairman of the faculty advisory committee and will direct the research and preparation of the dissertation.

**Animal Science**

The Department of Animal Science, with support from the Department of Food Technology and Science, offers programs leading to the Doctor of Philosophy degree in the following areas and of specialization:

1. Animal nutrition
2. Animal breeding
3. Animal physiology
4. Animal products

Supporting studies are required in related biological and physical sciences fundamental to the training of the candidate.

Additional specific course requirements
for the degree of Doctor of Philosophy in Animal Science include:

1. Minimum of 108 quarter hours credit in courses beyond the Bachelor's degree, exclusive of credit for the Master's thesis. Of this number, students are required to complete a minimum of 36 quarter hours in 6000 Doctoral Research and Dissertation.

2. At least 36 quarter hours credit in courses numbered 5000 and 6000, exclusive of Doctoral Research and Dissertation.

3. A minimum of 24 quarter hours credit must be completed in related fields outside of animal science.

The specific program of a candidate for the degree of Doctor of Philosophy in Animal Science depends upon the interest and previous training of the candidate. Actual course content of the program is planned with each student in consultation with a faculty advisory committee to meet requirements in the various areas of concentration.

Plant and Soil Science

The Department of Plant and Soil Science offers programs leading to the Doctor of Philosophy degree in the following areas of specialization:

1. Soils
2. Plant breeding and genetics
3. Crop physiology and ecology

Supporting studies are required in related sciences fundamental to the training of the candidate.

Some of the specific requirements for the degree are:

1. Minimum of 108 quarter hours credit beyond the Bachelor's degree exclusive of Master's thesis. Of this number, students are required to complete a minimum of 36 quarter hours in Doctoral Research and Dissertation.

2. Minimum of 30 quarter hours credit in courses numbered 5000 and 6000 exclusive of Doctoral Research and Dissertation.

The specific program for a candidate for the degree of Doctor of Philosophy in Plant and Soil Science will depend upon the interest and previous training of the candidate. The program of courses and research will be planned with the student in consultation with a faculty advisory committee. The major professor will serve as chairman of the faculty advisory committee and will direct the research and the preparation of the dissertation.

Departments of Instruction

Numbers in parentheses following the course titles indicate quarter hours credit offered.

Agricultural Biology

MAJOR
Agricultural Biology

DEGREE
M.S.

Agricultural Economics and Rural Sociology

MAJOR
Agricultural Economics
M.S., Ph.D.

Professors:
J. A. Martin (Head), Ph.D. Minnesota;
M. B. Badhwar, Ph.D. Purdue; D. W. Brown, Ph.D. Iowa State; C. G. Cleland, Ph.D. Wisconsin;
R. L. Lambdin, Ph.D. Virginia Polytechnic Institute; E. C. Bernard, Ph.D. Georgia

Associate Professors:
R. Bernhard, Ph.D. North Carolina State;
C. D. Pliess, Ph.D. Clemson; H. E. Reed, Ph.D. Ohio State.

Assistant Professors:
L. D. Lambdin, Ph.D. Virginia Polytechnic Institute; E. C. Bernard, Ph.D. Georgia

3130 Introductory Plant Pathology (4) Principles of plant pathology illustrated by diseases of common agricultural crops. Prereq: Introductory botany or zoology. Graduate credit for Introductory Plant Pathology 3 hrs and 1 lab. (Same as Botany 3130.)

3210 Economic Entomology (4) Structure, life history, habits, and principles of control of important insect pests of farm, garden, orchard, and household. 3 hrs and 1 lab.

3220 Apiculture (3) Biology of the honey bee, with emphasis on beekeeping equipment and apiary management practices relative to pollination of crops and allied production of honey and beeswax. 2 hrs and 1 lab.

4010 Biology of Soil Microorganisms (4) A study of the morphology and physiology of soil organisms, decomposition of organic matter, chemical transformations, and interactions between soil organisms and higher plants. Prereq: Introductory microbiology or 3150. 3 hrs and 1 lab.

4030 Forest and Shade Tree Entomology (3) Identification, biology, ecology, and control of forest and shade tree pests. Prereq: 3210 or equivalent. 2 hrs and 1 lab.

5000 Thesis

5010 Research Methods and Instrumentation in Plant Pathology and Entomology (3) Techniques for laboratory, field and greenhouse research in plant pathology and entomology. 1 hr and 2 labs.

5210 Plant Parasitic Nematodes (4) Morphology, physiology, taxonomy, and ecology of plant parasitic nematodes with emphasis on host-parasite relationships. Prereq: 8 hrs biological science or consent of instructor. 2 hrs and 2 labs. (Same as Zoology 5210.)

5220 Plant Disease Control (3) Basic problems and principles involved in controlling plant diseases. Prereq: 3150.

5230 Field Crop and Vegetable Insects (3) Taxonomy, biology, and control of insects affecting field and vegetable crops. Prereq: 3210 or equivalent course in applied entomology. 1 hr and 2 labs.

5240 Insect Pests of Man and Animal (3) A study of the taxonomy, biology and control of those insects parasitic on domestic animals and those found in human habitation. Prereq: 3210 or equivalent course in applied entomology. 2 hrs and 1 lab.

5250 Insect Pest Management (4) Principles and applications of biological, cultural, genetic, behavioral, and chemical methods of control to maintain pest populations below economic threshold levels. Prereq: 3210, Zoology 3110, or consent of instructor. 3 hrs and 1 lab.

5310 Special Problems in Plant Pathology or Economic Entomology (1-6) Comprehensive individual study of current problems in economic entomology or plant pathology. May be repeated. Maximum 9 hrs.

5410 Seminar (1) Review of literature and current research in plant pathology and economic entomology. May be repeated. Maximum 3 hrs.
farm supplies and merchandising agricultural products. Emphasis on accounting data and economic framework for managerial decision making.

4630 Advanced Agricultural Marketing (3) Theory of production organization and costs. Application of cost theory to the production organization of the marketing firm and problems of marketing. Market organization, structures, and price policies. Application of imperfect competition theory to the marketing policies of agricultural processing and merchandising firms.

4710 Agricultural Law (4) Survey of law and application to the farmer, his family and the agricultural industry. Property contracts, trusts, estate and succession, tax laws and other selected topics.

500 Thesis

5002 Non-Thesis Graduation Completion (3, 15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses University facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/N/NC only.

5011 Special Problems in Lieu of Thesis (3)

5120 Agricultural Price Analysis (3) Analysis and interpretation of factors affecting agricultural prices; determination of agricultural supply and demand; application of economic theory and statistical techniques to the agricultural price research. Prereq.: 3120 and Statistics 4310 or equivalent.

5130 Advanced Agricultural Production Economics (3) The theory and empirical concepts of agricultural resource allocation problems under various conditions of uncertainty. Prereq.: 4140 or equivalent.

5210 Seminar: Agricultural Policies (3)

5220 Seminar: Methodology of Research (3)

5230 Seminar: Adjustments to Industrialization (3)

5310 Research (3) Special research problems in agricultural economics and rural sociology. Gathering, tabulating and interpreting data and reporting writing. May be repeated. Maximum 9 hrs.

5410 Agricultural Marketing Analysis (3) Application of tools of economic analysis and measurement to problems at all levels of the marketing system for agricultural commodities. Prereq.: 4050 or equivalent.

5420 Advanced Land Economics (3) Problems in land tenure, land use, and conservation in the United States and selected foreign countries. Prereq.: 4530 or equivalent.

5440 The Economics of Agricultural Development (3) Role of agriculture in overall economic development; the economic nature of traditional agriculture, and the analysis of causal forces and structural interdependence of agricultural development under conditions of economic change. Prereq.: 4240 or consent of instructor.

5610 Quantitative Methods in Agricultural Economics (3) Study of analytical techniques useful in estimation of functions—supply, demand and production—and prediction of economic variables. Emphasis on the application of multiple regression; model specification, estimation technique using computer, and interpretation of results. Prereq.: Statistics 4310 or Economics 6510 or consent of instructor.

5710 Quantitative Methods in Agricultural Economics (3) Application of linear programming technique with empirical applications, made to problems of maximizing profit, minimizing cost, finding equilibrium and location. Other topics include input-output analysis, recursive programming, game theory, and nonlinear programming. Prereq.: Economics 4140 or consent of instructor.

6900 Doctoral Research and Dissertation

6120-30 Seminars in Agricultural Economics (3) Topics will be selected from the areas of economic organization, consumption, distribution in agriculture and related industries and public policies concerned with agriculture and related industries.

6210 Agricultural and Rural Transformation Problems (3) Systematic evaluation of policy and development proposals related to agricultural modernization, food supply, and rural living. The decision-making process and roles of social scientists. Analysis of current issues in U.S. and developing nations. Prereq.: Consent of instructor.

6410 Agricultural Supply Analysis (3) Estimating agricultural supply relationships using time series regression, production functions, linear programming, simulation and firm growth models with emphasis on correspondence between theoretical concepts and model attributes. Prereq.: 5130 or consent of instructor.

6420 Marketing and Resource Use (3) Institutional price and marketing policies. Analytical tools to measure efficiencies of marketing and resource use. Emergent marketing and resource use. Wastage management in the marketing systems to conserve resources and environment. Prereq.: 5410 or consent of instructor.

7000 Agriculture Engineering

7100 Introduction to Rural Sociology (3) Nature of rural society; social systems concept; rural-urban differences; nature of social relations; roles of social scientists. Analysis of current trends and problems in agricultural and rural sociology. Prereq.: 3420 or consent of instructor. 2 hrs and 1 lab. (Same as Sociology 5140.)

7200 Rural Sociology (3) Introduction to social science; population characteristics and movement; problems of rural people; tenancy, farm labor, health, services, educational facilities, churches, local government; impact of industrialization.

4450 Diffusion of Agricultural Technology (3) Analysis of the diffusion process whereby new technology spreads from scientists to final adopters. Topics include adoption process, communication behavior, mass media, role of professional change agents, opinion leadership, and two-step flow hypothesis. Prereq.: 3420 or consent of instructor.

5340 Special Problems (3) Special topics in rural sociology. Prereq.: 3420 or consent of instructor. May be repeated. Maximum 9 hrs.

5340 Seminar in Rural Sociology (3) Current rural sociological literature and research; relevance of general sociological theory and methodological techniques. Prereq.: 3420 or equivalent.

5340 Advanced Rural Sociology (3) Application of sociological concepts to analyze the changing structure and function of rural life; rural social values, attitudes, and norms as they influence the family, farming and informal groups, population shifts and changing farm technology. Prereq.: 3420 or equivalent.

5340 Research Problems in Rural Communities (3) Emphasis is given to problems that arise in selecting a design for rural research. Problems arising from sampling procedures, questionnaire construction, interviewer selection, training, and supervision are covered. Prereq.: Undergraduate course in statistics.

5400 Rural Population Analysis (3) Analysis of the U.S. and world population changes and the determinants of fertility, mortality, and migration with emphasis upon changes in the rural sector. Prereq.: Sociology 4110 or equivalent.

5540 Engineering Properties of Agricultural Materials and Products (3) Fundamental engi-
neering properties of agricultural products and materials as related to their handling, processing, and utilization. Prereq: Processing and Materials, Fluid Mechanics and Mechanics of Materials. 2 hrs and 1 lab.

5540 Agricultural Machinery Systems Analysis (3) Analysis of current field machinery; adaptation planning for systems operations; machinery for unique and alternate production and harvesting systems; operational management. Prereq: 4510. 2 hrs and 1 lab.

5510 Selected Topics in Agricultural Mechanization (3) Lecture, group discussion, and individual study on specialized agricultural mechanization developments. May be repeated. Maximum 9 hrs.

**Agricultural Extension Education**

**MAJOR**

**DEGREE**

**Agricultural Extension**

M.S. Professor: R. S. Dotson (Head), Ph.D. Pennsylvania State.

**Associate Professors:**

C. E. Carter, Jr., Ph.D. Ohio State.

3110 Introduction to Agricultural Extension (3) History, philosophy, organization, teaching methods; relationships with other educational agencies. Graduate credit for non-majors only.

4110-20 Field Studies (3, 3) Supervised work experience with county extension agents in a designated county. Prereq: 3110, and consent of instructor. Requires living off-campus for a specified time.

5000 Thesis

5011-21 Special Problems in Lieu of Thesis

5100 Special Problems in Agricultural Extension (1-6) May be repeated. Maximum 9 hrs.

5210-20 Long-range Extension Program Planning (3) Development of county extension program based on effective interpretation of physical, social, economic characteristics of areas. Prereq: 3110 or consent of instructor.

5220 Seminar (3) Review of literature and development in agricultural extension methods. Prereq: 3110 or consent of instructor.

5230 Evaluation in Programs of Agricultural Extension (3) Principles, instruments, and techniques of identifying, gathering, analyzing, and using data to appraise planning and teaching and to determine progress of clientele. Prereq: 5210 or consent of instructor.

5310 History, Philosophy and Objectives (3) Historical and philosophical foundation of formal Adult Education in American Agriculture from the Agricultural Societies (1785 to present). Prereq: 3410 or equivalent. 2 hrs and 1 lab.

5320 Volunteer Leadership in Agricultural Extension Programs (3) Theory, principles, and procedures in development of volunteer leadership for small groups in rural communities through agricultural extension programs. Prereq: 5310 or consent of instructor.

5330 Supervision of Agricultural Extension Programs and Personnel (3) Principles of human effectiveness; principles of successful supervision applied to various parts of county, district and other extension programs; and planning for effective extension management. Prereq: 5210 or 5220 or consent of instructor.

**Animal Science**

**MAJOR**

**DEGREES**

**Animal Science**

M.S., Ph.D. Professors: R. R. Johnson (Head), Ph.D. Ohio State; M. C. Bell, Ph.D. Oklahoma State; C. C. Chamberlin, Ph.D. Iowa State; H. M. Janisse, Ph.D. Tennessee; J. B. McNeron, Ph.D. Georgia; G. M. Mihalas, Ph.D. Wisconsin; M. J. Montgomery, Ph.D. Wisconsin; R. L. Murphy, Ph.D. Wisconsin; D. R. Nichardson, G. M. Mihalas, M. V. M. Indiana; H. V. Shirley, Ph.D. Illinois; R. R. Shrobe, Ph.D. Iowa State; E. W. Swanson, Ph.D. Minnesota; R. L. Tuggle, Ph.D. Kansas State.

**Associate Professors:**


**Assistant Professors:**

R. C. Cartee, D.V.M. Kansas State; J. A. Corrick, Ph.D. Tennessee; E. G. Doyle, D.V.M., Ph.D. Cornell; J. P. Hitchcock, Ph.D. Michigan State;

J. W. Holloway, B.S., Ph.D. Oklahoma State;

S. Bincak, D.V.M., Ph.D. Purdue; J. Oliver, D.V.M., Ph.D. Purdue; R. Schuh, Ph.D. Washington State;

J. D. Smidling, Ph.D. Texas A & M.

3110 Anatomy and Physiology of Farm Animals (4) Skeletal and jointed, skeletal muscles, blood and microcirculation, and the nervous, cardiovascular, respiratory, digestive, renal and endocrine systems; demonstrations of physiological-chemical phenomena. Prereq: General Biology or Animal Science for Agriculture, 3 hrs and 1 lab.

3120 Physiology of Reproduction (3) Comparative anatomy and physiology of the reproductive systems of higher vertebrates; gametogenesis, fertilization, implantation, prenatal growth, parturition and initiation of lactation; endocrine regulation of reproductive phenomena. Prereq: 3110. 2 hrs and 1 lab. (Same as Zoology 3220)

3210 Animal Nutrition (3) Properties, functions, utilization and deficiency symptoms of essential nutrients; nutritive value determinations and their use. Prereq: Animal Science for Agriculture and one quarter of organic chemistry. 2 hrs and 1 lab.

3230 Feeds and Ration Formulation (3) Feed-stuffs, additives, feeding standards; nutrient requirements and ration formulation for beef and dairy cattle, sheep, horses, swine, poultry and laboratory animals. Prereq: 3520. 2 hrs and 1 lab.

3410 Heredity in Animals (3) Basic chromosomal mechanism of heredity with emphasis on Monogenetic, Mendelian, and polygenic variations and their effects on traits such as linkage and cytoplasmic inheritance. Introductory to the biochemical basis of heredity and to quantitative inheritance. Illustrations of principles to animals with which students in agriculture are familiar. Prereq: Animal Science for Agriculture. 2 hrs and 1 lab.

3420 Principles of Animal Breeding (3) Genetic principles in the breeding of economic species. Genetic basis of variation. Partitioning of heredity according to various kinds of causative difference in genetic makeup and in environment. Selection and its consequences. Managing systems and procedures in commercial operations. Prereq: 3410 or equivalent. 2 hrs and 1 lab.

3510 Animal Hygiene and Sanitation (4) Parasitic, viral and bacterial organisms in farm animals; immunization and control in prevention against disease; veterinary regulations and quarantine; herd health programs. Prereq: General Microbiology or consent of instructor. 3 hrs and 1 lab.

3520 Avian Diseases (3) Major avian diseases; characteristics, prevention and treatment; management, practices and systems for domestic birds, upland game birds and waterfowl; 2 hrs and 1 lab.
3210 Nutrition and Management of Laboratory Animals (3) Principles of feeding, breeding and handling of laboratory animals; specific species' requirements, peculiarities and research for which best fitted; laws governing use of laboratory animals. Prereq: Animal Science for Agriculture and consent of instructor. 2 hrs and 1 lab.

4210 Physiology of Lactation (3) Development, anatomy, and functions of mammary glands; endocrinology, nutrition, and mammary development and milk secretion; factors affecting yield and composition of milk. Prereq: 3210.

4220 Avian Physiology (3) Anatomy and physiology of the avian system with emphasis on poultry. Prereq: 3210. 2 hrs and 1 lab.

4230 Applied Reproduction in Farm Animals (3) Methods and techniques in collecting, evaluating, processing and preserving semen; insemination of females; pregnancy determination; gestation and parturition. Male and female infertility. Prereq: 3220. 1 hr and 2 labs.

4310 Feeding Systems for Ruminants and Horses (3) Nutrition and feeding principles in the comparison of feeding systems utilized during the life cycle of cattle, horses and sheep. Prereq: 3330. 2 hrs and 1 lab.

4320 Feeding Systems for Poultry and Swine (3) Nutrition and feeding principles in the comparison of feeding systems utilized during the life cycle of poultry and swine. Laboratory feeding trials to demonstrate basic nutrition concepts. Prereq: 3330. 2 hrs and 1 lab.

4410 Applied Animal Breeding (3) The principles studied in 4340 (breeding of important classes and species) are taught by specialists in the breeding of dairy cattle, meat animals and poultry. Prereq: 3420. 2 hrs and 1 lab.

4810 Beef Cattle Production and Management (4) Principles of nutrition, physiology, and breeding in a complete beef cattle management program. Structure of industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production response and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4820 Dairy Cattle Production and Management (4) Principles of nutrition, physiology, and breeding in a complete dairy cattle management program. Topics will include the structure of the industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production response and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4830 Pork Production and Management (4) Principles of selection, nutrition, breeding, physiology and marketing in a complete pork production and management program. Structure of the industry, enterprise establishment, systems of production, production practices and herd improvement programs. Alternatives will be evaluated in terms of production response and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4840 Poultry Production and Management (4) Structure of the poultry industry, organization and management of poultry enterprises including rearing, housing, feeding, processing and marketing. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 3 hrs and 1 lab.

4850 Light Horse Production and Management (3) Integration of principles of nutrition, physiology and breeding into a light horse management program. Structure of the industry; systems of production and production practice; individual animal and herd improvement programs; tack, equipment and facilities for both pleasure owners and commercial producers. Alternatives will be evaluated in terms of pleasure, recreation, and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab.

4860 Lamb and Wool Production and Management (3) Integration of the principles of selection, nutrition, breeding, physiology and marketing into a complete lamb and wool production and management program. Structure of the industry, enterprise establishment, systems of production and responses and economic returns. Prereq: Completion of animal science sophomore and junior core courses or consent of instructor. 2 hrs and 1 lab.

5000 Thesis
5011 Problems in Lieu of Thesis (1-6) May be repeated. Maximum 6 hrs.

5110 Special Problems in Animal Science (1-6) May be repeated. Maximum 9 hrs.

5210 Endocrine Relations in Animal Production (4) Endocrine glands related to growth and reproduction; hormone preparation for altering growth and reproduction of farm animals. Prereq: 3210 or consent of instructor. 2 hrs and 1 lab.

5230 Advances in Mammalian Reproduction (3) Germ cell development, maturation, transport, metabolism, and preservation; fertilization and embryonic mortality. Prereq: 3220 or 4230. 2 hrs and 1 lab.

5240 Advanced Studies of the Secretion of Milk (3) Effect of endocrine and nutritional factors on mammary gland development; initiation and maintenance of lactation. Prereq: 4210. 2 hrs and 1 lab.

5311 Analytical Techniques in Animal Nutrition (3) Physical and chemical analyses of feeds, ingredients, and biological fluids associated with nutrition research. 1 hr and 2 labs.

5321 Energy in Animal Nutrition (4) Energy sources in animal feeds; carbohydrate and lipid compounds; nutritional functions, metabolism, evaluation and requirements. Prereq: 3320 or consent of instructor. 3 hrs and 1 lab.

5331 Proteins in Animal Nutrition (3) Proteins in feeds, amino acids and non-protein nitrogen; their application to farm animals. Prereq: 5321 and 5331 or consent of instructor. 2 hrs and 1 lab.

5341 Vitamins and Minerals in Animal Nutrition (3) Non-nutritional, history, identification, chemical properties, modes of action, determination, nutritional deficiency syndrome, sources and requirements. Prereq: 3320 or consent of instructor. 1 hr and 2 labs.

5410 Genetics of Animal Populations (3) The population and the individual, gene and zygotie frequencies; statistical descriptions of populations; forces influencing genetic changes; application to animal breeding. Prereq: 3420 or consent of instructor. 2 hrs and 1 lab.

5710 Methods of Evaluating Experimental Data in Animal Science (3) Techniques and methods of analyzing data from experiments in animal science based upon such statistical procedures as analysis of variance, covariance, linear regression and correlation, and multiple regression. Prereq: Statistics 5211 or equivalent. 2 hrs and 1 lab.

5720 Design and Interpretation of Experiments in Animal Science (3) Review of principles of experimental design and design and interpretation of data from research in animal science analyzing data from experiments that involve factorial, complex and disproportionate subclass frequencies; situations and procedures for use of computers in statistical analyses. Prereq: 5710. 2 hrs and 1 lab.

5910 Seminar (1) Current developments and literature in animal sciences. May be repeated. Maximum 3 hrs.

6000 Doctoral Research and Dissertation

6150 Topics in Milk Constituents (3) Properties of milk constituents and their relationship to milk and dairy products. Prereq: Food Technology and Science 4050.

6160 Topics in Dairy Microbiology (3) Microbiological problems related to various phases of the dairy industry.

6211 Advanced Topics in Animal Physiology (1-6) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs.

6220 Environmental Physiology of Farm Animals (3) Environmental factors and their measurement; physiological mechanisms of response to environmental factors and their measurement; interactions of animals and environment; terms of productivity and well-being. Prereq: Consent of instructor. 2 hrs and 1 lab.

6230 Animal Growth and Development (3) Physiological and nutritional aspects of growth of farm animals; effects of growth rates on physiological and productive functions. Prereq: 5311 and 5331 or consent of instructor.

6311 Advanced Topics in Animal Nutrition (1-6) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hrs.

6411 Advanced Topics in Animal Breeding (1-6) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hours.

6420 Animal Breeding Research Methods and Interpretation (3) Obtaining valid estimates of genetic parameters in animal breeding studies; least squares adjustment of data; the partition of variance; phenotypic, genetic, and environmental correlations; repeatability; heritability; and selection index. Prereq: 5410 and 5710.

6811 Advanced Topics in Animal Products (1-6) Recent advances and concepts, research techniques, current problems. May be repeated. Maximum 6 hours.

6910 Seminar (1) Seminars in animal nutrition, breeding, physiology and products. May be repeated. Maximum 6 hrs.

Food Technology and Science

MAJOR DEGREE

Food Technology and Science M.S.

Professors:
J. T. Miles (Head), Ph.D. Wisconsin; J. L. Collins, Ph.D. Maryland; W. W. Overcast, Ph.D. Iowa State

Associate Professors:

Assistant Professors:
S. D. Cunningham, Ph.D. Texas A & M.; G. W. Davis, Ph.D. Texas A & M.

3020 Dairy Products (4) Procurement, processing and distribution of fluid milk. Manufacture of frozen and condensed dairy products. 3 hrs and 1 lab.

3210 Food Composition (3) Determination and study of major constituents of fresh and processed foods; emphasis on attention to changes and interactions occurring during processing and storage. Prereq: General Chemistry. 2 hrs and 1 lab.

Institute of Agriculture
5150 Fats and Oils (3) The application of chemical principles to commercial technology of fats and oils. Prereq: 3210. 2 hrs and 1 lab.

5200 Research (1-5) Research in selected areas. Consent of department head. Credits and hours to be arranged. May be repeated. Maximum 10 hrs.

5310 Food Products Development (3) Fundamentals of the art, science and technology applied to the research, development and marketing of new food processes and products. Prereq: 4210 or 4310. 2 hrs and 1 lab.

5320 Food Thermobiology (3) Fundamentals of heat transfer as related to the rate of destruction of microorganisms and to the rate of loss of food quality through the calculation of minimum thermal processes for hermetically-sealed packages of foods. Prereq: 3220. 2 hrs and 1 lab.

5420 Advanced Food Quality Assurance (3) Applications of current instrumental methods used to control food manufacturing processes. Prereq: 4190. 2 hrs and 1 lab.

5510 Meat Technology (3) Physical and chemical changes that occur during the conversion of muscle to meat and the ultimate influence these changes have on quality and composition; meat and poultry production and quality control. Prereq: 3840. 2 hrs and 1 lab.

5530 Microorganisms Common in Food Products (3) Identification of desirable and undesirable microorganisms in food products and their relationship to manufacturing operations. Isolation and characterization of microorganisms from food products and plant equipment. Prereq: 4810 or Microbiology 3810. 3 labs.

5540 Microbial Cultures in Foods (3) Physical and chemical environment and metabolism of microorganisms as related to cultured food products. Prereq: 4810 and Microbiology 3810. 2 hrs and 1 lab.

Forestry, Wildlife, and Fisheries

MAJORS

B.S. 

Wildlife and Fisheries Science M.S.

Forestry

G. Schneider (Head), Ph.D. Michigan State; J. W. Barrett, Ph.D. Oregon State; C. S. Core, Ph.D. Syracuse; E. Thor, Ph.D. North Carolina State; F. W. Woods, Ph.D. Tennessee.


Assistant Professor: B. L. Dearon, Ph.D. Colorado State.

Forestry

*3200 Forest Environments and Ecology (3) Environments and ecology of forests and associated lands; emphasis on the application of ecological principles to contemporary problems. Prereq: 8 hrs of biology, botany, or zoology.

*3201 Forest Technology (3) Identification, nomenclature, identification, and silvicultural characteristics of the more common woody angiosperms native to North Carolina. Prereq: 4510 and 4810. 2 hrs and 1 lab.

*3500 Distribution and Silvics of Woody Angiosperms (3) Classification, nomenclature, identification, and silvicultural characteristics of the more common woody angiosperms native to North Carolina. Prereq: 3201. 2 hrs and 1 lab.

*3560 Forest Management (3) Principles of forest management with emphasis on multiple-use; concept as it influences forest management decisions; impact of public pressure for outdoor recreation on management decisions; management prescriptions. Prereq: 4006. S/NC only.

*3562 Forest Management (3) Principles of silviculture (3) Influence of site factors on reproduction, growth, development, and productivity; classification of forest structure; silvicultural laws. Prereq: 3020 or General Ecology; 3810, B.S. Ecology.

*3570 Conservation (3) Forest resources of state, nation, and world; forests in soil and water conservation; wildlife management and recreation; conservation programs.

4002 Utilization (3) Wood-using industries; processing forest products-sawmills, tree-loggers, plywood operations. Prereq: 3120.

4003 Field Methods of Timber Inventory (4) Study of forest trees; timber cruising; determining appropriate sample design for specific purposes; test and stand growth; site evaluation; field problems. Prereq: 3110.

4004 Forest Practice (3) Management of forest lands by public and private organizations; the "multiple-use" concept as it influences management decisions; impact of public pressure for outdoor recreation on management decisions; management prescriptions. Prereq: 4006. S/NC only.

4006 S/NC only.

*3610 Silvicultural Methods (3) Methods and application of intermediate and regeneration cuttings; site preparation; soil handling; methods and application of cutting methods to obtain desired goods and benefits. Prereq: 4002, 4003.

4020 Forest Watershed Management (3) Water as a forest resource: role of forests in the hydrologic cycle; control of water quantity, quality, and regime; watershed planning. Prereq: 4006. S/NC only.

* Graduate credit for non-forestry majors only.
Institute of Agriculture

4210 Forestry Organization and Administration (3) Problem analysis and decision making in forest resources management. Prereq: Senior standing in Forestry or Wildlife and Fisheries Science or consent of instructor. 2 hrs and 1 lab.

4220 Forest-Resource Management (4) The forest as an integration of resources; a review of forest management concepts; the multiple-use concept; valuation of forest resources for decision making and planning; taxation of the forest firm. Prereq: 4210.

4230 Forest-Resource Management Plans (4) Field demonstrations of principles in forest resource management; the forest as a system; management of forest enterprises as a producer of timber, recreational services, watershed services, and wildlife; producing multiple services; preparation of a complete plan based on optimizing forest uses. Prereq: 4210. 1 lab.

4240 Interpreting Forest Resources (3) Principles and techniques of interpreting forest resources, importance of environmental interpretation to management of forest resources, development and administration of interpretive programs. Prereq: 4210. 2 hrs and 1 lab.

4299 Seminar in Forest Management (3) Newly trees; forest ecology; variability and taxonomy and management. Prereq: 6 credits in sociology and/or economics. 2 hrs and 1 lab.

4309 Political Determinants of Recreation Development (3) Environmental and policy implications of recreation development in the public and private business sector (concerned with forest industry) are invited to conduct coursework. Prereq: 4230 or consent of instructor. 2 hrs and 1 lab.

4310 Seminar (1) Current developments in forest recreation. May be repeated. Maximum 3 hrs. S/NC only.

Wildlife and Fisheries Science

5220 Seminar in Forest Genetics (3) Population genetics and speculation, variation patterns and heritability in forest trees; gains with different breeding methods; planning and conducting forest genetics research. Prereq: 4420, General Genetics and consent of instructor.

5250 Recreation Planning for Forests and Associated Lands (3) Planning process for recreation development on forests and recreation-associated lands; analysis and critique of specific contemporary plans. Overnight field trips may be required. 2 hrs and 1 lab.

5260 Industrial Forestry (3) Structure and analysis of wood-using firms and industries. Forest taxation, land tenure and wood procurement alternatives. Development and application of forestry planning models. Prereq: 4230 or consent of instructor.

5270 Topics in Forest Industries Management (3) Current problems in industrial forestry are discussed and analyzed. Executives from the public and private business sector (concerned with forest industry) are invited to conduct coursework. Prereq: 4230 or consent of instructor. 2 hrs and 1 lab.

5280 Topics in Forest Industries Management (3) Current problems in industrial forestry are discussed and analyzed. Executives from the public and private business sector (concerned with forest industry) are invited to conduct coursework. Prereq: 4230 or consent of instructor. 2 hrs and 1 lab.

5310 Seminar (1) Current developments in forest recreation. May be repeated. Maximum 3 hrs. S/NC only.

5320 Seminar in Forest Genetics (3) Population genetics and speculation, variation patterns and heritability in forest trees; gains with different breeding methods; planning and conducting forest genetics research. Prereq: 4420, General Genetics and consent of instructor.

5400 Advanced Topics in Wildlife Science (3) Recent advances and concepts, research techniques and analysis of current problems. Prereq: 4520 or consent of instructor. May be repeated. Maximum 6 hrs.

Ornamental Horticulture and Landscape Design

MAJOR

Ornamental Horticulture and Landscape Design

DEGREE

M.S.

Professor:

D. B. Williams (Head), Ph.D. Pennsylvania State.

Associate Professors:


Assistant Professors:

J. W. Day, Ph.D. Mississippi State; G. L. McDaniel, Ph.D. Iowa State.

3030 Plant Propagation (3) Physiology, methodology, and environmental requirements for propagation. Prereq: 8 hrs of biological science. 1 hr and 2 labs.

3110 Greenhouse Management (3) Factors involved in management of greenhouses for production and research. Structures, soils, post control measures, heating, ventilating, lighting, water supply, crop succession. Prereq: Consent of instructor. 2 hrs and 1 lab.

4120 Landscape Design (4) Design and development of properties; planning, organization, structure, selection, and use of plant and structural materials, methods of presentation, specification. Prereq: Consent of instructor. 2 hrs and 2 labs.

4140 Landscape Design II (4) Advanced theory of design. Pictorial and abstract approach to landscape design. Development, analysis of contemporary trends and objectives, projected needs and development of plans. Prereq: 4140 or equivalent. 2 hrs and 2 labs.

4150 Whole Sale Nursery Management (3) Production, labor, and sales management; location, layout, culture, equipment and facilities. Prereq: 3030 or equivalent. 2 hrs and 1 lab.

4150 Retail Nursery Management (3) Essentials of good nursery management; location, layout and operation of landscape nurseries, garden centers, and chain store outlets. 2 hrs and 1 lab.

4180 Park Design (4) Design criteria for parks and outdoor recreation systems. Park site selection, analysis, planning and management related to needs and natural and economic resources. Evaluation of aesthetic and functional quality of parks and their impact on environmental quality of rural and suburban communities. Prereq: 4120. Recommended: 4140. 2 hrs and 2 labs.

4320 Advanced Topics in Grass Management (4) Principles and scientific basis of turfgrass culture: adaptation, ecology, physiology, soil fertility, and grass diseases. Prereq: 4430. 1 hr and 2 labs.

5320 Advanced Topics in Grass Management (4) Principles and scientific basis of turfgrass culture: adaptation, ecology, physiology, soil fertility, and grass diseases. Prereq: 4430. 1 hr and 2 labs.
4310 Floriculture I (3) Principles and practices employed in producing cut flower crops. Arrangement of principles of plant physiology as they control flowering, plant quality, and harvest schedules. Prereq: Greenhouse Management, Crop Physiology, or equivalent. 2 hrs and 1 lab.

4320 Floriculture II (3) Principles and practices employed in growing floricultural crops in pots and other containers. Analysis of problems associated with growing plants in a very restricted soil volume under controlled greenhouse conditions. Prereq: Greenhouse Management, Crop Physiology, or equivalent. 2 hrs and 1 lab.

4400 Individual Problem Study (1-5) May be repeated. Maximum 10 hrs.

5000 Thesis

5011-21 Special Problems in Lieu of Thesis (3-5, 2-6)

5100 Special Problems in Ornamental Horticulture and Landscape Design (3) May be repeated. Maximum 9 hrs.

5210 Golf Course Design, Development, and Management (4) Principles and applications in developing and managing golf courses. Selection and utilization of grass varieties and other plant materials and development of golf course systems. Prereq: 8 hrs biological sciences. 3 hrs and 1 lab.


5410 Histological Microtechnique (4) Preparation of plant tissue for microscopic examination, paraffin and plastic embedding, microscopy and mounting of sections, dyes and staining techniques and photography. Prereq: General biology or botany; general and organic chemistry; and consent of instructor. 2 hrs and 2 labs.

5500 Seminar (1) Discussion of current literature and development in ornamental horticulture and landscape design. May be repeated. Maximum 3 hrs.

Plant and Soil Science

MAJOR

Plant & Soil Science M.S., Ph.D.

Professors:
L. F. Steen
F. F. Bell, Ph.D., Iowa State; H. A. Fribourg, Ph.D., Iowa State; L. M. Josephson, Ph.D., Wisconsin; W. L. Parks, Ph.D., Purdue; L. N. Skold, M.S., Kansas State; M. M. Spring, Ph.D., California (Berkeley); H. D. Swingle, Ph.D., Louisiana State.

Associate Professors:
D. L. Coffey, Ph.D., Purdue; B. V. Conger, Ph.D., Washington State; L. S. Jeffery, Ph.D., North Dakota State; W. A. Kreuger, Ph.D., Illinois; G. M. Lessman, Ph.D., Michigan State; R. Lewis, Ph.D., North Carolina State; V. H. Pah, Ph.D., Iowa State; J. H. Reynolds, Ph.D., Wisconsin; H. C. Smith, M.S., Tennessee.

Assistant Professor:
F. L. Allen, Ph.D., Minnesota.

3200 Crop Ecology (3) Crops and environment; geographic location; site, heat, light, water, and interplant relationships as a basis for judging cultural practices used to modify environmental factors. Prereq: 8 hrs biological sciences. 2 hrs and 1 lab.

3400 Crop Physiology (3) Physiology of crop plants; relationships between crop production; use of general theories of physiology; effects of season, growth regulating substances, functions of light, heat, air, minerals and water. Prereq: 8 hrs biological sciences. 2 hrs and 1 lab.

3110 Soil Fertility and Fertilizers (4) Properties of soils in relation to plant nutrient availability and uptake. Methods of soil fertility evaluation and principles of fertilizer use; manufacture and properties of fertilizers. 3 hrs and 1 lab.

3120 Grain and Oil Crops (3) Distribution, improvement, morphology, culture, harvesting, and utilization of corn, small grains, grain sorghum, soybeans and related crops. Prereq: Soils. 8 hrs biological science. 2 hrs and 1 lab.

3140 Forage Crops (4) Characteristics, adaptation, improvement, management, and utilization of grasses and legumes for pastures, hay, and silage. Prereq: Soils. 8 hrs biological science. 3 hrs and 1 lab.

3150 Cotton and Tobacco (4) Characteristics, adaptation, improvement, culture, harvesting, and marketing of cotton and tobacco. Prereq: Soils. 8 hrs biological science. 3 hrs and 1 lab.

3180 Fruit Crops Management (4) Soils, cultivation, development of fruit crops plantations; pest control, harvesting, packing, storage, and pruning. Prereq: Agricultural Biology 3150 and 3210. 3 hrs and 1 lab.

3220 Soil Management (4) Soil management for crop production including cropping systems, fertilizer use, and tillage operations for specified soil and farming conditions. Prereq: Soils and Forestry 3320, 3 hrs and 1 lab.

3250 Soils in Forestry (3) Soil as a medium for tree growth; relation of physical, chemical, and biological properties of soils to tree growth and management of forest stands. Soil properties of importance in road location, recreational development and watershed management. Prereq: Soils. 2 hrs and 1 lab.

3510 Commercial Production of Cool Season Vegetables (3) Characteristics, economic importance, adaptation, and production for fresh and processing markets; emphasis on greens, salad, cole, root, bulb crops, perennials and Irish potatoes. Prereq: 8 hrs biological science. 2 hrs and 1 lab.

3520 Commercial Production of Warm Season Vegetables (3) Characteristics, economic importance, adaptation, and production for fresh and processing markets; emphasis on sweet potatoes, beans, tomatoes, pepper, cucurbits, sweet corn and okra. Need not have 3510 as prerequisite. Prereq: 8 hrs of biological science. 2 hrs and 1 lab.

3810 Interpretation of Agricultural Research (3) Statistics as applied to agriculture. Statistical methods in interpretation of research results. Prereq: Introductory Calculus-General Mathematics.

3710 Principles of Weed Science (4) Basic principles of weed science; history, ecology, economic importance, methods of control, types of herbicides, and specific recommendations for various crop and weed species. Prereq: 8 hrs biological sciences. 3 hrs and 1 lab.

4110 Soil Chemistry (4) Coollodial systems, properties and behavior of colloidal soil materials, relations of chemical properties to plant nutrition and water quality and Introductory Physics. 3 hrs and 1 lab.

4120 Principles of Crop Breeding (4) Genetic principles and techniques. Prereq: 8 hrs biological science or permission of instructor. 3 hrs and 1 lab.

4230 Soil Analysis (3) Analytical techniques used in soil chemistry and soil fertility studies. Prereq: 4110 or concurrent, 2-3 hrs.

4250 Agricultural Chemicals and the Environment (4) Characteristics, use, modes of soil degradation and environmental impact of chemicals used in agriculture, forestry and related uses with emphasis on agricultural pesticides; environmental safeguards imposed by federal and state regulations on chemical development and use. Prereq: 1 yr biology, 1 yr chemistry, 3 hrs and 1 lab.

4290 Soil Formation, Morphology, and Classification (4) Soil formation; properties, distribution, and classification of soils; interpretation of morphology; use of soil surveys. Prereq: Soils. 3 hrs and 1 lab.

4400 Problems in Plant and Soil Science (1-6) May be repeated. Maximum 9 hrs.

5000 Thesis

5011-21 Special Problems in Lieu of Thesis (3, 3)

5100 Special Problems in Plant and Soil Science (1-6) May be repeated. Maximum 9 hrs.

5200 Soil Crop Relationships (3-6) May be repeated. Maximum 6 hrs.

5240 Soil Productivity and Management (3) Concepts of soil productivity and management; quantitative evaluation of factors and their interaction affecting soil management decisions, cropping systems, water control and management, tillage and fertility management. Planning and evaluation of specific soil management programs. Prereq: 3220 and 4110 or consent of instructor.

5250 Pedology (4) Factors and processes of formation as related to the physical, chemical, and mineralogical properties of soils; soil in an ecosystem; classification of soils. Prereq: 4230 or consent of instructor. 3 hrs and 1 lab.

5310 Design and Interpretation of Experiments (3) Experimental design and procedures; effect of different variables on precision of experiments; problems dealing with the analysis of data. Prereq: 3610 or equivalent.

5340 Soil Physics (3) Chemical and physical relationships among the solid, liquid, and gaseous phases of the soil mass; their relation to plant growth and soil management. Prereq: 3180 and 3220.

5370 Advanced Soil Fertility (3) Fundamental concepts and soil chemistry as they relate to nutrient absorption by plant roots; interrelation of these concepts in soil fertility and soil management. Prereq: 4110.

5390 Soil Physical Chemistry (3) Structural properties of soil minerals determining their physicochemical reactions, ion exchange, Donnan equilibrium, double layer theory. Prereq: 4110; Chemistry 4110 or concurrent registration.

5600 Seminar (1) May be repeated. Minimum 3 hrs.

5710 Advanced Plant Genetics (3) Importance of polylolity in plants; detailed analysis of genome relationships, genetic recombination, mutation, heterosis, quantitative inheritance, heritability selection and self-incompatibility systems in relation to genetic principles. Prereq: Basic Genetics or consent of instructor.

5720 Quantitative Genetics (3) The genetic constitution of plant populations and changes in gene frequency; recognition and measurement of
continuous variation; estimation of variable components and genetic advance under different breeding procedures. Prereq: Basic Genetics or consent of instructor.

5750 Advanced Plant Breeding (4) Historical development of plant breeding concepts and methods, effects of heterosis, inbreeding, hybridization and selection. Improvement of self- and cross-pollinated crops. Prereq: 5710, 3 hrs and 1 lab.

5810 Crop Climatology (4) Meteorological factors affecting crop plants; crop distribution and centers of origin; general and specific climatic, weather, and vegetative systems; microclimatic influences on plant growth. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

5820 Advanced Crop Physiology and Ecology (4) Historical development of research in crop physiology and ecology. Interrelationships between physiologic processes and environmental factors. Crop adaptation to specific environmental conditions. Prereq: 3020, 3040; or Botany 3210, 4310 or consent of instructor. 3 hrs and 1 lab.

5850 Mechanisms of Herbicide Action (3) Principles of the uptake, translocation, mode of action and basis of selectivity of herbicides. The effects of herbicides on plant morphology, metabolic systems and enzymatic activities will be discussed. Prereq: Botany 3210 and Biochemistry 4110 or consent of instructor.

6000 Doctoral Research and Dissertation

6100 Special Topics in Soil Science (3) May be repeated. Maximum 9 hrs.

6200 Special Topics in Plant Breeding (3) May be repeated. Maximum 9 hrs.

6300 Special Topics in Crop Physiology and Ecology (3) May be repeated. Maximum 9 hrs.

6410 Experimental Designs (3) Principles of experimental designs used in agricultural research. Completely randomized, randomized complete block and latin square designs; the factorial experiment and confounding; lattice designs; and covariance. Prereq: 5310.

6510 Growth Control with Chemicals (3) Character, theories of action and use of auxins, gibberellins, cytokinins and inhibitors. Range of effects on growth. Prereq: Botany 3210 or equivalent. 2 hrs and 1 lab.

6600 Seminar (1) May be repeated. Maximum 3 hrs.
Donald D. Hanson, Dean
William J. Lauer, Assistant Dean

Professors:

Associate Professors:

Assistant Professors:
W. Barth, B. Arch., Pennsylvania; W. R. Benedict, B. Arch., Kansas State; D. Clark III, M. Arch., Harvard; A. Dezman, M. S. A., Rhode Island School of Design; L. D. Grieve, B. Arch., Tennessee; S. I. Hanke, III, B. Arch., Clemson; A. J. Lester, B. Arch., North Carolina State; R. Li, M. S., Columbia; M. S. Moffett, Ph. D., Massachusetts Institute of Technology; V. Narancic, B. Arch., Belgrade; T. W. Simpson, B. Arch., Auburn.

Lecturers:
A. G. Anderson, M. A., Missouri; M. C. Martin.

4170 Introduction to Preservation and Restoration (4) History and theory of restoration and preservation.

4311 Historic Preservation Laboratory (8) Directed studies for buildings of historical significance. Techniques of preservation, search of historic methods of construction, and studies of viable uses. Rehabilitation, restoration, preservation and adaptive uses.

4731-32 Earthquake Resistant Structures I, II (4, 4) Analyze and design of structures to resist earthquake effects. Earthquake phenomena. Vibration of a single degree structural systems. Resonance and damping. Introduction to dynamic analysis of structures, instrumentation and structural response. Frame and shear wall behavior. Ground-structure interaction. Prereq: Consent of instructor. (Same as Civil Engineering 4731-32.)

4733 Structural Design for Protection Against Extreme Hazards (4) Probability, risk, human values, insurance. Survey of possible hazards; floods, fire, hurricanes and tornadoes, earthquakes, nuclear effects, internal and external explosions. Building code and engineered design of steel, masonry, concrete and wood structures to resist extreme effects. Protective construction for human and system needs. Fire protection engineering, fire phenomena, life safety and analysis, high-rise building fires.

4739 Aesthetics of Engineering Structures (4) Architecture in engineering; theory and utilization of space, design, and materials in large structures. Bridges, exhibition halls, power plants.

4850 Elementary Structural Matrix Methods (4) Introduction to the generalized matrix methods of analysis of structure. Review of matrix algebra and vectors; development of member stiffness and flexibility matrices; assembly of structure stiffness and flexibility matrices. Prereq: Consent of instructor. (Same as Civil Engineering 4850 and Engineering Science 4850.)

4900 Aspects of Urban Environment (4) Interdisciplinary course in urban problems. Prereq: Consent of instructor. (Same as Psychology 4900, Real Estate 4900.) S/NC only.

4910 Architectural Photography (4) Use of photography as a design, research, and presentation medium. Emphasis on architectural photography using black and white media.

4920 Advanced Architectural Photography (4) Application of special photographic techniques with emphasis on color printing and processing. Prereq: Consent of instructor.
Graduate Programs

The College of Business Administration offers programs leading to six advanced degrees: the Doctor of Business Administration, the Doctor of Philosophy in Economics and in Management Science, the Master of Arts and the Master of Arts in College Teaching with a major in Economics, the Master of Science with majors in Economics and Statistics, and the Master of Business Administration. The Department of Industrial and Personnel Management participates with the Department of Psychology in the College of Liberal Arts in offering an intercollegiate program in Industrial and Organizational Psychology leading to the Master of Science and Doctor of Philosophy degrees. (See page 100.) Also, the Department of Management Science offers an intercollegiate program leading to the Master of Science degree. (See page 101.)

The two College-wide programs, the MBA and the DBA, are described below. Descriptions of other degree programs leading to the Master of Science degree. (See page 101.)

Graduate Programs

Viewing the business firm as operating in a dynamic social, political and economic environment which demands leaders capable of dealing with innovation and rapid change, the College places central importance on development of students' thought processes rather than on specialized subject matter and courses descriptive of past practices. Emphasis is focused on flexibility of mind, receptivity to new ideas, capacity to adapt one's reasoning powers and judgment to rapid changes, vigor and imagination in using the mind, ability to reason analytically and logically and, above all else, inculcation of an irrepressible desire to continue to learn and grow in knowledge throughout the student's life.

The MBA Program

The College-wide curriculum of the Master of Business Administration program is designed to prepare students for successful careers in business and institutional management and for imaginative and responsible citizenship and leadership roles in business and society. The program is designed to encompass the major functional areas of business and economics in order to provide the perspective necessary for those who aspire to positions of executive and professional leadership. The curriculum reflects the application of evolving knowledge in economics and the behavioral and quantitative sciences. This program is accredited by the American Assembly of Collegiate Schools of Business.

Completion of the MBA program requires from four to six quarters (51 to 78 quarter hours of course work) for a full-time student, depending upon the individual's undergraduate preparation in business and economics. The four-quarter sequence is designed for those who have completed a baccalaureate program in business administration. Those with undergraduate degrees in the humanities, engineering, social sciences or natural sciences will require up to six quarters, depending upon the extent of their preparation in business and economics.

The complete MBA program with a concentration in industrial management is offered by the regular graduate faculty of the College as a part-time evening program on the Knoxville campus, at Oak Ridge and at the Kingsport University Center.

Students may begin the program in any of the four quarters of the academic year; however, those entering the program in the winter or spring may find it difficult to complete the program in minimum time due to course scheduling and sequencing. The MBA student may select an area of concentration from the following fields: Accounting, Management science, Economics, Marketing, Finance, Real estate, Forest industries, and urban development, Governmental financial administration, Statistics, Industrial administration, Transportation and logistics.

All entering students must have completed college-level mathematics through at least one quarter (or semester) of calculus or remove the deficiency by taking appropriate courses in mathematics. Specific requirements of the MBA program are shown below. To qualify for the degree, a student must complete a minimum of 51 quarter hours of graduate course work in Groups B, C and D, at least 42 hours of which must be at or above the 5000 level. Further, at least half of the credit hours taken in Group C (concentration area) must be at or above the 5000 level.

There is no thesis requirement although ample opportunity is provided for research and writing in course work.
undergraduate program or included in the MBA curriculum prior to undertaking courses in the concentration area.

**Accounting.** Graduates are eligible for the CPA examination in Tennessee. Area prereq.: Introductory Financial Accounting (6); Intermediate Cost Accounting (6); Intermediate Theory (9); and Federal Income Tax (3).

The following areas must be included in the concentration unless taken in a graduate program: auditing, consolidation, advanced federal income tax, and computer concepts in accounting. Additionally, at least three of the following must be included: 5110, 5120, 5130, 5210, and 5420.

**Economics.** (See also Master’s and Ph.D. programs in this area.) Area prereq.: Intermediate Macro- and Microeconomic Theory (6).

Any combination of 12-18 quarter hours of economics courses listed in this catalog as approved by the faculty advisor.

**Finance.** Area prereq.: Finance 5050 or equivalent; 5110 (core course). A minimum of three courses must be taken in one of the following areas: Financial Management: 5120, 5130, 5140, 5620, 5800, 5990. Investments: 5420, 5430, 5810. Monetary Policy and Financial Institutions: 5800, 5810, 5820, 5930. Forest Industries Management. Area prereq.: B.S. degree in forestry, or equivalent.


**Group D—Electives.** Unless the student elects two areas of concentration, a minimum of 6 quarter hours must be taken in areas outside the area of concentration. The elective area is increased beyond 6 hours to the extent that the concentration area is less than 18 hours. With specific approval of the student’s advisor, an elective course may be taken outside the College of Business Administration.

Total, Group D 6-12

**MBA CONCENTRATIONS:** Typical course groupings are listed below. Area prerequisites may be taken in one’s

3 May not be taken by students whose undergraduate major was accounting or whose MBA area of concentration is accounting. Student’s faculty advisor must approve course to be substituted.

4 May not be taken by students whose program includes Statistics 5110. Student’s faculty advisor must approve course to be substituted.

5 May not be taken by students whose program includes Management Science 5310.

Concentration includes Management Science 5330 and 5340 and two to four additional courses selected from computer science, management science, statistics, or mathematics as approved by the faculty advisor.

Marketing. Area prereq.: Marketing 5050 or equivalent and 5200 (core course). Any combination of 12-18 quarter hours of marketing courses listed in this catalog as approved by the faculty advisor. Marketing 5300, 5330, and 5410 are required.


A course selected from architecture, civil engineering, economics, planning, transportation or other relevant areas approved by the faculty advisor.

Statistics. (See also Master of Science program in this area.) Area prereq.: Mathematics through second year of calculus including differential equations. Any combination of 12-18 quarter hours of statistics courses listed in this catalog as approved by the faculty advisor.

Transportation and Logistics. Area prereq.: Transportation 5050 or equivalent. Any combination of 12-18 quarter hours of transportation courses listed in this catalog as approved by the faculty advisor. Transportation 5210 normally is required.

**Other Requirements.** The application for Admission to Candidacy (see page 19) must be approved by the faculty advisor. Applicants must achieve a B average (3.0) or above in courses taken in the concentration area(s) of concentration and the Assistant Dean for Graduate Programs of the College of Business Administration before submission to the Vice Chancellor for Graduate Studies and Research.

To qualify for the degree, the student must achieve a B average (3.0) or above in courses taken in the concentration area(s) as well as in the overall program and pass a written comprehensive examination during the final quarter of the program. If the results of the written examination are not clearly passing or failing, a supplementary written or oral examination may be given in the same quarter. The complete examination process may be repeated one time, but it may not be taken until the quarter following the first attempt.

**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 Doctor of Jurisprudence and the Master of Business Administration degrees. A student pursuing the dual program may save up to two academic quarters (24 hours) of course work which would be required if the two degrees were to be earned separately.

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

Students who have been accepted by both colleges may apply anytime prior to, or after, matriculation in either college and may commence studies in the dual program at the beginning of any quarter subsequent to matriculation in both colleges, provided, however, that dual program studies be started prior to entry into the last 42 hours required for the J.D. degree and the last 24 hours required for the MBA degree.

Curriculum. A dual program candidate must satisfy the graduation requirements of both colleges. 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 credit toward the J.D. degree for acceptable performance in a maximum of 12 quarter hours of approved graduate level courses offered by the College of Business Administration. Three of the 12 quarter hours must be earned in Accounting 5810 or a more advanced accounting course. If College of Law credit is given for such an accounting course, the student may not receive College of Law credit for Legal Accounting (Law College Course 8590).

The College of Business Administration will award credit toward the MBA degree for acceptable performance in a maximum of 12 quarter hours of approved courses offered by the College of Law.

Except while completing the first year courses in the College of Law, students are encouraged to maximize the integrative facets of the dual program by taking courses in both colleges each quarter.

Awards of Grades. For grade recording purposes in the College of Law for graduate business courses and in the College of Business Administration for law school courses, grades awarded will be converted to either Satisfactory or No Credit and will not be included in the computation of the student's grade average or class standing in the college where such grades are so converted. The College of Law will award a grade of Satisfactory for a graduate business course in which the student has earned a B grade or higher and a No Credit for any lower grade. The College of Business Administration will award a grade of Satisfactory for a Law School course in which the student has earned a 2.3 grade or higher and a No Credit for any lower grade. Grades earned in courses of either college may be used on a regular graded basis for any appropriate purpose in the college offering the course. The student must pass a final written comprehensive examination to receive the MBA degree.

The DBA Program

The basic objective of the Doctor of Business Administration program is to provide the student an opportunity to attain the intellectual competence necessary to meet the highest standards for advancement to a professional position in an academic institution, business and industry, or government. The student will develop a sound foundation for expanding knowledge in the student's chosen area of concentration and will contribute through research to advancement of the state of knowledge in this area. Moreover, the student's educational experience should develop perspective toward education for business in a manner that will enable the student to spearhead innovation and change in response to needs.

The DBA program is structured around four major areas. First, it recognizes the interdisciplinary thrust of graduate education and provides the student with a sound foundation for expanding the body of knowledge related to business systems and their interactions with other socioeconomic systems and environmental forces. Second, the student's program is flexible enough to respond to individual needs and interests yet is formulated within a sound framework to achieve overall objectives. Third, emphasis is placed upon conceptual foundations and analysis of decision-making processes rather than the descriptive aspects of business foundation. Fourth, the student does advanced work in the basic disciplines of economic theory, behavioral science and quantitative science to provide the necessary foundations for research.

Foundation Requirements. Although the program is designed for students who have completed an accredited MBA (or equivalent) degree program, those with outstanding undergraduate records in any area may be admitted directly to the DBA program and may, if they desire, earn the MBA degree in a coordinated program of study. Program prerequisites include at least one year of college mathematics to include college algebra, general mathematics and a course in single variable calculus; a course in statistics; knowledge of computer programming (FORTRAN IV); intermediate economic theory (micro and macro); and introductory courses in financial accounting, business finance, marketing, operations (production) management, and the legal environment of business. Entering students deficient in any of these areas may enroll in courses designed to meet these requirements.

Course Requirements for the DBA Program. Each student must demonstrate, by passing appropriate graduate level courses in or by examination, an understanding of the business functional areas, the basic disciplines underlying the study of business administration, the student's concentration area and a supporting area.

Following are the requirements for each area:

A. Business Functional Areas. One graduate level course in each of the following areas must be completed. Students who have earned an MBA degree at an accredited institution probably will have met these requirements. Those without previous graduate work in one or more of these areas may fulfill the requirement by taking courses listed.

1. Managerial Accounting (Accounting 5810)
2. Financial Management (Finance 5110)
3. Marketing Management (Marketing 5200)
4. Organization Theory/Behavior (Industrial Management 5230)
5. Business Policy (Business Administration 5310)

B. Basic Disciplines. Each student must demonstrate proficiency in the following areas by completing course work indicated or by passing appropriate examinations:

1. Economics
2. Advanced Microeconomic Theory (Economics 5111)
3. Advanced Macroeconomic Theory (Economics 5121)
4. Organizational Behavior (Industrial Management 5610-20)
5. Quantitative Science

12 quarter hours in one or a combination of two of the following areas: statistics, management science, econometrics, or computer science. Approval of student's committee is required.

C. Concentration Area. This is the focal point of the program and the area in which the student expects to do his/her research and dissertation. A minimum of 24 quarter hours of course work is required, including 8 hours of doctoral seminars taken at this University. A study of research methodology of the discipline is included. Graduate work in the field taken at other institutions is considered by the student's committee in determining additional course work required. Available concentration areas are:

1. Accounting
2. Finance
3. Management
4. Marketing
5. Transportation and logistics

D. Supporting Area. A minimum of 12 quarter hours of graduate course work is required in an area outside of, but complementary to, the concentration area. The student may choose the supporting area from one of the following: one of the business functional areas, additional work in one of the basic disciplines, or a related area in another school or college of the University. The program of study should be arranged with an advisor in the discipline chosen and must be approved by the student's committee.

* Students who choose this field as a supporting area take Industrial Management 5170 and 5180.
* Statistics 5311 and 5312 and Management Science 5100 may not be included.
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 12 quarter hours of course work attempted which is specified in the student's degree program. Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Programs of The College of Business Administration upon recommendation of the student's faculty committee.

Admission Requirements

General admission requirements for the Graduate School are stated on pages 11-12. MBA and DBA applicants are required to take the Graduate Management Admission Test (GMAT). Applicants for programs in economics, management science, and statistics may submit results of either the GMAT or the Graduate Record Examination (GRE) aptitude portion. Applicants for economics who submit GRE aptitude scores must also submit the Advanced GRE score for economics. Applicants for management science must score a minimum of 500 on the GMAT and meet the quantitative methods prerequisites stated in the program description. Applicants whose native language is other than English must submit results of the Test of English as a Foreign Language (TOEFL). Scheduled dates and locations for taking these examinations may be obtained from the Graduate Record Examinations Service, Educational Testing Service, Princeton, New Jersey 08540.

In addition to procedures required for admission to the Graduate School (pages 11-12), DBA applicants must submit additional information on forms provided by the College of Business Administration. The application for all programs and supporting materials should be submitted at least three months prior to desired entry date.

The College of Business Administration is associated with each of the graduate schools of business as a member of the Graduate Management Admission Council.

Fellowships and Assistantships

Fellowships. Information concerning non-service fellowships administered by the Graduate School as well as application blanks, may be obtained from the Office of the Vice Chancellor for Graduate Studies and Research.

Assistantships. A limited number of graduate assistantships are available in each of the academic departments and in the Center for Business and Economic Research. Assistantships which carry remission of tuition and/or fees range up to $4500 per year, while others funded through research or grants by his/her faculty member have remission of tuition and/or fees range up to $5500 per year for half-time service. Awards are generally made on the basis of scholarship and research qualifications. Application forms may be obtained in any of the departments or from the Assistant Dean for Graduate Programs. Applications must be received by March 15 for consideration of assistantships to be awarded for the following fall term.

Center for Business and Economic Research

The staff of the Center for Business and Economic Research engages in studies of the business and economic environment in Tennessee, the Southeast, and the Nation. The Center serves the business community, state government, Individuals, and the University through dissemination of various kinds of economic and socio-economic information and supports the faculty of the College in seeking funding for research projects. Staff members conduct research in regional economics, public finance, and areas related to socioeconomic problems in the region. The Center publishes the results of its own research and that of others in monograph form so that significant developments in the various business disciplines and economics can receive widespread exposure. In addition, the Center staff does contract research on business and economic problems for governmental organizations and private industry. The Center publishes periodically the Tennessee Statistical Abstract and bi-monthly the Survey of Business. The Center is a member of the Association for University Business and Economic Research.

Tennessee Executive Development Program

The Tennessee Executive Development Program (TEDP) is designed to provide extensive continuing educational opportunities for executives from firms and organizations in Tennessee, the South, and the nation. The objectives of the program are to prepare and develop executives for increasingly higher levels of management responsibility and to sharpen existing executive skills needed for comprehensive decision making and leadership. Other major aims of the TEDP are to teach the fundamentals of analytical thinking and the use of the decision tools, and to examine the economic, political, technological and other environmental factors affecting the firm's operations.

The TEDP limits enrollment to thirty-two participants who live on campus for a total of four weeks spread over a three-month period. This arrangement provides executives with extensive opportunities to exchange ideas and operational concepts with contemporaries in other business areas and with TEDP faculty as well.

The faculty for the TEDP consists of senior professors who teach business-related subjects in the University's graduate programs and nationally recognized professors of other institutions. Each participating faculty member has deep experience in either consultation with or actual operations in business and industry. The TEDP faculty is augmented by out-

Minimum Academic Performance Standards

A graduate student in the College of Business Administration whose grade point average at any point after 12 hours is below 3.0 shall be placed on probation. A student on probation shall be dropped from the program unless his or her
standing practitioners in their fields of business and industry.

Department of Accounting

Numbers in parentheses following the course titles indicate quarter hours credit altered.

Accting and Business Law

J. E. Kiger (Head), Ph.D., Missouri, C.P.A.

Professors: N. E. Dittrich, Ph.D., Ohio State, C.P.A.; J. R. Williams, Ph.D., Arkansas, C.P.A.


Assistant Professor: M. C. Letsinger, M.S., Tennessee, C.P.A.

4120 Advanced Auditing (3) Case-oriented course including audit of specific asset, liability, revenue and expense accounts, with emphasis on reporting, data processing, statistical sampling, and internal auditing. Prereq: Principles of Auditing with C or better.


4990 Accounting Theory (3) Theory and conceptual framework underlying measurement of income and financial position as related to the resolution of key reporting problems. Prereq: Intermediate Accounting with C or better.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5050-60 introduction to Accounting (3, 3) User-oriented survey of financial and managerial accounting principles and practices. May not be taken by accounting majors.

5110 Seminar in Accounting Theory (3) Evolution of accounting theory, concepts underlying financial reporting models, and authoritative accounting literature in each relates to measurement of periodic performance and financial position. Prereq: Consent of department head. May not be taken by students with credit for 4900.

5120 Seminar in Advanced Auditing (3) Theory and concepts underlying the philosophy of auditing as related to current auditing issues. Prereq: 4910 and 5110. May not be taken for credit by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5110 or consent of instructor.

5130-40 Seminar in Current Accounting Topics (3, 3) Critical in-depth consideration of current issues in financial accounting literature. Prereq: 4930 or 5110 or consent of instructor.

5150 Research in Accounting (3) Directed problem-oriented research in financial accounting, managerial accounting and auditing topics. Prereq: 4910.

5160 Graduate Internship in Accounting (3) Full-time resident professional employment for one academic quarter involving qualified job experience, a written report of responsibilities, and an evaluation of student performance. Prereq: Consent of instructor.

5210-20 Seminar in Advanced Managerial Cost Accounting (3, 3) Analysis of current issues and formulation of individual research projects. Topics include cost allocation problems, budgeting, human resource measurement, social cost effects, performance evaluation and responsibility accounting concepts, service industry costing and analysis of not-for-profit ventures and projects. Prereq: Managerial Cost Accounting or equivalent. Must be taken in sequence.

5220 Auditing Concepts (3) Concepts and theory of auditing, the environment of internal and external auditing, nature of evidence, internal control evaluation, and reporting. Not intended for the auditing course. Prereq: Intermediate Accounting. Prereq or coreq: Statistical Sampling and AECS 3230 or equivalent currently.

5230 Advanced Income Tax (3) Federal income taxation with emphasis on tax planning and research. Not intended for persons who have credit for an advanced tax course. Prereq: Intermediate Accounting.

5300 Consolidations and Business Combinations (3) Theory and practice of accounting for interrelated business entities—domestic and foreign. Not intended for persons who have credit for a course with similar content. Prereq: Intermediate Accounting.

5420 Tax Research (3) Development of expertise in tax research utilizing tax service, tax periodicals, legal cases and other available sources. Includes individual research projects. Prereq: Advanced Federal Taxes or equivalent.

5430 Tax Planning (3) Advanced study of income tax planning, emphasizing alternatives available to minimize tax liability compatible with achieving taxpayer objectives. Prereq: 5420.

5510 Not-for-Profit Accounting (3) Theory and practice of budgetary and fund accounting, financial reporting, measures of output and accomplishment, and financial and performance auditing for non-profit entities. Prereq: 8 hrs of accounting and consent of instructor.

5610 Seminar in Advanced Managerial Accounting (3) Theory and practice of accounting in a business environment. The analysis, design, implementation, documentation, and control of accounting systems. Prereq: Introductory Cost Accounting and knowledge of a computer programming language.

5640 Seminar in Accounting Information Systems (3) A survey of the literature on accounting information systems and advanced systems analysis and design concepts. The informational needs of other functional areas of business and the role of accounting in fulfilling these areas are considered. Prereq: AECS 4630 or equivalent.

5650 Accounting Systems and EDP Concepts and Control (3) Elements and operation of a computer in a business environment. The analysis, design, implementation, documentation, and control of accounting systems. Prereq: Introductory Cost Accounting and knowledge of a computer programming language.

5660 Seminar in Accounting Information Systems (3) A survey of the literature on accounting information systems and advanced systems analysis and design concepts. The informational needs of other functional areas of business and the role of accounting in fulfilling these areas are considered. Prereq: AECS 4630 or equivalent.

5670 Accounting for Control (3) User-oriented survey of contemporary financial and managerial cost accounting. Prereq: AECS 5050 or equivalent or consent of instructor. Not available for accounting majors.

5820 Corporate Reporting Problems (3) A user-oriented survey of current corporate financial reporting problems and issues. May not be taken for credit by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5810 or consent of instructor.

6000 Doctoral Research and Dissertation 6110-30 Doctoral Seminar in Accounting (3, 3) Analysis of issues reflected in accounting literature. Prereq: 5 years of graduate credit in accounting and consent of instructor.

Business Law


Associate Professor: N. E. Shurtz, L.L.M., Georgetown.

5050 Legal Environment of Business (3) Surveys legal and quasi-legal institutions with emphasis on the administrative agencies which have particular significance to the businessman; examines government regulation of business; explains basic legal notions and principles that pertain to businessmen. (Available only as stated on page 36.)

Business Administration

MAJOR DEGREES

Business Administration MBA, DBA

5310 Business Policy (3) Case studies covering policy formulation and implementation and the decision processes involved in arriving at and implementing a company's policies. Not intended for persons who have credit for a course with similar content. Prereq: Consent of instructor.

5810 Research in Accounting (3) Directed problem-oriented research in financial accounting, managerial accounting and auditing topics. Not intended for persons who have credit for a course with similar content. Prereq: Consent of instructor.

5820 Seminar in Advanced Managerial Accounting (3) Analysis of current issues and formulation of individual research projects. Topics include cost allocation problems, budgeting, human resource measurement, social cost effects, performance evaluation and responsibility accounting concepts, service industry costing and analysis of not-for-profit ventures and projects. Prereq: Managerial Cost Accounting or equivalent. Must be taken in sequence.

5840 Seminar in Accounting Information Systems (3) A survey of the literature on accounting information systems and advanced systems analysis and design concepts. The informational needs of other functional areas of business and the role of accounting in fulfilling these areas are considered. Prereq: AECS 4630 or equivalent.

5850 Accounting for Control (3) User-oriented survey of contemporary financial and managerial cost accounting. Prereq: AECS 5050 or equivalent or consent of instructor. Not available for accounting majors.

5860 Corporate Reporting Problems (3) A user-oriented survey of current corporate financial reporting problems and issues. May not be taken for credit by students whose undergraduate major was accounting, or whose graduate concentration is accounting. Prereq: 5810 or consent of instructor.

College of Education

See College of Education

Economics

MAJOR DEGREES

Economics M.A., M.A.T., M.S., Ph.D.

Professors: J. R. Moore (Head), Ph.D., Cornell; R. D. Buttery, Ph.D., Texas; R. D. Cobb, Ph.D., Texas; G. R. Feiwel, Ph.D., McGill; J. F. Holly, Ph.D., Clark; H. E. Jones, Ph.D., Texas; F. J. Lee, Ph.D., Michigan State; W. C. Tile, Ph.D., University of Southern California; G. A. Spiva, Ph.D., Texas; R. H. Wolf, Ph.D., Vanderbilt.

International economics

Regional economics
A field, as agreed to by the Department, combining two or three of the above.

Exceptions to the foregoing are discouraged but may be petitioned by writing directly to the Department head who will decide with the advice of an ad hoc committee of three tenured members of the faculty. This petition is to be submitted at least nine months before the student takes the preliminary exam in question.

Course Requirements. Candidates for the Ph.D. degree in Economics will be required to complete a minimum of 72 quarter hours of course work beyond the Bachelor's degree, plus the dissertation which carries 36 quarter hours of credit. At least 54 hours shall be in economics.

4000 Special Topics (3) Student-generated course offered at convenience of department upon student initiative. Subject matter and contents determined by students and instructor with approval of the department.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for students other than those otherwise registered during any quarter when such a student uses university facilities and/or faculty time. This requirement may be repeated. S/NC only.

5011-12 Problems in Lieu of Thesis (3, 3) May be repeated. S/NC only.

6000 Doctoral Research and Dissertation

ECONOMIC THEORY

4110 Managerial Economics (3) Application of economic theory to business decision-making: emphasis on profit objectives, measurement and forecasting demand and costs, and capital budgeting. (Same as Water Resources Development 4110.)

4130 Business Cycles (3) Fluctuations in income, employment, prices, and output in the economy. Business fluctuations are defined as short-term fluctuations in aggregate economic activity, occurring at time intervals ranging from a few days to about a year. (Same as Finance 5810.)

4150 History of Economic Thought (3) A review of the development of economic thought, tools of analysis, and economics as a social science, together with an analysis of the economic conditions which influenced this development. Period covered: 1776 through 1936. Prereq: 1 yr of Principles of Economics and consent of instructor.

4170-40 Introduction to Mathematical Economics (3, 3) Application of mathematical methods in the theoretical study of micro- and macroeconomic phenomena. Designed for beginning graduate students who have limited training in analytic geometry, and calculus, but must be taken in sequence. Prereq: Intermediate Micro Theory and calculus, and analytic geometry or the equivalent.

5000 Introduction to Economic Analysis (3) The nature of economic science as a science; brief survey of the evolution of economics; analytical tools of micro- and macroeconomics. (Available only as stated on page 36.)

5060 Introduction to Economic Problems and Policies (3) Economic theory as a basis for problem solving; tools of public and private policies for economic stability, growth and minimum income, international economic relations, and the problems of applying economic theory.
621 Seminar in Advanced Macroeconomic Theory (3, 3) Prereq: 5121. May be repeated for credit with permission of the department. Prereq: 5121, 5122 and consent of instructor.

612 Seminar in European Economic History (3) Selected topics in European economic history. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

624 Seminar in American Economic History (3) Selected topics in American economic history. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

627 Seminar in the Economic History of the Third World (3) Selected topics in the economic history of societies other than those of Western Europe and English-speaking North America. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

610 Seminar in Regional Analysis (3) Selected topics in regional economic theory and analysis. May be repeated. Maximum 6 hrs.

620 Regional Economics Workshop (3) Selected topics in applied regional research. Emphasis on method and interpretation. May be repeated. Maximum 6 hrs.

650 Seminar in Environmental and Resource Economics (3) Topics in environmental quality, natural resource allocation by private markets, and issues in formulating public policy towards environmental problems. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

650 Economic Analysis of the United States (3) Historical developments in agriculture, industry, communications, transportation, banking, and trade and of changes in government economic policies.

4250 Problems in International Trade and Economic Development (3, 3) Problems or problem areas of current importance in the fields of both international economics and economic development.

4240 Economic Development of the United States (3) Historical developments in agriculture, industry, communications, transportation, banking, and trade of changes in government economic policies.

625 Economic Development of Europe (3) The beginnings of capitalism in medieval Europe, the expansion of Europe and the dominance of mercantilism in early modern times, the mechanization of industry, changes in agricultural organization, and growing importance of commerce in the nineteenth century; two world wars and their economic consequences.

4280 Economics of Resources (3) Description, needs and allocation of resources. Benefits and costs of development and use of resources in industrial society.

521 Seminar in International Trade Theory (3) Studies in pure theory of international trade.

522 Seminar in Economic Development (3) Studies of the economic problems of developing countries.

523 Economic History of Europe (3) Studies of the nature and functioning of economic systems and policies in the history of western civilization: economic development at different major issues of method and interpretation.

526 Economic History of the U.S. (3) Studies of major issues in the interpretation of American economic structure and policies from colonial times.

561 Location and Regional Development Theory (3) Theory of industrial, agricultural, and residential location; the economic basis for land use patterns and central places; examination of regional inequalities and national assistance for regional economic development.

562 Methods of Regional Analysis (3) Theory of regional structure and growth. Examination of regional models for impact analysis and economic forecasting. Methods of analysis include regional descriptive statistics, gravity and potential concepts, regional income and product accounts, shift and share analysis, economic base studies, and regional input-output, linear programming, and econometric models.

621-12, 6221-22 Seminar in International Economics (3, 3, 3, 3) Theory of specialization and trade. The balance of payments, exchange rates, monetary policy problems, capital movements, and foreign trade policies.

6231-32, 6241-42 Seminar in Economic Development (3, 3, 3, 3) Development and application of analytical tools to problems of economic policy faced by developing regions and countries.

6250 Seminar in European Economic History (3) Selected topics in European economic history. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

6260 Seminar in American Economic History (3) Selected topics in American economic history. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

6270 Seminar in the Economic History of the Third World (3) Selected topics in the economic history of societies other than those of Western Europe and English-speaking North America. May be repeated for credit with permission of the department. Prereq: Consent of instructor.

6610 Seminar in Regional Analysis (3) Selected topics in regional economic theory and analysis. May be repeated. Maximum 6 hrs.

6520 Regional Economics Workshop (3) Selected topics in applied regional research. Emphasis on method and interpretation. May be repeated. Maximum 6 hrs.

6650 Seminar in Economic Theory (3) An examination of current and past theories of wage and employment determination. Prereq: 5410, equivalent or consent of instructor.

6411-12, 6421-22 Seminar in Labor Economics (3, 3, 3, 3) Selected labor problems chosen for the current interest of continuity and significance—development and application of problems and techniques.

Finance


Assistant Professors: A. B. Bisce, Jr., Ph.D. Florida; R. A. Bohm, Ph.D. Washington; J. C. Golden, Ph.D. George Washington; W. D. Wiens (Milwaukee); J. H. Lord, MBA, MBA; R. E. Shreve, Ph.D. California (Los Angeles); D. L. Stevens, Ph.D. Michigan State.

Associate Professors: A. L. Auxier, Ph.D. Iowa; H. S. Banton, Ph.D. Georgia State; M. Lindahl, Ph.D. Illinois (Champaign-Urbana); J. M. Wachowicz, Jr., M.Acc.Sci., C.P.A., Illinois (Champaign-Urbana); R. A. Weir, Ph.D. North Carolina.

5000 Thesis

5002 Non-Thesis Graduation Completion (6-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

6000 Doctoral Research and Dissertation

FINANCE AND INVESTMENTS

5050 Survey of Finance Functions in Business (3) The scope and nature of managerial finance; financial planning and control; financial investment decisions; financial structure and the cost of capital; internal and external long-term financing; and working capital management. Prereq: Principles of economics and fundamentals of financial accounting. (Available only as stated on page 56.)

5110 Theory of Financial Management (3) Financial decision making with the objective of maximizing shareholder wealth. Decision areas include the investment decision, capital costs and the financing decision, and the dividend decision of the firm. Prereq: 5050. Coreq: Probability theory.

5120 Quantitative Techniques in Financial Management (3) An introduction to the applications of mathematics, probability, and sta-

5120 Real Estate Analysis (3) Analysis of real property investment, real estate financing, and appraisal theory. Prereq: Finance 5050 or equivalent.

5130 Housing and Urban Land Markets (3) Analysis of housing demand, supply and location. Segregation and housing discrimination. Impact of urban renewal and public policy on housing markets. Prereq: 5110 or consent of instructor.

5140 Real Estate Investment and Taxation Analysis (3) Analysis of economic factors and institutions which underlie real estate investment, development, and appraisal. Prereq: Finance 5050 or equivalent.

5170-80-90 Proseminar in Industrial and Organizational Psychology (3, 3, 3) Introduction to the basic concepts and ideas required for graduate study in industrial and organizational psychology. Must be taken in sequence during the student’s first year. (Same as Psychology 5170-80-90.)

5210 Personnel Management (3) Analysis and appraisal of the personnel function.

5220 Wage and Salary Administration (3) Analysis of problems, programs, and practices.

5230 Human Problems in Administration (3) Review and critique of research in industrial human relations. (Same as Psychology 5450.)

5240 Personnel Research Seminar (3) Review of research in personnel administration; development of experimental design. Prereq: 5210-20-30. (Same as Psychology 5460.)

5250-60-70—Industrial and Organizational Psychology (1-3, 1-3, 1-3) Reading in industrial and organizational psychology. Prereq: Consent of instructor. S/NC or letter grade.

5250 Management Problems in Industrial Research (3) Basic administrative problems encountered in the management of industrial technological research and engineering programs, and comparable programs in which professional personnel predominate.

5410-20-30 Production Management (3, 3, 3) A quantitative approach to the solution of production management problems. Prereq: 36 hrs of computer programming, or equivalent and consent of instructor.

5610-20 Organizational Behavior (3, 3) An examination of behavioral methodologies and perspectives, including a review of empirical behavioral research in organizations. Must be taken in sequence.

Industrial and Personnel Management

Professors:


Associate Professors:

R. D. Arvey, Ph.D. Minnesota; F. A. Chambill, MBA Indiana; R. L. Dippeys, Ph.D. Purdue; O. S. Fowler, Ph.D. Georgia; D. L. Johnson (visiting), Ph.D. Bowling Green; R. C. Maddox, Ph.D. Texas; C. W. Neel, Ph.D. Alabama.

Assistant Professors:

J. W. Bachmann, Ph.D. Virginia Polytechnic Institute; A. M. Francisco (visiting), Ph.D. Ohio State; W. Henderson, Ph.D. Purdue; W. W. Williams, Ph.D. Pennsylvania State.

4801-02-03 Readings in Personnel Management (1, 2, 3) Prereq: Personnel Administration, Statistics 4310, and consent of instructor.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5050 Production Management (3) Analysis of the production function with emphasis upon optimum allocation of man, material, and money. Prereq: Statistics 4310. (Same as MBA students only. Available only as stated on page 36.)

510 Organization Theory I (3) Analysis and design of organization structure.

5120 Organization Theory II (3) Dynamics of organization: leadership, motivation, informal organization. Prereq: 5110.

5130 Managerial Planning and Control (3) Principles of management planning and controlling, with emphasis on long-range corporate planning.

5990 Research in Finance (3) Directed research on a topic of mutual interest to the student and staff member. May be repeated. Maximum 6 hrs. Prereq: 5110.
5710 Management of Foreign Operations (3) Analysis of operational environment of international business firms and impact of internal and external factors on managerial decisions. Readings and cases will be used.

5810 Energy Management: Theory and Practice (3) Management of energy resources in operating systems; decision criteria, trade-offs, system analysis, energy audits, technical parameters, conservation methods, worldwide energy supply and demand, new energy technologies.

6000 Doctoral Research and Dissertation

6110 History of Management Thought (3) Significant historical ideas leading to the present state of the art of management.

6120 Advanced Organizational Theory (3) Analysis of the functioning of complex organizations: structure, culture, and adaptation.

6130 Seminar in Contemporary Management Issues (3) An examination of contemporary management policy issues. May be repeated.

6250-60-70 Seminar in Industrial and Organizational Psychology (3, 3, 3) Advanced problems in organizational psychology. Areas include performance evaluation, executive development, group processes, and morale. (Same as Psychology 6250-60-70.)

6380 Seminar in Industrial and Organizational Psychology (3) (Same as Psychology 6380.)

6900 Field Work in Industrial and Organizational Psychology (1-15) Supervised practice. One credit for each 30 hrs of such practice. Maximum 15 credits. (Same as Psychology 6900.)

Management Science

MAJOR DEGREE

Management Science Ph.D.

Associate Professors: C. E. Bell (Chairman), Ph.D. Yale; R. S. Garfinkel, Ph.D. Johns Hopkins.

Assistant Professor: R. E. Rosenthal, Ph.D. Georgia Institute of Technology.

Management Science Committee: Members of the Management Science faculty and in addition: R. W. Boring, Industrial Management; J. S. Bradley, Mathematics; R. L. Church, Civil Engineering; S. Selkow, Computer Science; C. G. Thigpen, Statistics.

MBA CONCENTRATION

Management Science 5310-30-40 forms the nucleus of a 12 to 18 hour concentration in management science for MBA students. See pages 35-36 for further MBA details.

THE DOCTORAL PROGRAM

The Ph.D. program in Management Science is designed to prepare students for management positions, research, and teaching related to the application of mathematical tools in the administration of complex organizations. Three primary objectives of the program are:

1. to provide, through management science course work, a thorough knowledge of common Management Science/Operations Research mathematical models and their uses;

2. to provide sufficient advanced study in an applied concentration area to qualify the graduate for a joint faculty position in the concentration area as well as in management science. The candidate may choose from the business functional areas (accounting, finance, marketing, production management, and transportation and logistics) or other disciplines, e.g., forestry, ecology, and public administration;

3. to develop in the student, through course work in mathematics, statistics, and computer science, a high degree of mathematical maturity which will serve the graduate well throughout a life-long career, whether in management, research, or teaching.

Degree Requirements. General University regulations in effect for the doctoral degree are stated on page 22.

Course Work. A minimum of 72 quarter hours of course work taken for graduate credit (exclusive of thesis or dissertation) is required. The candidate must complete a minimum of 36 quarter hours at The University of Tennessee, Knoxville, at least 9 of which must be at the 6000 level. Entering students who have completed graduate studies in applicable fields will be granted course credits for work which is equivalent to required courses in the program.

The program includes approximately 24 to 30 quarter hours of course work in the applied concentration area.

Qualifying Examinations. The student must demonstrate mastery of probability theory and statistical inference (Statistics 5110-20-30) by passing a written qualifying examination or by presenting other evidence of mastery of the material satisfactory to the faculty. Topics normally include matrix methods (Mathematics/Computer Science 5655-65-75) and real analysis (Mathematics 4510-20-30). Other options may be approved.

There is no foreign language requirement.

These requirements generally are completed by the end of the first year of the program.

Preliminary Examination. Prior to admission to candidacy for the degree, and normally after completion of the second year of the program, the student must pass a written preliminary examination covering the theory of deterministic and stochastic management science models. Topics included in this examination are determined on an individual basis. Students will be expected to demonstrate an integrative ability that goes beyond simple mastery of course content.

Research and Dissertation. The student must complete 36 quarter hours of Management Science 6000, Doctoral Research and Dissertation, through which he/she is expected to make a significant contribution to the science. A final oral examination is conducted over the dissertation and such other segments of the program that the faculty committee deems appropriate.
Marketing and Transportation

G. N. Dicer (Head), DBA Indiana.

Marketing

Professors:

D. W. Good, DBA Indiana; E. G. Hills, DBA Indiana; R. B. Woodruff, DBA Indiana.

Associate Professors:

D. J. Barnaby, Ph.D. Purdue; J. R. McMillan, Ph.D. Ohio State; R. C. Reizenstein, Ph.D. Cornell; G. D. Senti, DBA Indiana.

Assistant Professors:


5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5050 Survey of Marketing (3) Analysis of the marketing structure, institutions, functions, and marketing problems. Current trends and developments. (Available only as stated on page 36.)

5200 Marketing Management (3) Management of the basic marketing functions. Case problems and marketing decision simulation. Prereq: 5200 or equivalent.

5220 Promotion Management and Strategy (3) Assessment of communications theories and concepts useful to firms in achieving promotional goals. Planning, implementing, and evaluating the firm's promotional program. Social and economic role of persuasive communications. Prereq: 5200 or equivalent.

5230 Analysis and Design of Marketing Systems (3) A macroinstitutional approach to the marketing system. Conceptual framework for examining marketing agency and channel interrelationships, public policy, cost and efficiency, and innovation in marketing from the viewpoint of the decision maker. Prereq: 5200 or equivalent.

5300 Marketing Research (2) Investigation and solution of problems; application of research methods to functional areas of marketing. Research concepts, methods, and techniques. Prereq: Statistics 5311 or equivalent.:

5310 Quantitative Techniques in Marketing Analysis (3) Application of quantitative techniques to marketing problems. Models for decision making and strategy formulation. Prereq: 5300.

5350 Buyer Behavior Analysis for Marketing (3) Buyer behavior patterns with emphasis on the implications for marketing analysis and executive action. Marketing and the behavioral sciences. Prereq: 5300 or equivalent.

5410 Marketing Strategy (3) Components of marketing strategy including the development of the marketing mix. Consideration of alternative strategies. Coordination and control of marketing activities. Prereq: 5300 and 5350.

5450 International Marketing Management (3) Development and management of international marketing programs. Programs involved in marketing goods and services in foreign markets. Political, cultural, and economic conditions in different countries. Prereq: 5200 or equivalent.

5990 Research in Marketing (3) Directed research on a subject of mutual interest to student and staff member. Prereq: 5200 and 5300.

6000 Doctoral Research and Dissertation

6110 Seminar in Buyer Behavior Research (3) Examination of the behavior of individuals and groups in their roles as buyers of economic goods and services. Prereq: 5200 or Statistics 5311 or the equivalent, and Industrial Management 5610-20.

6210 Seminar in Marketing Models and Model Building (3) Examination of the nature, composition, and use of models for the analysis of marketing decisions and processes. Prereq: 9 hrs of graduate marketing.

6310 Seminar in Contemporary Marketing Issues (3) An examination of the fundamental nature of the marketing process, and analysis of several topics of current interest in marketing. Specific topic areas will vary with each course offering. Prereq: 9 hrs of graduate marketing, incl. 5200 and 6110.

Transportation and Logistics

Professors:


Associate Professors:

J. H. Foggin, DBA Indiana.

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5250 Survey of Transportation and Logistics (3) Intensive survey of the logistical demands made by society and specific users upon the nation's transportation system and the problems facing carriers and government in meeting these demands. (May not be included in a concentration or minor in transportation.)

5110 Theory and Functions of Economic Regulation (3) Development of the economic and philosophic basis of regulation. A critical analysis of the impact of regulatory decisions on management objectives.

5210 Business Logistics (3) Development of logistics concept to guide the design and analysis of logistics systems. Setting and importance of objectives, and importance of the formulation of objectives. Prereq: 5210.

5220 Physical Distribution Strategy (3) Development and administration of basic logistical policies. Analysis of physical distribution and supply problems with emphasis on executive action. Practical applications through a case approach and simulation game. Prereq: 5210, Statistics 5311.

5510 Urban Transportation Policy (3) A study of the movement of people, goods and information in urbanized areas with special emphasis on the formulation of national, state, and local policy toward the firms providing these services.

5810 International Transportation Policy (3) Comparative analysis of transport systems in other countries. Analysis of U.S. policy relative to international transportation.

5910 Transportation Law and Carrier Liability (3) Legal rights and responsibilities of carriers and users. Processes before regulatory agencies and analysis of the regulatory statutes with appropriate agency and court decisions.

5920 Current Topics in Transportation and Logistics (3) A seminar designed to study, in depth, a current policy or problem area in transportation or logistics. The topic selected will be announced prior to each offering.

5990 Research in Transportation and Business Logistics (3) Directed independent research on a subject of mutual interest to student and faculty member. Prereq: 12 hrs in transportation.

6000 Doctoral Research and Dissertation

6110 Seminar in National Transportation Policy (3) A critical analysis of contemporary national transportation policy issues. Prereq: 5110.

6210 Seminar in Transportation and Logistics Models (3) Analysis of the current quantitative methodologies used in transportation and logistics research. Prereq: Statistics 5311-12, Management Science 5100.

6220 Transportation and Logistical Systems—Analysis and Simulation (3) Directed independent research, analysis, and simulation of a transportation or logistics system. Prereq: 6210.

Office Administration

Professors:

G. A. Wagoner (Head), M.S. Indiana; D. Reese, Ph.D. Iowa.

Associate Professors:


Assistant Professors:

B. J. Brown, Ed.D. Tennessee; P. G. Campbell, M.S. Austin Peay; H. Petree, M.S. Tennessee; C. S. Robertson, M.S. Tennessee.

4310 Business Letter Writing (3) Modern business letters; types of letters studied; principles applied by solving letterwriting problems.

4320 Business Report Writing (3) Report writing, tabular and graphic presentation, basic instruction in formal research reports and thesis writing, sources of business information.

4410-20 Advanced Shorthand and Transcription (3, 3) Improvement of ability to take dictation and transcribe mailable copy; emphasis on skill necessary to meet occupational standards. 3-2 hour periods.

4430 Supervised Office Experience (3) Orientation to office position through actual office work; typewriting techniques, shorthand, vocabulary, and information required by secretary, record keeping, office etiquette, interviews, and appropriate dress for office. 2-3 hour periods.

4520 Office Systems (3) Routines and procedures for handling correspondence and mailing; filing systems; oral communications; office planning and layout; systems of control.

4540 Problems in Office Management (3) Work simplification; cost control and budgeting; development of standards; use and preparation of office manuals. Prereq: Office equipment problems, 4520 or consent of instructor.
THE MASTER'S PROGRAM

Statistics

DEGREES

MAJOR

Statistics

Professors:

C. C. Thigpen (Head), Ph.D. Virginia Polytechnic Institute; D. S. Chambers, MBA

Texas; R. A. McLean, Ph.D. Purdue.

Associate Professors:

H. A. Laaster, Ph.D. Rutgers; J. W. Philpot, Ph.D. Virginia Polytechnic Institute; R. D. Sanders, Ph.D. Texas; D. J. Wheeler, Ph.D. Southern Methodist; M. S. Younger, Ph.D. Virginia Polytechnic Institute.

Assistant Professors:


THE MASTER'S PROGRAM

The M.S. program in Statistics is designed to provide students a basic foundation in theoretical and applied statistics for meaningful careers as consulting and practicing statisticians. A candidate should possess an undergraduate degree with a strong background in calculus, but no restrictions are imposed regarding the undergraduate major. The typical Master of Science degree program in Statistics is as follows:

Statistics Major Area

Quarter Hours

Probability theory 3
Theory of statistical inference 6
Additional coursework in statistics as approved by the student's committee 9
Additinal coursework as approved by the student's committee 9

Minor Area

Selected with the approval of both the Department of Statistics and the department in which the student is to be taken 9
Thesis 8
Total minimum hours 45

*Twelve hours of approved course work, to include Statistics 5610, may be substituted for the thesis requirement.


4510 - 50 Analysis of Variance (3) Linear and multiple regression, weighted least squares, polynomial models, use of dummy variables, selection techniques in multiple regression, non-linear least squares estimation. Prereq: Second year of calculus and introduction to linear regression.

5100 Special Topics in Statistics (3) Prereq: Consent of Instructor. May be repeated. Maximum 9 hrs.

5060 Applied Multivariate Analysis (3) Canonical correlation; discriminant analysis for several groups; and for equal and unequal covariance matrices; principal component analysis; Hotelling's T², multivariate analysis of variance and covariance. Prereq: One year's course work in applied statistics, including analysis of variance and multiple regression analysis.

5070 Factor Analysis (3) Principal component analysis and principal factor analysis; estimates of communalities; methods of rotation; interpretation of factors; cluster analysis. Prereq: 5060.

6210 Stochastic Processes II (3) Special analysis, time series, linear and nonlinear systems. Prereq: 5210.

College of Business Administration 45

4551-69 Problems in Office Management (3, 3)

4552-62 Form Design

4553-63 Records

4554-64 Mechanization

4555-65 Correspondence

4556-66 Supervision

4557-67 Work Simplification

4558-68 Training

4559-69 Work Measurement

Prereq: 4320, 4520, or equivalent.

4710 Punched Card Methods (3) Card design, key punching, sorting, tabulating, and preparation of reports; application to problems in fields of accounting, statistics, personnel, economics, and other areas of research. 3 hrs and 2-2 hr. labs.

4720 Punched Card Applications (3) Advanced problems on tabulator andcollator, introduction to programming, system design, and preparation of procedure manuals and flow charts. Prereq: 4710 or equivalent.

5011 Problems in Lieu of Thesis (3)

5050 Data Processing in Business (3) Fundamentals of data processing, computer programming and applications, systems design. (Available only as stated on page 36.)

5055-59 Work Measurement (3, 3)

5061-65 Work Simplification (3, 3)

5066-70 Supervision (3, 3)

5072-76 Planning and Organization of Departmental Procedures (3, 3)

5077-81 Management of Office Operations (3, 3)

5082-86 Management of Office Information (3, 3)

5092-96 Management of Office Documents (3, 3)

5100-04 Management of Office Images (3, 3)

5110-14 Management of Office Communications (3, 3)

5120-24 Management of Office Services (3, 3)

5130-34 Management of Office Facilities (3, 3)

5140-44 Management of Office Resources (3, 3)

5150-54 Management of Office Technology (3, 3)

5160-64 Management of Office Environment (3, 3)

5170-74 Management of Office Environment (3, 3)

5180-84 Management of Office Environment (3, 3)

5190-94 Management of Office Environment (3, 3)

5200-04 Management of Office Environment (3, 3)

5210-14 Management of Office Environment (3, 3)

5220-24 Management of Office Environment (3, 3)

5230-34 Management of Office Environment (3, 3)

5240-44 Management of Office Environment (3, 3)

5250-54 Management of Office Environment (3, 3)

5260-64 Management of Office Environment (3, 3)

5270-74 Management of Office Environment (3, 3)

5280-84 Management of Office Environment (3, 3)

5290-94 Management of Office Environment (3, 3)

5300-04 Management of Office Environment (3, 3)

5310-14 Management of Office Environment (3, 3)

5320-24 Management of Office Environment (3, 3)

5330-34 Management of Office Environment (3, 3)

5340-44 Management of Office Environment (3, 3)

5350-54 Management of Office Environment (3, 3)

5360-64 Management of Office Environment (3, 3)

5370-74 Management of Office Environment (3, 3)

5380-84 Management of Office Environment (3, 3)

5390-94 Management of Office Environment (3, 3)

5400-04 Management of Office Environment (3, 3)

5410-14 Management of Office Environment (3, 3)

5420-24 Management of Office Environment (3, 3)

5430-34 Management of Office Environment (3, 3)

5440-44 Management of Office Environment (3, 3)

5450-54 Management of Office Environment (3, 3)

5460-64 Management of Office Environment (3, 3)

5470-74 Management of Office Environment (3, 3)

5480-84 Management of Office Environment (3, 3)

5490-94 Management of Office Environment (3, 3)

5500-04 Management of Office Environment (3, 3)

5510-14 Management of Office Environment (3, 3)

5520-24 Management of Office Environment (3, 3)

5530-34 Management of Office Environment (3, 3)

5540-44 Management of Office Environment (3, 3)

5550-54 Management of Office Environment (3, 3)

5560-64 Management of Office Environment (3, 3)

5570-74 Management of Office Environment (3, 3)

5580-84 Management of Office Environment (3, 3)

5590-94 Management of Office Environment (3, 3)
College of Communications

Donald G. Hileman, Dean
James A. Crook, Assistant Dean for Undergraduate Studies
George A. Everett, Assistant Dean for Graduate Studies
Jack B. Haskins, Director, Communications Research Center

The College of Communications offers two graduate degrees with a major in Communications, the Master of Science (M.S.) degree and the Doctor of Philosophy (Ph.D.) degree. In addition, communications is available as a minor for students majoring in other departments. Required course work will be selected after discussion with the major advisor and an advisor from the College of Communications.

The College is accredited by the American Council on Education for Accredited Institutions, by the American Association of Schools and Departments of Journalism and Broadcast Education, and by the Broadcast Education Association.

A graduate student in the College of Communications whose grade point average, not including incomplete grades, is below 3.0 at any time after the end of 12 hours of graduate credit shall be placed on probation. A student on probation shall be dropped from the program unless his or 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 12 quarter hours of graduate course work attempted which is specified in the student's degree program.

Exceptions to this policy may be made only with the approval of the Assistant Dean for Graduate Studies of the College of Communications upon recommendation of the student's faculty committee.

MASTER OF SCIENCE

The Master of Science degree with a major in Communications is offered for students who primarily desire (1) advanced preparation in effective communication for print or broadcast media, (2) knowledge of mass media advertising and management, (3) an understanding of the social role of the press, or (4) preparation for teaching communications.

The prospective student who is interested only in acquiring basic skills in journalism, advertising, or broadcasting is advised to consider a second baccalaureate rather than an advanced degree.

Applicants must meet admission requirements normally specified for admission to potential candidate status in the Master of Science program in the College of Communications: a) an undergraduate B average, b) an above average verbal aptitude score on the Graduate Record Examination, and c) such other evidence of qualifications as may be required by the Graduate Studies Committee. Applicants must also complete the California Psychological Inventory.

Students are admitted to the program only for summer and fall quarters each year. Applications for the graduate program, including all necessary materials, that are not received at least six weeks before registration may not be processed in time for admission to full potential candidate status in the first quarter. In these cases, the student may still qualify for non-degree or postbaccalaureate status. The degree program has two options: the thesis option requires 45 hours of approved graduate work:

- 24 hours of approved courses in the major, including Communications 5100, 5120, 5140, and 6100, at least 9 hours in one concentration area (advertising, broadcasting, journalism), and at least 15 hours at the 5000 level;
- 9 hours of thesis work;
- at least 12 hours in a minor area approved by the major advisor, at least 6 of which must be at the 5000 level.

If a candidate submits evidence of record that he/she has satisfied the objectives of thesis research, the student may then petition to be exempt from the thesis and to substitute 9 hours of 5000-level communications courses approved by the committee.

After the student completes the formal program of courses and research, the student must pass an oral examination conducted by his/her graduate committee.

The non-thesis option requires completion of 45 hours of approved graduate work:

- 33 hours of approved courses in communications, including Communications 5100, 5120, and 5140, at least 12 hours in one concentration area (advertising, broadcasting, journalism), and at least 15 hours at the 5000 level;
- at least 12 hours in a minor area approved by the major advisor, at least 6 of which must be at the 5000 level;

* The student must declare which option he/she will pursue upon completion of the core curriculum (5100, 5140, 5120).

** Minor: Students who hold a bachelor's degree in advertising, broadcasting, or journalism must minor outside the College of Communications.
—completion of an approved communications project (no more than one independent study-type course directly related to the project may be taken as part of the 45-hour program);  
—after completion of formal course program and project, the student must pass a 3-4 hour comprehensive written examination conducted by his/her graduate major.

Communications majors in the M.S. program must demonstrate ability to use a typewriter proficiently within their first quarter in residence.

DOCTOR OF PHILOSOPHY

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

The program is interdisciplinary, consisting of a required core curriculum and recommended emphasis outside the College in the related social and behavioral sciences. The program is flexible and will accommodate a variety of career goals in communications.

The Master's degree is not required for entry into or completion of the doctoral program. Program planning, however, will permit the Master's degree to be earned if desired. 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 Bachelor's degree.

The following are normally minimal requirements for admission to full potential candidate status: (a) a 3.0 (4.0 system) grade point average in undergraduate studies, or 3.5 for graduate work if applicant holds a Master's degree; (b) above the fiftieth percentile in verbal and quantitative aptitude on the Graduate Record Examination; (c) completion of the California Psychological Inventory; (d) endorsement by at least three faculty members of career or professional colleagues chosen by the Graduate Studies Committee; (e) a statement of the applicant's goals and reasons for pursuing the doctoral. Personal interviews with members of the Graduate Studies Committee may be required. Professional experience in some field of communications is a highly desirable criterion for admission.

The following program represents work normally required for an individual with only the Bachelor's degree and no technical competence: (a) prerequisite courses offered by the College of Communications and approved by the major advisor for applicants lacking the necessary academic and/or professional background; (b) core curriculum: 33 hours of course work; (c) primary concentration in communications: 15-18 hours of course work; (d) secondary concentration in a cognate minor subject normally outside communications: 12 hours of course work; (e) technical competence area in either teaching, research, or administration: 15-18 hours of course work and, for those who lack appropriate professional experience, an internship the equivalent of 9 credit hours; (f) research tool: 12 hours of course work, e.g., statistics, foreign language, or computer science; (g) dissertation: 36 hours of Communications 6000.

The following courses represent the required core curriculum (beyond the Bachelor's degree):  
Communications 5100, Introduction to Graduate Studies  
Communications 5140, Communications Theory  
Communications 5120, Research Methods  
Communications 6100, Seminar in Communications Theory  
Communications 6200, Seminar in Communications Topics

One of the following: Communications 6300, Survey Research Methods in Communications; 6310, Experimental Research Methods in Communications; 6320, Seminar in Historical Research Methods in Communications. For the teaching or administrative technical competence area: a one-week, non-credit computer program course and Statistics 5211, or Sociology 5320 and Statistics 4250; for the research technical competence area: Statistics 5050 and 5090.  
Continuing and Higher Education 5450, Instruction in Higher Education.  
Industrial and Personnel Management 5110-20, Organization Theory I and II (or equivalent courses approved by committee).

Admission to candidacy must be attained at least three quarters prior to graduation and requires successful completion of a preliminary examination.

Communications Research Center

The Communications Research Center is a vital adjunct to the communications graduate program. Objectives of the Center are: (a) to conduct original research in mass and public communication; (b) to disseminate research-generated information; and (c) to provide research services to faculty and students, professional communicators, and others interested in improving the quality of human communications.

Departments of Instruction

Numbers in parentheses indicate quarter hours credit offered.

Communications

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

Professors:  
B. H. Haskins, Ph.D. Minnesota; D. G. Hileman, Ph.D. Illinois; D. W. Holt, Ph.D. Northwestern; J. R. Lynn, Ph.D. Southern Illinois.

Associate Professors:  

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) 
Required for the non-thesis student not otherwise registered during any quarter when such a student uses facilities and/or for faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5100 Introduction to Graduate Studies (3) 
Scope and methods of advanced study in communications. Information sources, literature review methods, scholarly style, thesis and degree requirements and procedures, overview of traditional and behavioral research methods.

5120 Research Methods (3) 
Communications research strategy and methodology. Scientific process, bases for derivation and verification of hypotheses, and basic methods of designing research in communications.

5130 Advanced Principles of Mass Communications (3) 
A proseminar covering all phases of mass communications including the history, development and current status of the communications industry, the principles of broadcasting, and the principles of advertising.

5140 Communications Theory (3) 
Analysis of contemporary theories of human communication emphasizing similarities and differences or communications processes in interpersonal, intrapersonal, and mass communications systems. (Same as Speech 5140.)

5150 Seminar in Communications Issues (3) 
Examination of contemporary topics in communications. Maximum 6 hrs. Prereq: 5100 and 5140, or consent of instructor.

5970 Independent Study (3) 
Reading, research, or projects on special topics in communication. On an individual basis, under faculty direction, with consent. May be repeated.

6000 Doctoral Research and Dissertation

6100 Seminar in Communications Theory (3) 
An intensive analysis of selected theories and supporting research data dealing with source, message, media, receiver, or situational variables in the process of communication. Prereq: 5100. Recommended: 5140.

6200 Seminar in Communication Topics (3) 
Intensive analysis of special issues and problems in human communication. Repeatable; each section will cover one specific professional area, e.g., international communication, public service communication, political communication. Prereq: 5100. Recommended: 5140.

6300 Survey Research Methods in Communications (3) 
Survey methods applied to opinion and communications media research problems. Planning, sampling, questionnaire construction, data gathering (mail, mail, telephone), data processing and interpretation, attitude measurement and message prototyping applications. Prereq: 5120 or consent of instructor.

6310 Experimental Research Methods in Communications (3) 
Experimental methods applied to communications research problems. Causal inferences from various research designs. Control, single-factor and multifactor experimental designs. Laboratory and field experiment situations. Prereq: 5120 or consent of instructor. Basic statistics course prereq or coreq.

6320 Seminar in Historical Research Methods in Communications (3) 
Materials and methods in historical, descriptive, and legal research in communications theories and behavior. Prereq: 5100, 5120, Speech 5450. Recommended: 5140, 6100.
Advertising

Professors: R. Joel (Head), Ph.D. Wisconsin; D. G. Hileman, Ph.D. Illinois; J. R. Lynn, Ph.D. Southern Illinois.


3830 Advertising Copy and Layout (4) Importance of layout in advertising; impact of various factors; translation into persuasive words and pictures. Principles and techniques of writing copy and preparing layouts. Lecture and labs. Prereq: Advertising Principles, Marketing Communications II, or consent of instructor.

4000 Advanced Advertising Copy and Layout (4) Creative strategy and execution of advertisements for mass media. Problems in idea creation for advertisers. Lectures and labs. Prereq: 3830 or consent of instructor.

4360 Advertising Media (3) Study of media, markets, and audiences. Evaluation of media in relationship to communication needs of advertisers. Prereq: 3830 or consent of instructor.

4460 Advertising Cases and Problems (3) Case approach to study of advertising problems. Analysis of campaigns and trends. Prereq: 4000 and 4360 or consent of instructor.

4470 Advertising Campaigns (4) Practical application of principles and techniques of advertising in planning and execution of advertising campaigns. Market and consumer research; development and allocation of budgets. Choice of appeals and approaches; media selection; preparation of advertisements. Prereq: 4000 and 4360 or consent of instructor.


5530 Advanced Advertising Research (3) Nature, scope, and application of research in advertising, including measurement of advertising, media audiences, and evaluation of advertising messages. Prereq: 4460 or consent of instructor.

5510-20-30 Creative Projects (3, 3, 3) Creative or problem-solving interests related to advertising. Designed for the advanced student who wishes to explore the theory and skills to specific problems in advertising. Prereq: 4000 and 4460 or consent of instructor.

5790 Independent Study (3) Broadcasting

Professor: D. W. Holt (Head), Ph.D. Northwestern.

Associate Professors: H. H. Howard, Ph.D. Ohio; G. J. Simpson, M.S. Syracuse.

Assistant Professors: F. A. Lester, M.A. Tennessee; M. K. Sidell, Ph.D. Northwestern; R. A. Shirley, M.A. Tennessee.

3350 Television and Radio Advertising (3) Principles and practices underlying successful radio-television advertising; emphasis on media research, rate structure, programming, creativity; instruction in television commercials.

3350 Radio-Television Writing (3) Theory and technique of writing all types of broadcasting scripts except news and dramas. Special events, interviews, musical scripts, radio talks, and promotion material. Emphasis on commercials.

4100 Speech for Broadcasting (3) Fundamentals of today's broadcast conditions as they affect the announcer; communication and oral interpretation of general American speech; Spanish, Italian, German, and French pronunciation highly recommended but not mandatory. Public Speaking.

4040 Advanced Television Production (3) A semi-independent course of study in program origination, producing, directing, and performing with free or restricted orientation toward the professional broadcast student. Prereq: Television Production or consent of instructor.

4610 Broadcast News Operation (3) Theory and practice of broadcast news and public affairs events for radio and television. Gathering and production of news broadcasts, using tools of broadcast newsroom. 2 hrs and 1 lab. Prereq: Radio-Television News and Television Film News or consent of instructor.

4670 Radio-Television Management (3) Business policies and practices of networks and local stations. Departmental functions, cost and income figures, sales techniques, promotion, advertising agencies, and governmental regulations. Specialized lectures by commercial broadcasters. Prereq: Introduction to Broadcasting or consent of instructor.

4680 Broadcast Sales Management (3) Problems and principles of television and radio sales, including case studies in sales development, pricing, promotion, and other problem areas of sales management. Prereq: Introduction to Broadcasting or consent of instructor.

5410 Educational Broadcasting (3) Summary, analysis, application, and evaluation of television and radio broadcasting for educational purposes.

5510-20-30 Creative Projects (3, 3, 3) For students having specialized broadcasting interests or those who wish extensive directed study in creative writing or production projects.

5610 Public Affairs Broadcasting (3) Study of the news and public affairs function in broadcasting stations and networks, including management, economics, personnel utilization, sources of program materials, ethical and legal aspects. Public affairs program development, particularly the press conference, interviews, and news specials. Prereq: Radio-Television News or consent of instructor.

5620 Broadcast Law and Regulations (3) Sociopolitical control of broadcasting; effect of law, regulations, and public pressures upon station policies. Particular emphasis upon the unique situation of broadcasting among the media in terms of First Amendment. Prereq: Journal- ism 4410 or 5210 or consent of instructor.

5630 Broadcast Documentary Writing (3) Study of the role of the documentary in radio and television. Research, writing, and critique of documentary programs.

5650 Radio-Television Program Development (3) Planning basic program structures for broadcasting stations. Historical trends in programming and current programming practices as related to audience requirements, governmental policy, and competitive conditions. Individual station program development on both the local station and network levels. Prereq: Introduction to Broadcasting or consent of instructor.

5790 Independent Study (3) School of Journalism


Associate Professors: J. N. Adamson, M.S. Tennessee; J. C. Crook, Ph.D. Iowa State; G. A. Everett, Ph.D. Iowa; S. S. Puetz, M.S. Tennessee; F. E. Shaw, Ph.D. Stanfard; F. B. Thomburg, M.A. Florida.


3120 Writing Feature Articles (3) Writing feature articles for newspapers, trade journals, and magazines. Major emphasis on the craft of feature writing and sales technique. Prereq: Writing for Mass Media or consent of instructor.

3410 Communications Law (3) Statutory law and judicial precedents affecting mass communication media. Concepts of the press, invasion of privacy, copyright, broadcasting, advertising, and postal regulations.

3560 Investigative and Specialized Reporting (3) Investigative and interpretative reporting of complex or specialized subjects to place news in perspective or to clarify situations. Emphasis on writing for publication. Prereq: Reporting.

3710 Public Relations (3) Theories and principles of public relations. Overview of PR as a management tool of business, government, institutions and organizations. Cannot be taken for credit by communications majors.

3720 Public Relations: Advanced (3) Publicity organization, techniques and tools. Preparation of communications materials to gain support from target publics. Prereq: 3710.

3730 Public Relations Cases (3) Case studies and application of public relations principles to problems in business and industry, government, institutions, organizations, trades and professions. Prereq: 3720.

3810 Specialized Publications (3) Business and industrial publications. Individual projects on newspapers and magazines for such fields as agriculture, business and industry, engineering, home economics. Prereq: Editing for Mass Media or consent of instructor.

4130 Editorial Writing (3) Analysis of editorial policies, practices, pages, instruction and practice in writing editorials, columns, paragraphs, and interpretative articles.

4310 Reporting Public Affairs (3) Instruction and practice in reporting news of courts, politics, government, finance, labor, and social affairs. Prereq: Journalism.

4410 Mass Media and Society (3) Role of communications media in society. Codes and ethical restraints on publications and broadcast media. Effects of the press, censorship, and propaganda. Social responsibilities of the practice of journalism.


4570 Journalism in the High School (3) Functions and methods of high school publications. Staff organization, writing and editing techniques, editorial problems, and business management.

4910 News and Feature Photography (3) Advanced principles and methods in black-and-white photography. Emphasis on news and feature photography. Prereq: Basic photography or consent of instructor.

4950 International Communications (3) Communication of news and opinion among nations and under varying types of political and economic systems; world news organizations; the role of the press in international affairs; internal and external barriers to the flow of information; comparison of world press systems.

4990 Problems in Research (3) An independent work course. Intensive study of some phase
of the major field, investigative procedures, and report writing.

5210 Government and the Press (3) Historic and current problems in the relations of executive, judicial, legislative, and regulatory segments of the government and the press. Prereq: Communications History or consent of instructor.

5250 Public Opinion and Mass Media (3) Students will consider the nature of public opinion with emphasis on the role of the press in its formation and how the press in turn is influenced by public opinion. Prereq: 4410 or consent of instructor.

5510-20-30 Writing and Editing Projects (3, 3, 3) A course serving students with specialized writing or editing interests, such as agriculture, politics, labor, finance, science, for technical as well as general publications. Prereq: Reporting or Editing for Mass Media.

5560 Magazine Article Writing (3) Techniques of writing the in-depth article for mass circulation magazines. Methods of organizing and presenting material. Problems in specialized areas, such as business, science, agriculture, the humanities. Prereq: 3120 or consent of instructor.

5710 Studies in Public Relations Communications (3) Detailed examination of the problems of communication between institutions and organizations and their publics. Case histories and evaluations of programs. Prereq: 3710 or consent of instructor.

5810 Magazine Editing and Production (3) Analysis of editorial and production problems of general, regional, and specialized publications. Reader interest evaluation. Individual editorial projects. Prereq: Consent of instructor.

5950 Communications and International Development (3) A seminar examining the role of mass media in national and international development. Communications and change in the developing countries. Problems in international and cross-cultural communications. Prereq: 4950 or consent of instructor.

5970 Independent Study (3)
The faculty of the College of Education is committed to performing three major functions: (1) to provide professional preparation for teachers, administrators, and school service personnel at undergraduate and graduate levels; (2) to collaborate with school personnel, educational agencies, professional groups, and others interested in the evaluation and improvement of educational opportunities, programs, and services; and (3) to promote and conduct experimental and research studies in education.

The College of Education holds membership in the American Association of Colleges for Teacher Education. All certification and degree programs through the doctoral level are fully accredited by the National Council for Accreditation of Teacher Education, the Southern Association of Colleges and Schools, and the Tennessee State Department of Education.

The College of Education, through the Graduate School, offers programs leading to the Master of Arts in College Teaching, the Master of Science degree, the Specialist in Education degree, and the Doctor of Education and Doctor of Philosophy degrees.

MASTERS OF SCIENCE

On the Master's level professional study may be planned (1) in one of the areas listed on page 8, (2) in appropriate combinations of these areas, or (3) in combinations of one or more of these areas with appropriate subjects or areas in other colleges.

SPECIALIST IN EDUCATION DEGREE

This degree may be earned in Educational Administration and Supervision, in Educational Psychology and Guidance, in Curriculum and Instruction, in Safety Education and Service, or in Vocational-Technical Education.

DOCTORAL DEGREES

The College of Education offers programs of advanced study leading to the Doctor of Education degree in the major areas listed on page 8, and to the Doctor of Philosophy degree in Health Education.

Bureau of Educational Research and Service

Four major types of activities—research, development, educational services, and publications—are channeled through the Bureau of Educational Research and Service (BERS), located in Claxton Education Building. The research activities relate to the development of research proposals, conducting research, and assisting others in development of research proposals in the College of Education.

Developmental activities relate to change efforts in curricular content and instrumental methodology. Educational services include a wide list of activities such as in-service educational programs, consultant services, educational services, and administrative training programs. Official publications of the College of Education are developed through the Bureau. A limited number of graduate student assistantships are available.

The Educational Opportunities Planning Center and the School Planning Laboratory are integral parts of the Bureau of Educational Research and Service.

EDUCATIONAL OPPORTUNITIES PLANNING CENTER

The Educational Opportunities Planning Center (EOPC) works with school districts in the Tennessee-Kentucky area to help meet their desegregation and sex discrimination needs by assisting with needs assessment and by helping develop plans to meet the needs. Staff members provide in-service training for local school personnel. Such training is directed toward solutions of curricular, human relations, and other types of problems created or compounded by school desegregation and sex discrimination. On-site evaluation of locally installed practices and continuing cooperative evaluation of the progress of local programs is an additional major effort. This program is funded by the U.S. Office of Education.

SCHOOL PLANNING LABORATORY

The School Planning Laboratory (SPL), located in Claxton Education Building, assists schools and colleges in integrating curriculum offerings with architectural designs, organizing regional institutes to promote innovative construction concepts, encouraging full staff utilization to secure an optimal learning environment, facilitating renovative projects within existing buildings, and conducting custodial clinics on proper maintenance techniques. Course work relating specifically to school planning is offered through the Department of Educational Administration and Supervision, while two-year graduate assistantships are under the administrative auspices of the Laboratory.
Departments of Instruction

Numbers in parentheses following the course titles indicate quarter hours credit offered.

Art and Music Education
Charles H. Ball, Head

Art Education
MAJOR
DEGREE
Art Education
M.S.
Professor:
J. W. Robertson, Ed.D. Columbia.
Associate Professor:
Assistant Professor:
J. P. Watkins, M.S. Tennessee.

The Master of Science Degree in Art Education is offered for art teachers, supervisors, and art-trained persons holding the baccalaureate degree. The program provides both thesis and non-thesis options. Moreover it is possible to achieve Tennessee Certification in art while pursuing the Master’s degree program.

The thesis option requires 45 quarter hours as follows:
1. Art Education 5310, 5320, and electives ......... 18 hrs
2. Education Curriculum & Instruction 5710, and electives .......... 9 hrs
3. Minor (selected with committee) ........... 9 hrs
4. Thesis (Art Education 5000) ............ 9 hrs

The non-thesis option requires 45 quarter hours as follows:
1. Art Education 5210, 5310, 5320, and electives ...... 21 hrs
2. Education Curriculum & Instruction 5000, and electives .......... 9 hrs
3. Minor (selected with committee) ........... 9 hrs
4. Electives ...................................... 6 hrs

The thesis option requires satisfactory completion of an oral examination prior to awarding the degree, while the non-thesis option requires satisfactory completion of a final written examination. Both the oral and written exams are conducted by the student’s Master’s degree committee.

Not all courses in art education are offered regularly each quarter, so the student should plan his or her program carefully with a faculty advisor.

3210 Art in the Secondary School Program (3) Program planning; materials and equipment; relation to other school experiences. Classroom observation. Prereq.: 9 hrs art education 1 hr and 2 labs.
3920 Clay in School Program (3) Exploring methods of hand-built forms, glazing and firing procedures. Prereq.: Introduction to Art Education in the Schools. 1 hr and 2 labs.
3930 Textiles in School Program (3) Exploration of processes of weaving, stitchery, batik, and silk screen. Prereq.: Introduction to Art Education in the Schools. 1 hr and 2 labs.
4120 Designing of Teaching Aids for Art in School Program (3) Design and preparation of charts, exhibitions, slides, films, and other teaching aids for art grades one through twelve. Prereq.: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.
4130 Three-Dimensional Design in School Program (3) Exploration of wood, wire, metal, plastics, and other sculptural materials. Prereq.: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.
4150 Lettering, Posters, and Displays in the School Program (3) Design and layout; techniques and procedures. Prereq.: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.
4160 Appreciation of the Arts in the School Program (3) Prereq.: Introduction to Art Education in the Schools or consent of instructor. 1 hr and 2 labs.
4350-50-70 Problems in Art Teaching (3, 3, 3) Prereq.: Consent of instructor.
5000 Thesis
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.
5210 Organization, Administration, and Supervision of Art in the School Program (3)
5310 Art in Education (3) Historical background, current philosophy, theory, and trends; nature and function of aesthetic behavior in the visual arts; relationships to psychology, sociology, and anthropology.
5320 Program Development in Art Education (3) Objectives, organization, content selection, facilities, and equipment; supervision; evaluation; professional growth; leadership and community relationships; art for the special student.
5850-50-70 Problems in Art Education (3, 3, 3) Prereq.: Consent of instructor.

Music Education
MAJOR
DEGREE
Music Education
M.S.
Professors:
Associate Professors:
Assistant Professor:
W. H. McDaniel, M.S. Tennessee.

Thesis and non-thesis programs lead to the Master of Science degree in music education. Prerequisites: At least 27 quarter hours, minor areas in music (9 hours), and professional education (9 hours). Required courses: Music Education 5000, 5210, 5220, 5230: Curriculum and Instruction 5710.

Requirements for non-thesis option:
1. Minimum of 51 quarter hours of course work with a minimum of 26 hours at the 5000 level.
2. Evidence of ability to understand and interpret research through completion of:
A. Educational Statistics 5610 or the equivalent.
B. Music Education 5710.
C. Satisfactory performance of research activities in required courses in music education listed below.
3. Curriculum design:
   - With the exception of the required courses listed below, with approval of the student's advisor, courses may be selected as described more fully below. This provides the flexibility necessary for the student to pursue in some depth specialized interests and needs in the following areas of music teaching: Elementary; Secondary (Junior and Senior High); Vocal (Choral); Instrumental (Band and Orchestra); and Supervision.
   - (1) A major: at least 27 quarter hours in music education.
   - (2) A minor: at least 15 quarter hours in music education.
   - (3) 9 quarter hours in professional education, including Educational Statistics 5610 and Educational Psychology 4760 or equivalents and a 3-hour elective.
   - 4. Specific course requirements:
     A. Music Education Foundation (15 quarter hours)
        (1) One seminar (3 hours)
        (2) 5210, Psychological Foundations of Music.
     B. Music
        Six quarter hours in applied music (piano; voice; a band or orchestra instrument; or theory and composition).
        C. Education (limited elective of 6 quarter hours)
            Education 4760, Advanced Child Study; or 5050, Learning and Development in Children; 5320, Advanced Educational Psychology; or other appropriate course in educational psychology with 3 hours credit.
     5. Electives (with approval of advisor):
        A. Music Education: 12 credit hours from courses numbered 5000.
        B. Music: 9 credit hours from courses at the 3000, 4000, or 5000 levels.
        All courses required in the undergraduate curricula may be included.
        C. Education: 3 credit hours, elected from other departments in Education.
     6. Evaluation (in addition to routine examinations in courses):
        A. Written comprehensive examination in major and minor fields.
        B. The student shall elect one of the evaluations procedures below (with approval of advisor and committee):
           (1) Oral examinations in major and minor fields.
           (2) A public recital in principal instrument, piano or voice.
           (3) The presentation in public performance of an original musical composition(s).
accepted by the committee as music suitable for school music performing groups.

(4) Plan, rehearse and conduct a full public performance of music by junior or senior high school music groups. This shall be carried out as a long-term project under the supervision of the student's committee.

7. Student's Committee: A minimum of three faculty members: the advisor from music education; one member from music; one member from education.

4410 The Administration and Organization of Recreational Music Programs (3) Purpose of music in recreation; scope of activities, organizational procedures, resources, and coordination required in community music programs.

4441-42-43 Teaching Class Piano (1, 1, 1) For majors in music, music education, or elementary education. Prereq: Consent of instructor.

4450 Music in Special Education (3) The role and application of classroom music activities in the educational and rehabilitational programs of atypical children. Study of the use of music in activities with emotionally disturbed, brain-injured, speech defective, physically disabled, and mentally retarded children. For majors in Special Education. Prereq: Teaching Music in the Primary, Intermediate, and Upper Grades.

4460 Marching Band Techniques (3) Functions, organization, and direction of the school marching band.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required of candidates for the M.A.C.T. degree. Additional credit may be earned for non-thesis students who are not recommended for the M.A.C.T. degree. No previous credit is earned for courses taken under this option. A thesis option requires satisfactory completion of a final oral examination, and the non-thesis option requires satisfactory completion of a final written examination.

5110 Seminar in College Teaching (3) Effective college teaching; testing and measurement; recent research in college instruction; major problems and trends in higher education. Required of candidates for the M.A.C.T. degree. S/NC only.

5210 Psychological Foundations of Music (3) Perception; function; aesthetics; talent measurement; implications for teaching theory and practice. A review of classic and current experimental studies. Prereq: Consent of instructor.

5220 The Administration and Supervision of School Music (3) Relates primarily to improvement of the teacher-learning, child-learning process in music education. Problems of supervision, research, and in-service education, teacher preparation, and guidance given careful consideration and study.

5230 Comparative Teaching Procedures in Music Education (3) Modern teaching theories and their implications.

5240 Evaluation Procedures in Music Education (3) Tests, measurements, and evaluation of musical development of students at all levels. Standard educational measurements and teacher-made tests applicable to music and specialized evaluative techniques for use in classroom situations. The uses of musical aptitude and achievement tests. Statistical measures applied to learning music. Prereq: General psychology, educational psychology and elementary education.

5250 The Role of Music in Education (3) An exploratory course designed for school personnel, other than music teachers, on the role of music in public education. No previous experience in music required.

5260 Music for Early Childhood (3) Prereq: Teaching Music in the Intermediate and Upper Grades or Teaching Music in the Elementary School or consent of instructor.

5270 Studies of Music for Children in the Primary Grades (3) Children's growth processes in music, including musical experiences. For the major in music education and/ or elementary education. Prereq: Teaching Music in the Intermediate and Upper Grades or Elementary School or consent of instructor.

5320 Advanced Choral Literature and Conducting (3) Reading, conducting and interpreting vocal scores suitable for school, college, church, and community groups; emphasis on contemporary and standard major choral works. Prereq: Undergraduate degree with a major in music or music education; choral and instrumental conducting, choral methods and materials or equivalent.

5350-56-70 Special Problems in Music Education (3, 3, 3) Individual identification and study of current problems in music education at all levels of instruction and in the various specialized areas of the music curriculum. Prereq: 5710 or the equivalent and consent of instructor.

5410 Advanced Band Literature and Conducting (3) Reading, conducting, and interpreting band scores suitable for school, college, and community bands; emphasis on contemporary and standard band literature. Prereq: Undergraduate degree with a major in music education; choral and instrumental conducting and teaching instrumental music or equivalent.

5510-20-30 The Talent Education Program of Shinichi Suzuki (2, 2, 2) Study of the psychology, procedures and literature utilized by Shinichi Suzuki in the Talent Education program in Japan. Prereq: Consent of instructor.

5710 Research in Music Education (3) Prereq: Consent of instructor.

5810 Seminar (3) Music teaching in the primary and intermediate grades. Survey of research, professional literature and development of bibliography. Laboratory activities. Projects. Prereq: Admission to M.S. program.

5820 Seminar (3) Music teaching in the vocal and general music areas of the junior high school curriculum. Survey of research, professional literature and development of bibliography. Laboratory activities. Projects. Prereq: Admission to M.S. program.

5830 Seminar (3) Music teaching in the instrumental areas of the elementary, junior high, and senior high curricula. Survey of research, professional literature and development of bibliography. Laboratory activities. Projects. Prereq: Admission to M.S. program.

5840 Seminar (3) Music teaching in the vocal, theoretical, historical, and appreciation areas of the secondary school curriculum. Survey of research, professional literature and development of bibliography. Laboratory activities. Projects. Prereq: Admission to M.S. program.

5900-10-20 Independent Study (3) Directed study of problems and special institutes.

5910 Seminar in College Teaching (3) Effective college teaching; testing and measurement; recent research in college instruction; major problems and trends in higher education. Required of candidates for the M.A.C.T. degree. S/NC only.

5920 Theory and Research in Human Learning (3) Same as Educational Psychology 5330.

5930-70 Problems in Continuing and Higher Education (3, 3) Independent study of problems and special institutes.

5940 American Higher Education (3) Purposes, functions, organization, and programs.

5950 Instruction in Higher Education (3) Problems, procedures, and techniques.

5960 Adult Development (3) Changes in characteristics of the adult over the life span and implications for adult education.

5970 Governance of Colleges and Universities (3) Study of the development, change, trends, process, and structure of collegiate government.

5980 Fiscal Problems in Higher Education (3) A study of revenue sources and fiscal management in public and private colleges and universities.

5990 Program Planning in Continuing and Higher Education (3) Theory and methods for planning adult education programs.

5995-55-75 Practicum in Continuing and Higher Education (3, 3, 3) Supervised practice in selected areas of instruction or administration of continuing or higher education programs.

Continuing and Higher Education

MAJOR

Adult Education

DEGREE

M.S.

Professors:


Associate Professor:

K. O. McCullough, Ph.D. Florida State.

Assistant Professor:

Curriculum and Instruction

MAJORS

Curriculum

DEGREES

Curriculum and Instruction Ed.S., Ed.D.
Elementary Education M.S.
English Education M.S.
Foreign Language Education M.S.
Instructional Materials M.S.
Mathematics Education M.S.
Science Education M.S.
Social Science Education M.S.

Professors:


Associate Professors:


Assistant Professors:


Instructor:


Graduate programs are designed to improve scholarship and educational competence in a number of areas leading to the Master of Science degree, the Specialist in Education degree, or the Doctor of Education degree.

THE MASTER'S PROGRAM

For the Master of Science degree, thesis and non-thesis options are available in the following majors: Curriculum, Elementary Education, English Education, Foreign Language Education, Instructional Materials, Mathematics Education, Science Education, or Social Science Education. The non-thesis option requires the completion of 51 quarter hours of course work.

THE SPECIALIST PROGRAM

The Educational Specialist degree program in the Department of Curriculum and Instruction will encompass concentrations in the following areas:

Curriculum

Elementary education

English education

Foreign language education

Instructional materials (media)

Mathematics education

Science education

Social science education

The program includes a minimum of 90 quarter hours of graduate study. If the student has earned the Master's degree, a maximum of 45 hours of the Master's work may be credited to the 90 hour Ed.S. requirement. (45 hours of 5000-level courses are required.) The program must also include the following:

1. A minimum of 12 hours taken in one of the eight areas listed above.

2. A minimum of 12 hours taken within the College of Education in areas other than the student's major area.

3. A minimum of 12 hours taken outside of the College of Education.

4. A minimum of 9 hours earned through the writing of a thesis. (Students who have written a thesis for the Master's degree may be exempted from a thesis in the Ed.S. program provided, in the judgment of the student's committee, the thesis meets the standards of research appropriate for the Ed.S.

5. A minimum of 45 elective hours taken according to a plan jointly developed by the student and the major professor in terms of the student's professional goals.

THE DOCTORAL PROGRAM

The doctoral major in Curriculum and Instruction will include emphasis upon the following fields: curriculum, social foundations, educational research, elementary education, English education, foreign language education, mathematics education, science education, social science education. For further information, write the Department of Curriculum and Instruction.

4910 International Education: Europe and the Americas (3) Historical, philosophical, and sociological foundations; special reference to England, USSR, France, and Germany.

4911 Philosophies of Education in Cultural Perspective (3) Education in relation to the liberal, conservative, reactionary, and radical currents of thought in American culture.

4150 School Library Administration (3) Same as School Library Information Science 4150.

4210 Curriculum in Elementary School Social Studies (3) Survey of current curricular approaches and trends in elementary school social studies. Prereq: Teaching experience or student teaching.

4215 Teaching Elementary School Science (3) Methods and materials used in teaching science in elementary school. Developmental and diagnostic/corrective programs. Not open to students with recent course or background in teaching elementary school science.

4216 Teaching Elementary School Mathematics (3) Methods and materials used in teaching mathematics in elementary school. Developmental and diagnostic/corrective programs. Not open to students with recent course or background in teaching elementary school mathematics.

4217 Teaching Elementary School Language Arts (3) Methods and materials used in teaching elementary school language arts. Development of functional relationships, curriculum areas, diagnostic procedures, and corrective work. Not open to students with recent course or background in teaching elementary school language arts.

4250 Initiating the Activities Program (3) Prereq: Child Study, 6 hrs. of Methods of Teaching in the Elementary School.

4269 Philosophy of Education: Introductory Studies (3) Truth, knowledge, and valuation in relation to the work of the schools. Prereq: History and Philosophy of Education, Child Study or Educational Psychology; Adolescence, or equivalent.

4261 Educational Classics (3) Discussion of selected writings from Plato to Dewey.

4289 Diagnosis and Correction of Classroom Reading Problems (3) Prereq: Teaching of Reading in the Elementary School or equivalent.

4300 Developmental Reading in the Secondary School (3)

4301 Teaching Developmental Reading (3) Methods and materials used in teaching reading in the elementary school. Including development of functional relationships with other curriculum areas, diagnostic procedures and remedial work. Not open to students with recent course work or background in the teaching of reading.

4303 Language Development of Children: Birth-Preadolescence (3) In-depth view of language development during years birth through preadolescence; application of process of language development to instructional programs for early and middle childhood.

4349 The Junior High School and Middle Schools (3) To identify and analyze the distinguishing characteristics of the Junior High and Middle School curriculums.

4355-68-70 Problems in Teaching English (3, 3, 3)

4362-61-71 Problems in Teaching Mathematics (3, 3, 3)

4352-63-72 Problems in Teaching Social Studies (3, 3, 3)

4353-63-73 Problems in Teaching Science (3, 3, 3)

4354-64-74 Problems in Teaching Language Arts (3, 3, 3)

4355-65-75 Problems in Teaching General Curriculum (3, 3, 3)

4356-66-76 Problems in Instructional Materials (3, 3, 3)

4357-67-77 Problems in Teaching Foreign Languages (3, 3, 3)

4359-68-79 Problems in Teaching Conservation (3, 3, 3)
5143 Supervised Readings in Philosophy of Education (3) Prereq: At least 12 hrs in history or philosophy of education.

5150-60-70 Seminar (1-3, 1-3, 1-3) Topics of significance in curriculum, elementary education, secondary education or social foundations as they relate to the goals of the student's program. Maximum 9 hrs. S/N/C only.

5180-90-200 Educational Specialist Research and Thesis (3, 3, 3)

5210 Seminar in International Education: Asia and Africa (3) Historical, philosophical, and sociological foundations; special reference to Japan, China, India, and Nigeria.

5211 Instructional Strategies in Elementary School Social Studies (3) Specific teaching methods and instructional procedures for organizing social studies learnings will be compared. Prereq: An undergraduate social studies course or equivalent.

5220 Supervised Readings in International Education (3) Supervised readings and research in any area of international education, with emphasis on historical, sociological, and philosophical foundations. Prereq: Consent of instructor.

5230 Diagnosis and Remediation of Arithmetic Difficulties (3) Prereq: 4260 or consent of instructor.

5240 Creative Thinking and Expression in the Elementary School (3) Designed to give students the opportunity to examine the development of creative potential across the academic curriculum of the elementary school. Prereq: Consent of instructor.

5250 Secondary School Instruction (3)

5270 The Elementary School Curriculum (3) Theoretical background and experimental approaches.

5280 The Teaching of Language Arts in the Elementary School (3) Trends, issues, and research in content and method for the elementary program.

5281 Teaching Science in the Elementary School (3) Recent trends, issues, and research findings cannot be received for both 5281 and 5282.

5282 Teaching Science in the Elementary School (3) Trends, issues, and research in content and method for the elementary program.

5283 Programs and Materials in Teaching Elementary Science (3) In-depth analysis of new and innovative science program materials, as well as instructional strategies inherent in the teaching of these materials. Prereq: 5282 or equivalent, or consent of instructor.

5284 Seminar in Teaching Elementary Science (3) Analysis of current curricular issues related to elementary science. Emphasis on individual student presentations, projects, and investigations. Prereq: Teaching Science in the Elementary School or 5282 or equivalent, or consent of instructor. At least one year teaching experience (K-9).

5290 The Teaching of Mathematics in the Elementary School (3) Trends, issues, and research in content and method for the mathematics program, grades 1-8. Prereq: Teaching Mathematics in the Elementary School and 5 hrs Structure of the Number System or consent of instructor.

5291 Programs and Materials in Elementary School Language Arts (3) Examination of programs and special instructional aids associated with the language arts. Prereq: 5280 or equivalent, or consent of instructor.

5292 Seminar in Research and Theory in Teaching Mathematics in Elementary School (3) A systematic study of research and theory and their application to the teaching of mathematics. Prereq: Teaching Arithmetic in the Elementary School or equivalent, consent of instructor, and 1 yr of teaching experience.

5302 Psychology of Reading (3) Presents a deeper understanding of the reading act, a more accurate insight into the relationship between learning theory and reading, and a greater knowledge of the role of reading in the child's overall intellectual development. Prereq: An undergraduate reading course or consent of instructor.

5304 Programs and Materials for Reading Instruction (3) Developing a rationale for the examination, selection, and use of materials in the reading program. Special emphasis on distinguishing between approaches and materials for teaching reading. Prereq: Teaching Reading in the Elementary School or 4300 or consent of instructor.

5305 Trends and Issues in Teaching Reading (3) A critical analysis of programs, materials, innovations, and developments in reading. Prereq: An undergraduate course in reading or consent of instructor.

5306 Teaching Reading to the Linguistically Different Learner (3) Language characteristics and special reading problems pertaining to the linguistically different learner. Prereq: Undergraduate reading course, 4300 or 4301 or consent of instructor.

5350 Curriculum Development and Evaluation (3)

5360-70 Curriculum Development in the Local School (3, 3)

5365 Mathematics Laboratories in Elementary School (K-9) (3) Designed for elementary school teachers dealing with activity-oriented mathematics laboratory materials and pedagogical strategies. Theoretical considerations and development of curricula and materials for the laboratory. Prereq: Consent of instructor.

5380 Diagnosis of Remedial Reading Problems (3) Prereq: 4260.

5381 Remediation of Remedial Reading Problems (3) Prereq: 5380 or consent of instructor.

5382 Developmental Reading Practice (3) Disposition and teaching children having developmental and corrective reading needs. Prereq: 4260.

5383 Remedial Reading Practice (3) Prereq: 5381.

5390 Organization and Administration of Reading Programs (3)

5410 The High School Curriculum (3) Theoretical background and experimental approaches.

5530 Curriculum Laboratory for High Schools (3) Study and production of syllabi, courses of study, socio-cultural units, and other materials.

5550 Curriculum Planning and Development (3)

5610 Educational Statistics (3)

5620 Problems in Direction and Supervision of Student Teaching (3)

5630 Practicum in the Individualization of Instruction (3) Prereq: Student Teaching in the Elementary School or Directed Learning in the Elementary School or Advanced Teaching in the Elementary School.

5640 Newer Trends in Elementary Education (3) Trends in classroom procedures, equipment, and materials of instruction; problems involving improvement of instruction.
5650-60 Curriculum Laboratory for Elementary Schools (3, 3) Study and production of syllabi, courses of study, source units, and other materials.

5670 Curriculum Laboratory for Early Childhood Education (3)

5680 Teacher-Parent-Community Relations (3) Development of techniques for effective relations between parents and teachers. Roles and expectations of parents and teachers, parent involvement, and influence of community on educational process are studied.

5690 Design of Instructional Media (3) Design and application of an instructional development model to arrive at solutions to instructional problems, including the development and design of a learning sequence or module, using appropriate media in an actual learning setting. Prereq: 4750 or consent of instructor.

5691 Advanced Production of Audiovisual Software (3) Advanced local production skills such as lettering, overhead projectuals, mounting, preserving, synctaping, photocopying, nonphotographic slides, and videotaping for producing classroom audiovisual software. Prereq: 5690 or consent of instructor, Library and Information Science 4750 or equivalent.

5692 Evaluation of Instructional Media (3) Evaluating and recycling a media prototype to meet needs and objectives of learners. Prereq: 5690 and consent of instructor.

5693 Administering Instructional Media Programs (3) Examines the duties, functions, and responsibilities of media professionals developing and administering a media program in various organizational and learning settings. Prereq: 5691, 5692, or consent of instructor.

5694 Utilization of Educational Television and Radio (3) The effective use of non-commercial educational TV and Radio in schools and colleges. Prereq: Consent of instructor.

5695 Research in Instructional Media (3) Reviews media research and its application toward the improvement of instruction and learning. Prereq: Consent of instructor.

5696 Practicum Experience in Instructional Media (3) Practicum experience in a professional media role as identified by the student in the use of instructional learning settings. Prereq: Consent of instructor.

5710 Techniques of Research in Education (3) Study and application.

5720 Classroom Observation and Analysis (3) Classroom observation and analysis procedures; development of objective observation, examination of existing observation systems.

5800 Seminar in Cooperative Curriculum Research (3) Action research procedures and their application to programs.

5820 Seminar in the Teaching of Mathematics (3) Analysis of teaching strategies related to subject matter and learner problems. Student presentations initiate discussion sessions. At least 1 yr teaching experience (Math grades 7-12) or consent of instructor.

5823 Teaching Mathematics in the Middle and Junior High School (3) Study and discussion of problems related to teaching mathematics in middle and junior high schools. Emphasis on understanding structure of mathematics for curriculum development, as well as teaching methods, and materials for teaching. Materials suitable for individualized instruction, mathematics laboratory investigations, and independent study are considered. Opportunities for individual projects. Prereq: Teaching Arithmetic in Elementary School or Teaching of Math, Grades 7-12, or equivalent.

5830 Seminar in Mathematics Education (3) Current curricular issues and individual student projects and investigation.

5835 Teaching Mathematics in the Senior High School and Community/Junior College (3) Study of curriculum and teaching problems. Emphasis on methods of teaching "analysis" courses such as Algebra II, trigonometry, analytic geometry and calculus. Prereq: Teaching of Math, Grades 7-12, or equivalent.

5841 Trends and Issues in Early Childhood (3) Historical background, trends, and issues as basis for evaluating current programs: materials and techniques of teaching.

5842 Problems in Education: Early Childhood Education (3) May be repeated. Maximum 9 hrs. Six hrs may be taken concurrently.

5843 Seminar in Early Childhood Education (3) Analysis of research dealing with various aspects of early childhood education (K-3) with emphasis on application to programs and methods of instruction. Prereq: 5710 or 5690 or equivalent.

5844 Mathematics in Early Childhood Education (3) Study of behavioral characteristics of children in regard to mathematics, content materials and functional instructional settings and teaching strategies for development of mathematical ideas. Prereq: Teaching Arithmetic in the Elementary School or equivalent.

5845 Social Studies and Science in Early Childhood Education (3) Systematic examination of integrative approaches to and substantive classification systems of the content areas of social studies and science for early childhood education. Emphasis on selection of appropriate social studies and science content and approaches for the young child. Prereq: Teaching Social Studies and Science in the Elementary School or equivalent.

5846 Language Arts in Early Childhood Education (3) Examination of language development of the young learner with emphasis on teaching methods, procedures, program and materials in an early childhood language arts program. Prereq: Teaching Language Arts in the Elementary School and Teaching Developmental Reading in the Elementary School or equivalent.

5850-67 Problems in Education: English (3, 3, 3)

5851-67 Problems in Education: Mathematics (3, 3, 3)

5852-67 Problems in Education: Social Studies (3, 3, 3)

5853-67 Problems in Education: Science (3, 3, 3)

5854-67 Problems in Education: Language Arts (3, 3, 3)

5855-67 Problems in Education: General Curriculum (3, 3, 3)

5856-67 Problems in Education: Instructional Materials (3, 3, 3)

5857-67 Problems in Education: Foreign Languages (3, 3, 3)

5859-67 Problems in Education: Conservation (3, 3, 3)

5899 Field Experience (1-6) Experiences in the application of curricular and instructional principles, methods, and materials in the schools. Program includes study, observation, and permission of instructor required. May be repeated. Maximum 12 hrs; S/N only.

5900 Seminar in the Teaching of English in the Secondary School (3)

5901 Linguistics and the Teacher of English (3) Analysis and application of linguistics in the classroom.

5902 Teaching Composition in the High School (3) Techniques for teaching rhetoric.

5903 Teaching Fiction in the Secondary School (3) Reading, study, and analysis of literary selections.

5904 Teaching the Mass Media in the English Classroom (3) To acquaint the English teacher with the nature of mass media and its importance to American education and life.

5905 Teaching English in the Community/Junior College (3) Emphasis upon gaining a thorough understanding of the communication needs of community/junior college students and of the objectives, strategies, and materials for meeting these needs.

5906 Teaching Poetry in Grades 7-12 (3) A study of materials and strategies for teaching poetry.

5907 Teaching Drama in Grades 7-12 (3) A study of strategies and materials for teaching drama in the classroom.

5908 Developing Speaking and Listening Skills in Grades 7-12 (3) A study of strategies and materials for teaching speaking and listening.

5909 Instructional Theory and Design (3) Course is designed for those individuals at the Master's and who have interest in intensive study of the instructional process and its relationship to curriculum and learning.

5910-20-30 Problems in Lieu of Thesis (3, 3, 3)

5911 Directing the Forensic Program (4) (Same as Speech 5911.)

5912 Play Production in Secondary Schools (4) (Same as Theatre 5912.)

5915 The Function of the Thinking Process in Education (3) Analysis of the thinking processes for the purpose of tracing its implications for educational theory and practice.

5916 The Teaching of Natural Science (3) Emphasis on teaching strategies, testing and evaluation techniques, and professional guidelines for program planning in science.

5917 Seminar in Science and Environmental Education (3, 3, 3) Comprehensive studies of recent developments in science education of concern to classroom instructors and students on the interrelationships of environmental factors on science education.

5918 The Teaching of the Social Studies (3)

5980 Projects, Programs, and Materials in Social Studies (3) Examination of projects and aids associated with each of the social science disciplines.

6000 Doctoral Research and Dissertation

6010 Studies in English Education (3) Reading and study in various areas of the teaching of English; composition, language, and literature.

6020 Seminar in Teaching the Social Studies (3) Problems associated with classroom instruction in junior and senior high schools.

6030 Research and Theory in Teaching Reading (3) A systematic study of research and theory in their application to the teaching of reading. Attention will be given to research design as it applies to reading investigations. Prereq: Two 5000-level courses in reading.

6031 Seminar in Reading and Language Arts (3) A critical review of topics new to the broad area of language arts. Two topics each term chosen by need and the instructor(s). Prereq: 5000-level course in reading and one 5000-level course in language arts.
6040 Seminar in Curriculum and Instruction (1) Required three quarters. S/NC only.

6060 Advanced Study of Methodology in the Elementary School (3) (Continuation of 5640) Consideration will be given to recent and current literature in the field and to sound educational practices in guiding the learning of children. Prereq: 5640 or consent of Instructor.

6070 Advanced Seminar in International Education (3) Analysis of selected problems: political factors in the creation of educational policy, social stratification and its bearing on education in elite and mass societies, relation of education to manpower planning and technological change, and others.

6080 Advanced Seminar in Philosophy of Education (3) A critical study of some selected philosophical issues in education. Prereq: At least 2 courses in history or philosophy of education.

6081 Phenomenology and Education (3) A critical study of some selected philosophical issues in education. Prereq: At least 2 courses in history or philosophy of education.

6082 Philosophical Analysis and Education (3) The philosophical analysis of the language and concepts used in educational research and writing. Prereq: At least 2 courses in history or philosophy of education.

6150 Education as Social Policy (3) Education as an instrument of national or cultural well-being: problems faced by society in shaping an educational program; comparisons of education in this country and in other nations.

6210 Seminar in Elementary School Social Studies Research (3) Survey of current research in elementary social studies, the status of research in the field, needed research-related research from other fields. Prereq: An undergraduate course and one graduate course in social studies, or equivalent.

6230 Programs for Curriculum Improvement (3)

6250 Seminar in History of Education (3) May be repeated with consent of instructor.

6282 Advanced Studies in Elementary School Language Arts (3) Critical research analysis of some selected issues in elementary school language arts. Prereq: 5280 or equivalent and consent of instructor.

6350 The Professional Education of Teachers (3) Basic theories, programs, and practices.

6400 The Dynamics of Educational Change (3) Causes of the lag between educational theoretical practice; factors useful in reducing this lag.

6500 Advanced Studies in Early Childhood Education (3) May be repeated. Maximum 6 hrs.

6510 Advanced Studies in Elementary School Social Studies (3) A critical analysis of current research in elementary social studies, the status of research in the field, needed research-related research from other fields. Prereq: An undergraduate course and one graduate course in social studies, or equivalent.

6710 Advanced Educational Statistics (3)

6720 Interpretation of Data (3) Types of data found in published materials in education; principles of sound interpretation.

6730 Theory and Evaluation in Curriculum Planning (3) Application of principles of evaluation to curriculum programs in the elementary and secondary school. Prereq: 5270 or 5410 or equivalent.

6731 Studies in Curriculum Theory and the Structure of Knowledge (3) Analysis of major curriculum theories, models, and designs; structures of knowledge and structures of disciplines in elementary and secondary school programs. Prereq: 5270 or 5410 or equivalent.

6740 Curriculum Workshops in Instructional Improvement (3) Observation and participation in workshops sponsored by the College of Education; evaluation of workshop approaches to teacher education and instructional improvement.

6750-60-70 Problems in Curriculum and Instruction (3, 3, 3)

6830 Studies in Mathematics Education (3) Reading and study related to historical trends and issues in mathematics education in the United States for the purpose of providing a broad perspective on current curricular problems and future trends. Prereq: 5830 or consent of instructor.

6850 Principles of Educational Leadership (3) Conflicting concepts, with application to major problems in instruction, supervision, and administration.

6899 Internship (1-6) Advanced level experiences in application of principles and practices of curriculum development and instructional improvement. Program prerequisites must be met and permission of instructor required. May be repeated. Maximum 12 hrs. S/NC only.

**Educational Administration and Supervision**

**MAJOR**

<table>
<thead>
<tr>
<th>DEGREES</th>
<th>ED.M. and Supervision</th>
<th>Ed.D.</th>
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<tbody>
<tr>
<td><strong>Professors:</strong></td>
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<tr>
<td>D. H. Stoller (Head), Ph.D. Ohio State;</td>
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<tr>
<td>J. M. Achilles, Ed.D. Rochester;</td>
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<tr>
<td>O. B. Pratt (Emeritus), Ph.D. Ohio State;</td>
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<tr>
<td>L. W. Hughes, Ed.D. Ohio State; J. T. Lovell, Ed.D. Florida;</td>
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<tr>
<td>O. K. O'Fallon, Ed.D. Colorado; G. M. Peccolo, Ph.D. Iowa; R. K. Roney, Ed.D. Tennessee;</td>
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<tr>
<td>C. K. Tanner, Ed.D. Florida State;</td>
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<tr>
<td>C. E. Trotter, Jr., Ed.D. Tennessee;</td>
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*Associate Professors:*


Programs are planned for (1) students preparing for administrative positions normally found in the educational structure of the state; (2) students preparing for the position of supervisor of education; (3) administrators and supervisors in service who wish to improve their professional competence; (4) students and teachers preparing for teaching positions involving administrative responsibilities; and (5) students preparing for teaching educational administration or for administrative positions in higher education.

In addition to M.S. and Ed.D. degrees, a special two-year graduate program is offered which leads to the Ed.S. (Specialist in Education) degree and which provides advanced preparation for applicants judged to be potentially competent school administrators.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5100 Internship in Educational Administration (3) May be repeated with consent of department. Maximum 6 hrs.

5130 Introduction to Educational Administration (3)

5180-50-200 Educational Specialist Research and Thesis (3, 3)

5220 Philosophy and Theory in Educational Administration (3)

5230 Seminar in the Behavioral Sciences for Educational Administration (3)

5290 The Politics of Education (3) Special emphasis on leadership structures, operational beliefs, and communication of ideas with regard to community decisions concerning education.

5310 School Administration in a Multietnic Society (3) Seminar offering opportunity to identify and explore educational problems arising from ethnic and racial diversity, tensions, and possibilities with which school administrators must deal within the individual school or on a district-wide basis.

5420 District Level Administration (3)

5430 Building Level Administration (3) For beginning school principals and administrators, and for those operating in rural elementary, secondary, or consolidated schools.

5440 Introduction to Law, Finance, and Business Management at the Building Level (3)

5450 Organization of the School Program (3)

5470 Introduction to School Facility Planning (3)

5480 Introduction to Supervision and Personnel Administration (3) Principles, methods, and techniques of leadership.

5490 Administration of Community Education (3) Examine administrative factors of primary importance in the development of community education programs in the public schools.

5520 Introduction to Educational Planning (3)

5560 Analysis and Interpretation of Research for Educational Administrators (3)

5580 Seminar in Communication Skills for Educational Administrators (3)

5711-21-31 Problems in Educational Administration and Supervision: School Operation (3, 3, 3)

5712-22-32 Problems in Educational Administration and Supervision: Higher Education (3, 3, 3)

5713-23-33 Problems in Educational Administration and Supervision: State School Administration (3, 3, 3)

5714-24-34 Problems in Educational Administration and Supervision: Preparation Programs (3, 3, 3)

5715-25-35 Problems in Educational Administration and Supervision: Community Education (3, 3, 3) Investigations of administrative problems through independent study.

5720 Seminar in Urban School Administration (3) Studying and analyzing administration in urban school districts.

5730 School Business Management (3)

5740 School Law (3) Study of constitutional provisions, special legislation, and legal interpretation of Tennessee law affecting educational administration.
6040 Seminar in Educational Administration and Supervision: Business Management (3, 3, 3)

5984 Specialized Seminar: Finance (3)

5970 Maintenance of School Plants (3)

5810 Survey Research Methods (3) Overview of descriptive studies, data collection, analysis, and interpretation for survey studies and school surveys, strategies for descriptive research in education.

5830 Contemporary Economics and Educational Finance (3)

5890 Decision Making and Decision Theory in Educational Organizations (3) This seminar is a laboratory for learning about various theoretical constructs underlying executive decision making and involves direct application of decision theory in a variety of problem-solving activities. It is designed for both the preservice and practicing administrator. Attention is given to executive decision making at the several administrative levels in the complex educational organization. S/NC only.

5910-20-30 Problems in Lieu of Thesis (3, 3, 3)

5980 Administration in Higher Education (3)

5981 Specialized Seminar: School Operation (3)

5982 Specialized Seminar: Higher Education (3)

5983 Specialized Seminar: State School Administration (3)

5984 Specialized Seminar: Preparation Programs (3)

5991 Specialized Seminar: Theory (3)

5992 Specialized Seminar: Finance (3)

5994 Specialized Seminar: Business Management (3)

5995 Specialized Seminar: Personnel (3)

5998 Specialized Seminar: School Law (3)

6000 Doctoral Research and Dissertation

6040 Seminar in Educational Administration and Supervision (1) Required three consecutive quarters. S/NC only.

6100 Internship in Educational Administration (3) May be repeated at the discretion of the student's committee. An opportunity for doctoral students and other advanced graduate students to gain experience in the performance of the critical tasks of educational administration while under the supervision of a practitioner and University representative.

6210 Modern Trends in the Theory and Practice of Educational Administration and Supervision (3)

6220 Programs for the Professional Preparation of Educational Administrators and Supervisors (3)

6460 School Personnel Administration (3) Study of personnel administration functions, both for professional and supporting staff in educational organizations. Topics will include recruitment, selection, placement, personnel policies, employee wages and salary administration, fringe benefits, collective negotiations, human relations, staff development, and staff evaluation.

6480 Special Topics in School Personnel Administration (3) Topics such as human problems of school personnel administration; staff planning, record systems, personnel policy development, and personnel management in education; and staff evaluation. May be repeated. Maximum 12 hours.

6530 Futuristic Educational Planning Methods (3) Study of methods for describing alternative futures.

6550 State-Federal Relations in Education (3)

6550 Legal Foundations of Public Education (3)

6580 Administration of Complex Educational Organizations (3)

6670 Advanced Study in School Facility Planning (3)

6890 Specialized Doctoral Seminar in Politics of Education (3) Seminar on political theories and practices as they affect the operation of the public school system. Series of appropriate interdisciplinary discussions based on literature and research from education, sociology, and political science. Students will conduct one field inquiry. Prereq: 5200, 5810 or equivalent or consent of instructor.

6969 Specialized Seminar: School Plant (3)

6997 Specialized Seminar in Organization and Structure (3) Survey and critical analysis of organizational theories in education including a systematic review of the status of organizational and leadership research in education and related disciplines; implications for further research; application of existing theory and research to known educational settings. Prereq: Consent of instructor.

6999 Specialized Seminar: Supervision (3)

Educational Psychology and Guidance

MAJORS

DEGREES

Guidance

M.S.

College Student Personnel

M.S.

Educational Psychology

M.S.

and Guidance

Ed.D., Ed.D.

Professors:


Associate Professors:


Assistant Professors:


Graduate programs (thesis or non-thesis option) lead to the M.A. or M.S. degree with a major in Guidance, College Student Personnel, or Educational Psychology, to the Specialist in Education degree, and to the Doctor of Education degree. Appropriate courses taken in this department and in the Department of Psychology will satisfy requirements for certification as a school psychologist. Write the department for information concerning the program requirements. Application deadline to Ed.D. is February 1 and July 15; Ed.S. and M.S. deadline is October 15, February 1, May 1, and July 15.

4110 Psychology of Sex Role Development (3) Examination, from both a theoretical and research base, of factors which contribute to sex role development with attention to changes in sex role definition in society and role of education in these changes. Aimed at the undergraduate or graduate student with minimal background in behavioral sciences.

4130 Mental Health (3) Studies and exploration of positive mental health. Application of mental health criteria to a study of personality assessment instruments.

4350-60-70 Problems in Educational Psychology and Guidance (3, 3, 3)

4440 General Evaluation Procedures for Public Schools (3) Prereq: 3 hrs in Child Study or equivalent.

4554-55-56 Student Leadership Workshops (1, 1, 1) Series of small group and individualized experiences to develop knowledge and skills in leadership roles. Sections are designed for Resident Assistants, Student Government leaders, student activities, and other student organizations. Prereq: Consent of instructor.

4640 Standardized Testing (3) Use and interpretation of standardized group instruments in the assessment of intelligence, aptitude, achievement, vocational interests and personality adjustment.

4650 The Construction of Classroom Tests (3) Concerned with teacher-made classroom tests: instructional objectives, principles of test construction, item analysis, evaluation of a test's reliability and validity, the interpretation of test scores, the relationship between testing and grading.

4760 Advanced Child Study (3) Prereq: 3 hrs in Child Study, Adolescence or consent of instructor.

4800 Psychology of the Culturally Disadvantaged Child (3) Significant behavioral differences and the reasons for these differences; appropriate intervention approaches.

4890 Differential Psychology (3) Nature and sources of individual differences in behavioral characteristics, and differences between racial, ethnic, socioeconomic, sex, and other groups.
5900 Organization and Administration of Counselor Programs (3) Basic principles, procedures, and policies. Prereq: 4130, 4640 or consent of instructor.

5990 Practicum in College Student Personnel (3) Prereq: 5550-60-70 or consent of instructor. May be repeated by permission of instructor. Maximum 9 hrs.

6000 Doctoral Research and Dissertation

6040 Seminar in Educational Psychology and Guidance Required 3 quarters.

6099 Internship (1-6) Supervised employment at an off-campus approved internship site. Consent of instructor. May be repeated. Maxi- mum 12 hrs. S/NC only.

6110 Application of Research Design in Educational Psychology and Guidance (3) Major types of research design and statistical analysis unique to educational psychology, counseling, and college student personnel. Although several types of designs are discussed, emphasis is on those designs that are "experimental" in nature. Prereq: 2 courses in statistics or consent of instructor.

6120 Application of Experimental Research Design in Education Psychology and Guidance (3) Major types of experimental designs used by researchers in educational psychology, counseling, and college student personnel. Prereq: 6110 or equivalent course.

6219 Field Work in School Psychology: Level I (2) (Same as Psychology 6219.)

6550-60-70 Seminar in College Student Personnel (2, 2, 2) Contemporary issues in the area of college student personnel, college counseling, student development, etc. Prereq: Consent of instructor, admission to the doctoral program. S/NC only.

6610-20-30 Seminar in Dissertation Proposal Writing (2, 2) The preparation and evaluation of doctoral dissertation proposals. Prereq: Two consecutive statistics courses or consent of instructor.

6650-60-70 Systems Approaches in Psychological Services II (3, 3, 3) (Same as Psychology 6650-60-70.)

6659-69-79 Practicum in School Psychology III (2, 2, 2) S/NC only. (Same as Psychology 6659-69-79.)

6750-60-70 Problems in Educational Psychology and Guidance (3, 3, 3) S/NC only.

6810 Seminar in Counseling I (3) S/NC only.

6840-50-60 Seminar in Professional Issues (1, 1, 1) Issues in professional development: Job selection, convention participation, publishing, grant proposal soliciting, consulting, etc. For final year doctoral students only.

6910 Special Topics Seminar I (3) Intensive exploration of specific research or theoretical topics with students who have the necessary background. The topic will vary from quarter to quarter, depending upon the instructor. Prereq: Advanced standing as a doctoral student. May be repeated. S/NC only.

6941-42-43 Practicum in Guidance, Counseling, and Personnel Services (5, 5, 5) Supervised practice in application of guidance tools and techniques. Minimum: 90 clock hours each quarter. Prereq: 5889 and consent of instructor.

6944-45-46 Teaching Practicum in Educational Psychology and Guidance (3, 3, 3) Prereq: Acceptance in doctoral program and consent of instructor.
Special Education and Rehabilitation

MAJORS

Special Education
Vocational Rehabilitation Counseling

DEGREES

M.S.
M.S.
M. Ed.
M.S.
M.S.
M.S.
M.S.
M.S.
M.S.

Professors:

Associate Professors:

Assistant Professors:
J. L. Case, Ph.D. Kansas; C. R. Colvin, Ed.D. Virginia; R. F. Kreutzer, Ph.D. Kansas; W. D. Smith, M.S. Florida State.

Instructors:
R. F. Bynum, M.S. Florida State; R. N. Freeman, Ph.D. Tennessee; M. H. Raulerson, M.A. Kentucky; J. E. Sieiffert, B.A. Gustavus Adolphus.

Lecturers:
H. L. Byrd, Jr., M.S. Tennessee; S. W. Mulkey, M.S. Tennessee; O. E. Reece, B.S. Memphis State.

Coordinator:

An experience program for regular teachers, special teachers, and rehabilitation personnel may be planned to meet the needs of exceptional children and adults in relationship to the program of general and special education. Specialized courses may be designed over the several areas of exceptionality with emphasis in an area of special interests or need. Facilities are available for continuous observation and participation in direct relationships with handicapped children and adults who are hospitalized, homebound, or in residential schools, special classes, or regular classes.

Course sequences may be planned in specialized areas to include:
1. hearing impaired
2. gifted
3. learning disabilities
4. mentally retarded
5. multiple disabilities
6. socially or emotionally maladjusted
7. rehabilitation counselor education
8. disability evaluation education

Programs lead to the Master of Science degree in Special Education with an emphasis in one of the specialized areas. Among the areas of specialization available is disability evaluation (non-thesis only).

Under the sponsorship of Social and Rehabilitation Services, a specialized In- stitute for the preparation of professionals to adapt their skills toward services to hearing impaired and deaf people is provided.

For further information write the department head.

EDUCATION OF THE HEARING IMPAIRED

4000 Rehabilitation Practicum (3) Evaluation of client data, planning rehabilitation pro- gress. Prereq: 4200.

4190 Speech Development of the Hearing Impaired (3) Anatomy and physiology of the speech system. Relationship of hearing to speech development. Theories and techniques of speech development and improvement for hearing impaired children. Prereq: Audiology 3060. (Same as Audiology and Speech Pathology 4180.)

4200 Practicum in Speech Development of the Hearing Impaired (3) Applications of theories and techniques of speech development and improvement with hearing impaired children. Prereq: 4190 and consent of in- structor. (Same as Audiology and Speech Pathology 4200.)

4210 Language Development of the Hearing Impaired I (3) Systems by which formal lan- guage is presented. (Same as Audiology and Speech Pathology 4210.)

4220 Language Development of the Hearing Impaired II (3) Techniques; various systems by which formal language is presented. Pre- req: consent of instructor. (Same as Audiology and Speech Pathology 4220.)

4230 Communication Processes for the Hearing Impaired (3) The various communicative skills required by the hearing impaired person; speech and language development; audiological training; speech-reading; manual language and its relation to other forms of communica- tion. Observations and practicum. Student must acquire a degree of proficiency in the use of manual language.

4240 Nature of Hearing Impairments (3) Basic principles of audiology, anatomy and physi- ology of hearing, nature and causes of hear- ing loss; methods and instrumentation for the assessment of hearing; interpretation of audiograms; selection and use of hearing aids; relation of audiologic services to medical and other rehabilitative disciplines. Observations and practicum.

4250 Introduction to the Education and Psychology of the Hearing Impaired (3) (Same as Audiology and Speech Pathology 4250.)

4280 Curriculum Development in Elementary and Secondary Schools for the Hearing Impaired (3) Adoption of curriculum develop- ment and methods in public school education to meet needs of deaf and hard of hearing students in residential and integrated settings.

4290 The Teaching of Reading to Hearing Impaired Children (3) Reading readiness activi- ties, developmental approaches, theories, and specialized materials for curricula in teaching reading. Prereq: 4210 or consent of in- structor.

4870 Student Teaching with Hearing Impaired Children (9) S/NC only.

4871 Practicum with Hearing Impaired Children (6) S/NC only.

4939 Laboratory in Aural Rehabilitation (1-6) (Same as Audiology 4939.)

5040 Advanced Clinical Practice in Audiology (5) (Same as Audiology 5040.)

5220 Linguistics in the Education of the Hearing Impaired (3) Recent research and developments in linguistics related to the hearing impaired. Prereq: 4240.

5240 Seminar in Language Remediation for the Hearing Impaired (3) Projects and discus- sion will pertain to current and recent de- velopments in educational methodologies and to research pertaining to teaching language to the hearing impaired. The topics will in- clude research and materials current in the use of various instructional systems and their adaptations. Emphasis will be placed on approaches which accommodate and assist the integration of hearing impaired children in the regular classroom.

5250 Seminar on Educational Implications of Language Deficiency (3) Readings, discussion, and projects pertaining to the impact of language deficiency on educational planning for the variety of children whose educa- tional handicap may be defined in terms of language deficiency.

5310-20-30 Manual Communication (2, 2, 2) Acquisition of basic and advanced skills in fingerspelled and signed forms of communica- tion. Emphasis is on ability to express and receive the manual forms. Prereq: Consent of instructor. Must be taken in sequence.

5410 Instructional Media for the Handicapped: Design, Production, and Evaluation of Proto- typical Curriculum Materials (9) Perception, communication, and learning theories; media design and advanced production techniques; evaluation procedures. Emphasis on planning and producing prototypical media materials specifically designed to meet the needs of handicapped learners. Instructional systems for persons holding major responsibilities for media in the handicapped or similar setting. Prereq: 4410 or equivalent (For Summer Media Institute only.)

5490 Educational and Vocational Guidance of the Deaf and the Hard of Hearing (3) Evalua- tion; test techniques for diagnosis and guidance; social and personality adjustment; oc- cupational opportunities.

5540 Seminar in Language Pathology (3) (Same as Audiology and Speech Pathology 5540.)

5580 Curriculum Development Applied to Pro- grams for the Hearing Impaired (3) Analysis of current curriculum trends in order to adapt them for hearing impaired individuals. Applica- tion of new curriculum options in the educa- tion of these children. Implementation of current education theories into programs for hearing-impaired children. Prereq: Curriculum and Instruction 5580 or the equivalent and consent of instructor.

EDUCATION OF THE MENTALLY RETARDED

4110 The Nature and Concept of Mental Re- tardation (3) Identification, description, and study.

4120 Education of the Mentally Retarded Child (3) Philosophy and psychology underly- ing the teaching and guidance of the mentally re- tarded; methods and materials in special and regular classes. Prereq or coreq: 4110.

4440 High School Programs for the Mentally Retarded (3) Trends, issues and research re- lating to core and work study programs.

4810 Student Teaching Mental Retardation (3) Prereq: Major in educable mentally re- tarded, S/NC only.

4811 Student Teaching Mental Retardation (9) S/NC only.

4922 Student Teaching of the Educable Men- tally Retarded (3) Observation and supervised practicum. S/NC only.

5111 Psychology of Mental Retardation (3) Intellectual functioning, psychological theories and learning impairments. Enrollment limited to students with educational and educational implications emphasized. Prereq: 4110.

5112 Psychology of the Severely Mentally Retarded (3) Program and curriculum develop- ment for training/education of the severely
5115 Case Load Management in Rehabilitation
(3) Study of the management of caseloads in state rehabilitation agencies and public/private rehabilitation facilities: analysis of appropriate industrial management models related to rehabilitation programs; and simulated experience in planning, decision making, and case selection.

5120 Psychosocial Aspects of Disability (3) Medical and psychological impact of major disabilities; rehabilitation processes including implications of family and community.

5130-40 Seminar in Rehabilitation (3, 3)

5145-46-47 Practicum in Rehabilitation (3, 3, 3) Supervised experience in the area of rehabilitation with emphasis on the application of concepts, principles, and skills acquired in previous or concurrent course work. Prereq: Consent of Instructor.

5150-60 Internship in Rehabilitation (9, 9)

5170 Systematic Human Relations Training (3) Instruction and exercises in active listening, observing verbal and non-verbal behavior, empathetic understanding, and communicating with handicapped individuals.

5180 Approaches to Rehabilitation Counseling (3) Explorations of various approaches and techniques in individual and group counseling with handicapped adults to further develop the student's own counseling skills. Training in problem-solving techniques and utilization of alternative modes of counseling procedures in rehabilitation. Prereq: 5170 or consent of instructor.

DISABILITY EVALUATION EDUCATION

5700 Evaluation and Mobilization of Community Resources (3) Study of issues, processes, and program relating to community resources and service integration with emphasis on social and rehabilitation facilities and agencies. Introduction to community resources and mobilization of community resources to facilitate development of innovative service programs for the handicapped.

5710 Medical Aspects of Disability I (3) A study of the etiological, clinical signs, symptoms and diagnostic procedures related to musculoskeletal, neurological, circulatory, and respiratory disabilities encountered in the helping professions (and how these conditions effect the structure and function of the human body). Emphasis on identification of alternative procedures used to eliminate or minimize resulting handicaps are emphasized along with the skills necessary to communicate effectively with lay persons and the medical community concerning the evaluation of impairments and administration of appropriate rehabilitation services.

5720 Medical Aspects of Disability II (3) A study of the etiological, clinical signs, symptoms and diagnostic procedures related to neurologic, skin, digestive, genito-urinary, endocrine, mental, visual and hearing disorders commonly encountered in the helping professions (and how these conditions effect the structure and function of the human body). Remedial techniques or approaches used to eliminate or minimize resulting handicaps are emphasized along with the skills necessary to communicate effectively with lay persons and the medical community concerning the evaluation of impairments and administration of appropriate rehabilitation services.

5730 Vocational Assessment in Disability Evaluation (3) Study of the criteria for vocational assessment of disabled persons and procedures involved in the management of caseloads in state rehabilitation agencies and public/private rehabilitation facilities: analysis of appropriate industrial management models related to rehabilitation programs; and simulated experience in planning, decision making, and case selection.

5740 Disability and Work in Society (3) The relationship of work and the workplace to the physical, social, psychological, and economic development of the disabled individual. Orientation to the process and techniques of vocational evaluation, and work adjustment services in rehabilitation.

5750 Principles and Problems of Disability Evaluation (3) Seminar; individual identification and analysis of principles and problems of disability evaluation process or structures; emphasis on problems of disability evaluation process or structures; emphasis on innovation, exploration of alternatives, and sharing experience within the group. Prereq: 5700 or consent of instructor.

5760 Seminar: Functional Capacity Assessment (3) Study of the criteria for residual functional capacity assessment in disability insurance claims evaluation; problems in achievement or acquisition of residual functional capacity assessments. Prereq: 5710-20 or consent of instructor.

5770-71 Current Problems in Disability Evaluation (3) Study of current problems in disability claims evaluation; examination of current problems in process, content or administration of disability claims evaluation; workshops in identification and proposal of alternative solutions. May be repeated with consent of instructor. S/N only.

SCHOOL SPEECH AND HEARING THERAPY

4930 The Public School Speech and Hearing Program (3) Organization, administration, and procedures.

4940 Appraisal and Speech and Language Disorders (4) (Same as Audiology and Speech Pathology 4940.)

4950 Stuttering (4) (Same as Audiology and Speech Pathology 4950.)

4960-40-40 Clinical Practice in Speech Pathology (1-6, 1-6, 1-6) (Same as Audiology and Speech Pathology 4960-40-40.)

4970 Audiology II (4) (Same as Audiology and Speech Pathology 4970.)

4980 Aural Rehabilitation: Speechreading and Auditory Training (4) (Same as Audiology and Speech Pathology 4980.)

4990 Laboratory in Aural Rehabilitation (1) (Same as Audiology and Speech Pathology 4990.)

4940 Advanced Aural Rehabilitation (4) (Same as Audiology and Speech Pathology 4940.)

5040 Advanced Clinical Practice in Audiology (1-4) (Same as Audiology and Speech Pathology 5040-40.)

5300 Cerebral Palsy (3) (Same as Audiology and Speech Pathology 5300.)

5300 Cleft Palate (2) (Same as Audiology and Speech Pathology 5300.)

5540 Seminar in Language Pathology (3) (Same as Audiology and Speech Pathology 5540.)
EDUCATION OF THE VISUALLY HANDICAPPED

4169 Education of Partially Sighted Children (3) Curricular adjustments and materials; home visits for parents; cooperation in medical care and teaching of neglected children.

4850 Eye Problems Encountered by the Teacher (3) Eye anatomy and hygiene; common diseases and defects; testing and treatment; educational adjustments for specific eye conditions; related service resources.

4923 Student Teaching of the Partially Sighted (3) S/NC only.

GENERAL COURSES

3333 Education of the Exceptional Child (3) Principles, characteristics, and special needs; local and statewide programs for diagnosis and care; educational provisions in regular or special classes; home teaching; social and vocational guidance.

3520 Language-Speech Handicapped Child in the Classroom (3) Recognizing and understanding speech problems; observing normal and defective speech development in children; incorporating speech improvement activities into the curriculum. For students not majoring in speech-hearing.

4360-60-70 Problems in the Education of Exceptional Children (3, 3, 3) Prereq: Consent of instructor.

4740 Diagnostic and Remedial Approaches in Special Education and Rehabilitation (3) A critical examination of specialized tests and methods employed in measurement of educational needs of children and adults who are mentally retarded, learning disabled, multiply handicapped or physically handicapped.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student has completed the requirements and/or time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5260 Education of Gifted Children (3) Curricular and social adjustments.

5400 Assessment and Remediation of Learning Disabilities (3) Three approaches involving identification and remediation of learning problems of children who are handicapped neurologically and medically; task analysis of cognitive, affective, and psychomotor skills and use of formal diagnostic and testing materials emphasizing cognitive development. Research dealing with optimizing teaching instruction combined with a prescriptive teaching approach to learning disabilities.

5401 Prescriptive Teaching for Children with Learning Disabilities (3) Diagnostic test materials to assess functional levels of ability followed by specific remedial recommendations consistent with functional ability level. Emphasis on reading and mathematics skill development. Materials designed for ethnic populations, high interest-low vocabulary, assessing sensory, linguistic, and motor development.

5402 The Exceptional Child in the Regular Classroom (3) Adoption, modification, delivery, and maintenance of instructional activities for the exceptional child within the regular classroom. Learning and academic considerations will be stressed. Prereq: 5401 or consent of instructor.

5403 Resource Teachers for the Handicapped (3) To help students acquire the skill to maintain educational programs for children in regular public education environments; includes job descriptions and expectations; interpersonal relationships; assignments of abilities, modifications of curriculum content, and applied teaching methodologies.

5450-90-70 Experience in Teaching and Supervision of Exceptional Children (1-6, 1-6, 1-6)

5510-20-30 Administrative Practicum on Problems in Institutional Care of Children (3, 3, 3) Physical and social development; business and personnel management. Prereq: Training and experience in institutions for children, or consent of instructor.

5590-60-70 Problems in the Education of Exceptional Children (3, 3, 3)

5620 Counseling Parents of Exceptional Children (3) Interpreting the exceptionalities (handicapped and gifted) to parents and helping in the understanding and acceptance of the child in the school/home.


5630 Seminar: Issues and Theories in the Education of the Exceptional Child (3) Current trends in the education of the exceptional child, application of philosophical approaches to their education, an analysis of current theories of learning oriented to the exceptional child. Review and discussion of current research concerning the education and/or rehabilitation of exceptional persons. Prereq: Curriculum & Instruction 5800 or Educational Psychology 5210 and consent of instructor.

5910-20-30 Problems in Lieu of Thesis (3, 3, 3)

5970 Juvenile Delinquency and the School (3) Responsibilities of the school in studying sources of maladjustment; the school function in community programs for children's welfare; curricular adjustments; directed study of socially maladjusted children, their environment, and programs for meeting their needs.

VOCATIONAL-TECHNICAL EDUCATION

MAJORS

Agricultural Education

Business Education

Home Economics Education

Industrial Education

Vocational Technical Education

DEGREES

M.S.

M.B., MACT

M.S.

M.S.

M.S.

ED.D.

ED.D.

ED.D.

ED.D.

ED.D.

Professors:

R. J. Woodin (Emeritus), Ph.D. Ohio State.


Associate Professors:


Assistant Professors:

W. A. Cameron (Acting Head), Ph.D. Ohio State.


Instructor:

R. Pierce, M.A. East Tennessee State.

THE MASTER'S PROGRAM

Each vocational service area (agricultural education, business education, distributive education, home economics education, industrial education and vocational-technical education) offers similar programs leading to the Master's degree. Both thesis and non-thesis options are available. Details regarding the Master's programs of each of the service areas may be obtained from the chairman of the different services. The MACT is also available in the business education area.

THE SPECIALIST PROGRAM

The Ed.S. degree program, which is a thesis or non-thesis program, is a cooperative undertaking involving all vocational service areas. Options are available in agricultural, business, distributive, and industrial education and in general vocational-technical education.

THE DOCTORAL PROGRAM

The comprehensive Ed.D. program in Vocational-Technical Education is designed to provide for achieving professional objectives, developing needed competencies, and gaining desirable experiences and understanding of vocational-technical areas.

The Vocational-Technical Education doctoral curriculum consists of the following: professional education core, 15 quarter hours; service area, 18 hours; vocational-technical education, 18-27 hours; cognate fields, 9-18 hours; research techniques, 6-12 hours; and dissertation, 36 hours. A minimum of 120 hours above the baccalaureate is required.

4750 Audiovisual Methods and Techniques (3) (Same as Curriculum and Instruction 4750.)

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5010 History and Organization of Vocational-Technical Education (3) Development of vocational and technical education in the public schools through an analysis of social forces, legislation and organizational models.

5020 Competency Based Vocational Education (3) Introductory, comparative, and practical approaches to competency-based curricula and materials in vocational and technical education.

5040 Guidance and Pupil Personnel Services in Education (3) (Same as Educational Psychology 5040)

5180-90-200 Educational Specialist Research and Thesis (3, 3, 3) Selection, analysis and completion of original investigation which will be beneficial to the investigator and the vocational-technical field.

5260 Continuing Education in Vocational-Technical Education (3) Importance, objectives, historical development, psychological and sociological formulations, methods and techniques, research, and evaluation.

5270 Placement, Follow-up and Evaluation Procedures in Occupational Education (3) A comprehensive course to explore the methods and procedures in establishing placement programs, follow-up procedures, evaluation, and curriculum revision in occupational education.

5300 Occupational Program Development for Disadvantaged Persons (3) Emphasis will be on problems of the academic, socioeconomic, cultural and/or other handicaps that prevent individuals from succeeding in regular vocational education programs.

5310 Supervision of Vocational-Technical Education (3) Principles of supervision of program planning, coordination and instruction. Roles and functions of supervisors.

5580-60-70 Problems in Vocational-Technical Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

6000 Doctoral Research and Dissertation

6040 Seminar in Vocational-Technical Education (1, 1, 1) Required 3 consecutive quarters during residency. S/NC only.

6210 Curriculum Planning in Vocational-Technical Education (3) Prereq: Curriculum and Instruction 5410 or equivalent.

6220 Program Planning and Development in Vocational-Technical Education (3) Concepts and principles of planning vocational-technical and manpower state, local and institutional programs; use of research in planning, role of advisory committees, theories of planned change, administrative structures, and evaluation procedures.

6230 Evaluation of Vocational-Technical Education Programs (3)

6310 Administration of Vocational-Technical Education (3) A study of administrative principles and their relationship to vocational and technical training.

6411-12-13 Internship in Vocational and Technical Education (3, 3, 3) Field experiences in selected areas of vocational and technical education. S/NC only.

Agricultural Education

4510-20-30 Problems in Agribusiness Education (1-6, 1-6, 1-6) May be repeated. Maximum 9 hrs.

4710-20-30 Seminar in Agricultural Education (1, 1, 1) Emphasis on student teaching in Agricultural Education or consent of department head.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5011 Problems in Lieu of Thesis (3)

5110 Graduate Seminar in Current Problems (3)

5111-12-13 Graduate Seminar: Current Problems in Business Education (1, 1, 1)

5120 Graduate Seminar in Tests and Measurement (3)

5130 Graduate Seminar in Guidance (3)

5140 Organization and Operation of Area Vocational-Technical Schools (3) (Same as Industrial Education 5140.)

5410-20-30 Practicum in Business Education (2, 2, 2)

5510 Evaluation of Research in Business Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.

5611-21-31 Problems in Business Education: Typing (3, 3, 3)

5612-22-32 Problems in Business Education: Shorthand (3, 3, 3)

5613-23-33 Problems in Business Education: Bookkeeping and Accounting (3, 3, 3)

5614 Methods and Materials for Vocational Office Education (3) Course designed for concentration on methods and materials for vocational office education programs. Emphasis will be given to development of instructional aids, recent developments and research, individualized instruction, and occupational clusters for VOE.

5624 Problems in Business Education: Clerical Practice (3)

5615-25-35 Problems in Business Education: General Business (3, 3, 3)

5617 Problems in Business Education: Business Law (2)

5618 Organization and Management of Vocational Office Education Program (3) Principles and procedures for developing office occupations with emphasis given to guidelines in cooperatives, labor, and model office programs. Consideration will be given to organizational, instructional, and advisory activities (clubs), the enrollle, the instructor and advisory committees.

5628-38 Problems in Business Education: Administration (3, 3)

5619 Problems in Business Education: Payroll and Skill Building (3)

6119-20-30 Current Issues in Business Education (3, 3, 3)

6210-20-30 Advanced Studies in Business Education (3, 3, 3)

6410 Higher Education for Business (3)

Distributive Education

4130 Areas of Distribution (3) Marketing, product or service technology, social skills, basic skills, and distribution in the economy as these areas affect the distributive education curriculum in secondary and postsecondary programs.

4140 Supervised Distributive Experience (3) Minimum 200 hours experience in approved distributive business; concurrent analytic project.

4300 Organization and Operation of Distributive Education (3) Background and development; needs; federal and state legislation; curriculum implications; establishing, evaluating, reporting, and improving the program.

4320 Methods and Materials in Distributive Education (3) Prereq: 4310 or consent of instructor.

4330 Coordination Techniques in Distributive Education (3) Selecting training agencies; job analysis; selecting and briefing the training supervisors; advisory committees; adult and other community services. Prereq: 4310, 4320.

4510-20-30 Problems in Distributive Education (3, 3, 3) Selected research problems in teaching and coordinating distributive education programs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110 Administration and Supervision of Distributive Education (3) Operation of a distributive education program and the work of the principal. Program evaluation and advisory committees in implementation.

5110-20-30 Practicum in Distributive Education (2, 2, 2)

5510 Evaluation of Research in Distributive Education (3) Prereq: Curriculum and Instruction 5610 or equivalent.

5611-21-31 Problems in Distributive Education: Typing (3, 3, 3)

5612-22-32 Problems in Distributive Education: Shorthand (3, 3, 3)

5613-23-33 Problems in Distributive Education: Bookkeeping and Accounting (3, 3, 3)

5614 Methods and Materials for Vocational Office Education (3) Course designed for concentration on methods and materials for vocational office education programs. Emphasis will be given to development of instructional aids, recent developments and research, individualized instruction, and occupational clusters for VOE.

5624 Problems in Distributive Education: Clerical Practice (3)

5615-25-35 Problems in Distributive Education: General Business (3, 3, 3)

5617 Problems in Distributive Education: Business Law (2)

5618 Organization and Management of Vocational Office Education Program (3) Principles and procedures for developing office occupations with emphasis given to guidelines in cooperative, laboratory, and model office programs. Consideration will be given to organizational, instructional, and advisory committee activities (clubs), the enrollle, the instructor and advisory committees.

5628-38 Problems in Business Education: Administration (3, 3)

5619 Problems in Business Education: Payroll and Skill Building (3)

6119-20-30 Current Issues in Business Education (3, 3, 3)

6210-20-30 Advanced Studies in Business Education (3, 3, 3)

6410 Higher Education for Business (3)

Home Economics Education

5000 Thesis
5102 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not other- wise registered during any quarter when such a student uses university facilities and faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110 Advanced Methods of Teaching Home- making Classes for Adults (3)

5110 Furthering Good Human Relationships in the Classroom (3) Relationships between problems in human relations, basic needs of individuals, techniques of interpersonal rela- tions and social values in developing more effective teacher education programs.

5200 Evaluation in Home Economics Educa- tion (3) Purpose of evaluation in develop- ment of home economics programs; analysis of techniques used in evaluation. Development of techniques for determining progress of students; emphasis on individual problems of evaluation.

5310 The Problem Method of Teaching Home Economics (3) Underlying philosophy; skills and techniques. Observation and discussion.

5440 Curriculum Development and Implemen- tation in Family Relationships Instruction (3) Review and organization of content for teach- ing family relationships. Analysis and evalua- tion of research methods and terms in their appropriateness for reaching curricu- lum objectives in family relationships.

5520 Teaching Home Economics in College (3) Methods, organization, and evaluation.

5530 Organization of the Homemaking Cur- riculum in Secondary Schools (3) Critical review of recent advances in home economics educa- tion. Consideration will be given to the de- velopment of teaching material in relation to total homemaking program in the secondary school—day-school, adults, home experience, and Future Homemakers of America.

5510 Supervision of Home Economics in the Public Schools (3) For teachers with successful- ful experience in vocational home economics who are preparing for supervisory positions in vocational education. Program planning, organization, and administration. Field contacts with urban and rural programs.

5620 Wage Earning Programs in Home Eco- nomics (3) Planning, establishing and imple- menting wage earning programs in home economics.

5710-20-30 Special Problems for Non-Thesis Students (3, 3, 3)

5810-20-30 Problems in Home Economics Education (1-3, 1-3, 1-3) May be repeated. Maximum 3 hrs per course.

5910-20 Seminar in Home Economics Educa- tion (3, 3) Research literature and techniques. Prereq: Consent of instructor.

Industrial Education

3110 History and Philosophy of Industrial Education (3)

3210-20-30 Part-time Programs in Cooper- ative Industrial Training (3, 3, 3) Principles of organization, methods and materials.

3310 Shop Organization and Management (3)

3320-30 Materials and Methods for Shop and Related Subjects Teachers (3, 3)

3340 School Shop Safety (3)

3610 Development and Utilization of Advisory Committees (3) Philosophy and rationale for use of craft advisory committees. Their selec- tion, organization, implementation and utiliza- tion.

4110 Foramanship Training by the Conference Method (3)

4120-30 Job Analysis (3, 3) Principles, prac- tice, instructional methods.

4310-20 Curriculum Building in Trade and Indus- trial Subjects (3, 3) Prereq or coreq: 4120.

4510-11-12 Seminar in Industrial Education (3, 3, 3) Educational innovations, current events, problems, and other topics associated with the field of industrial education.

4520-21-22 New Developments in Industrial Education (3, 3, 3) Developments, pressings problems, and recent trends in the field of industrial education as presented by a co- ordinating instructor in conjunction with knowl- edgeable resource personnel.

4621 Special Topics in Drafting (3) Industrial practices in specialized areas of drafting selected for the individual student. Prereq: 6 hrs drafting.


4671 Materials and Processes (3) Organic and inorganic materials and processes used to produce finished products. Content, cur- riculum and techniques of laboratory opera- tion. Prereq: Consent of instructor.

4682 Power and Energy (3) Development, con- trol, transmission, conversion, interrelation- ship of power sources; content, curriculum, and techniques of laboratory operation. Pre- req: Consent of instructor.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not other- wise registered during any quarter when such a 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.

5110-20-30 Administration and Supervision of Industrial Education (3, 3, 3) Principles of voca- tional education; relationships with general education and with trade and labor organiza- tions; special problems in administrating and supervising various types of schools and classes under the federal vocational education acts.

5140 Organization and Operation of Area Voc- ational-Technical Schools (3) Understanding of the area vocational-technical school con- cept; administration and supervision of voca- tional and technical education programs in area schools. (Same as Business Education 5140.)

5210-20-30 Special Problems in Industrial Education (3, 3, 3)

5310 Methods of Research in Industrial Educa- tion (3)

5410 Improving Teachers in Service (3) Prob- lems of coordination in part-time and ap- prentice training programs.

5420 Advisory Committees and Apprenticeship Training (3)

5430 Vocational School Administration and Management (3)

5440 Advanced Methods of Teaching Skills and Technical Education (3) Proper selection and effective application of contemporary methods and techniques in the teaching of specialized skills and technical related informa- tion.


5540 New Developments in Industrial Techn- ical Education (3) Prereq: B.S. in Industrial Education plus teaching experience.

School of Health, Physical Education and Recreation

Madge M. Phillips, Director

Graduate programs are available to students preparing for (1) teaching and research positions in colleges, high schools and elementary schools; (2) administrative and supervisory work in athletics, health education, physical education, and recreation; (3) recreation specialist positions in various public, voluntary, private, and commercial agencies and institutions; and (4) public health positions in community health education, health planning and administration, and environmental health.

THE MASTER'S PROGRAM

Four programs leading to the Master of Science degree are available: Physical Education, Recreation, Safety Education, and School Health Education. Forty-five quarter hours are required for the M.S. Approximately 23 quarter hours of work selected from courses numbered 5000 and above are included in the M.S. requirement. Course selection shall be made according to each student's professional interests in health, physical education, safety, or recreation with the approval of the major professor. Non-thesis options are available in all M.S. degree programs. 3 credit-hour seminars, approved teaching tech- niques and/or statistics and/or a seminar in research will be required. Each non-thesis degree candidate will take a final comprehensive examination.

Programs leading to the Master of Public Health are also available in Community Health Education, Health Planning/Administration, and Occupational/Environmental Health and Safety. Fifty-four quarter hours are required for the M.P.H. degree. One full quarter of field practice is required. During field practice, no student shall hold a full-time job except by special permission of the division chair- man. Students may be placed in all parts of this country.

DOCTORAL PROGRAMS

The Doctor of Education and the Doctor of Philosophy degrees are offered in Health Education. See further description under Health Education.

The Doctor of Education degree is offered with a major in Physical Education
Division of Health and Safety

MAJORS

Health Education
Public Health
Safety Education and Service
School Health Education

DEGREES

Ed.D., Ph.D.
M.P.H.
M.S.
Ed.S.
M.S.

Professors:

R. H. Kirk (Chairperson), H.S.D. Indiana;
W. J. Huffman, Ed.D. Illinois; R. Kent, Ph.D.
North Carolina; B. C. Wallace, Ed.D. Colorado.

Associate Professors:

I. A. Ahmad, Ph.D. Oregon; A. J. Brown,
Ed.D. Tennessee; C. B. Hamilton, Dr. P.H.
Oklahoma; J. Goraki, Dr. P.H. U.C.L.A.;
M. A. Million (Emeritus), M.A. Yale.

Assistant Professors:

A. J. Pickett, M.S. Columbia; A. F. Thompson,
Ph.D. Michigan State.

Lecturers:

M. Duffy, M.D. Pennsylvania; H. P. Hopkins,
Ph.D. North Carolina; C. P. McCammon
(Emeritus), M.D. Temple.

The Health and Safety Division offers the following degree programs:

Master of Public Health degree with a major in Public Health. Option in community health education is accredited by the American Public Health Association. Options with specialization in health planning/administration or occupational/environmental health and safety are also available.

Master of Science degree with a major in School Health Education or Safety Education and Service (thesis and non-thesis options). Non-thesis option requires 45 quarter hours of course work.

Educational Specialist degree in Safety Education and Service.

Doctor of Education degree in Health Education.

Doctor of Philosophy degree in Health Education.

Public Health

3000 Foundations of Health Science (3) In-depth study of the several content areas relating to personal and environmental health problems, i.e., mood modifying products, consumer health, international health, personal health practices, reciprocal relationships involving man, disease, and environment.

3210 First Aid and Emergency Care (4) Theory and practice of first aid and emergency care. Instruction in medical self-help. Course leads to Red Cross Certification in Advanced First Aid and Emergency Care. (Applicant must be at least 16 years of age.) Prereq: 1 yr of biological science and 1 course in bacteriology.

3310 Communicable and Noncommunicable Diseases (3) Modern concepts of diseases; etiology of common communicable and chronic diseases, including sanitation and control. Prereq: 1 yr of biological science and 1 course in bacteriology.

3320 Environmental Health (3) History of the sanitary awakening; disease-producing relationships and controls of water, sewage, refuse; milk, meat and other foods, air, insects, and soil; sanitation of homes, swimming pools, industrial plants, markets, and public bathing places. Healthful school living as affected by buildings and grounds, lighting, heating, ventilation, and control and safety provisions. 2 hrs and 1 lab.

4120 Community Health Problems—Alcoholism (3) Explores problems of alcoholism regarding overall health of community. Emphasis placed on factors making alcoholism a serious public health problem. Various types of educational programs to control the disease covered.

4130 Community Health Problems—Suicide (3) Explores problems of suicide regarding overall health of community.

4140 Community Health Problems—Health Education (3) Exploration of ramifications of death and dying as related to personal and community health.

4210 Urban and Industrial Health (3) Health problems created by a burgeoning population and the megalopolis; industrial health problems of concern to management, supervisor, and industrial worker; control of occupational diseases, poisons, accidents, and other conditions incidental to industry.

4220 Communications for Better Health (3) Selective study of communications in the health area and development of skills of teaching health classes, teaching safety classes, teaching physical education classes, rendering services to local schools, agencies, and the School of Public Health.

4410 Consumer Health and Safety Education (3) Survey of major consumer health and safety problems; selecting, purchasing, and financing of safety and medical services.

4411 Instructor's Advanced First Aid and Emergency Care (3) Designed to teach first aid. Satisfactory completion qualifies one for American National Red Cross Certification as an Advanced First Aid and Emergency Care Instructor. (Applicant must be at least 21 years of age.) Prereq: First Aid and Emergency Care or valid Advanced First Aid and Emergency Care Certificate.

4420 Drug Abuse Education (3) The drug abuse problem and suspected causes; the pharmacology of drugs and their effects on society and methods of drug abuse education.

4700-10-20 Field Practice in Public Health (3, 3, 3) Field practice in public health under supervision of public health professional. S/NC only.

4730 Workshop in Public Health Education (3-8) For teachers, nurses, case workers, sanitarians, and other public and private health agency personnel: emphasizes the problem-solving approach through small group interaction. Course methods vary according to the critical incident technique. May be repeated.

4840-50-60 Problems in Public Health Education (1, 1, 1) Individual identification and study of current problems in public health education. Extensive reading of literature required.

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5010-20-30 Workshop in Public Health (3, 3, 3, 3) Designed to deal with specific public health problems in a short or an extended period of time.

5070-80-90 Field Practice and Seminar in Public Health (3-5, 3-5, 3-5) Internship or field experience under professional supervision in public health. S/NC only.

5110 Environmental Health (3-5) Varied environmental factors within the general framework of air, food, water, shelter, transportation
as they affect man's survival, prevention of disease, performance and enjoyment. Lecture, demonstrations, laboratory and field practice. Prereq: Consent of instructor.


5150 Industrial Toxicology (3) Study of elements of industrial toxicology as they relate to the improvement of occupational safety and health. Prereq: Consent of instructor.

5220 Health and Sickness in the Focus of Public Health Education (2) Formulation of models of positive health within the life cycle and within the community; types of sickness affecting individuals and groups. 1 hr and 2 labs.

5410 Epidemiology (3) The study of the incidence and prevalence of disease in man.

5420 Administration of Public Health (3) Administrative considerations of public health agencies including governmental aspects, legal bases, organizational principles, personnel factors, fiscal management, and public relations.

5430 Vital and Medical Statistics (1) Application of basic statistical principles to living things.

5440 Methods and Materials in Public Health Education (4) Theory and practice in the use of communication techniques and materials in community health education. 3 hrs and 2 labs.

5540 Factors in Problem Solving for Community Health (5) Test skills in communications and group process en route to problem identification, objective setting, problem solving, and planning for health education. 4 hrs and 2 labs.

5550 The Public Health Educator in Community Organization and Development (4) An overview of health organizations and agencies in the community. Laboratory to delineate a community near the campus and to practice. 2 hrs and 4 labs.

5560 Functions and Roles of the Public Health Educator (3) Professional scene is examined with special attention to roles and functions. Consideration of philosophy and motivation and differences between health education service and health education program for community learning levels. 1 hr lecture-seminar session per week.

5580 Physical Activity and Health (5) (Same as Physical Education 5580.)

5705-95 Advanced Professional Health Education (3-5) Theory and practice in selected areas.

5840-50-60 Problems in Public Health Education (1-3, 1-5, 1-3) Individual identification of current issues. Extensive reading and critical analysis of literature required.

6000 Doctoral Research and Dissertation

6050 Critical Analysis of Writing and Research in Health Education (3) (Same as School Health Education 6030.)

6050-60 Seminar in Health Education (3, 3) (Same as School Health Education 6050-60.)

6210 Health Aspects of Gerontology (3)

6220 Seminar on the Nation's Health (3)

6230 International Health (3)

Safety

3520 Principles of General Safety (3) Deals with the principles, practices, and procedures in general safety. Covers safety problems in school, traffic, recreation, industry, home, and other public areas.


4410 Driver and Traffic Safety Education (5) Preparation of teachers of driver education in schools and colleges. Students are required to teach at least one non-driver. Valid driver's license required. 3 hrs and 2 labs.

4420 Advanced Driver and Traffic Safety Education (5) Development of competence in teaching of driver education through use of simulation, multimedia and multiple-car driving range. Emphasis placed on teaching skills and supervision. Prereq: 4410.

4430 Sports Safety (5) Accident prevention and injury control in sports activities; philosophy of sports safety; human environmental factors and their interrelationship in sports injury and their control; risk-taking and decision solution strategies; and contributions of sports medicine to safety. 3 hrs and 2 labs.

4720 Workshop in Safety (3-6) Deals with special safety education problems. For advanced undergraduate students, graduate students, teachers, administrators and administrators. May be repeated.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) May not be used toward degree requirements. May be repeated. S/NC only.

5320 Behavioral Problems in Safety Education and Accident Prevention (3) Problems of behavior, causes of accidents, and the application of the principles of psychology in the development of safe behavior in all segments of our environment.

5330 Problems and Research in Accident Prevention (3) Analysis of safety problems found in a wide variety of accidents that occur in the community; the findings of current research in the behavioral sciences related to variation in the incidence of accidents.

5340 Organization, Administration, and Supervision of Safety Programs (3) National, state, and local level programs including administrative, institutional, and supervisory aspects. Basic emphasis on implementation of relevant programs.

5350 Civil and Defense Education (3) In-depth study of civil and defense problems; tornadoes, floods, fires, mass civil disorders, and nuclear and personnel attack by alien countries.

5720-30-40 Graduate Workshop in Safety (3-6, 3-6, 3-6) Deals with specific safety problems. Designed especially to explore special safety problems in a concentrated period of time.


5870-90-90 Current Issues in Safety Education (1, 1, 1)

6010-20-30 Internship and Research in Safety (3, 3, 3) Designed to allow the student opportunity for engaging in field experience to enable that a significant problem in that experience will be identified, researched, and reported on in acceptable form.

School Health

3210 First Aid and Emergency Care (4) (Same as Public Health 3210.)

3410 School Health Instruction (3) Selection of health content in the school program.

3420 School Health Services (3) Development, maintenance, and protection of the health of students including examination, screening, special services, communicable disease control, emergency care, and school health records.

3510 The School in Community Health (3) Role of the teacher in community health education; the school's responsibility in promoting healthful living and the place of existing media and agencies in the program. Not open to health and physical education majors.

3610 Methods in Elementary Health Instruction (3) Preparation and presentation of health topics. Teaching method is emphasized and student participation stressed. Required for elementary teachers. Prereq: 3510 or Principles of Personal Health or Elementary Nutrition.

3620 The Teaching of Sex Education (3) Trends, content, methods and materials in sex education.

3650 Methods in Secondary Health Instruction (3) Preparation and presentation of health topics. Teaching method is emphasized and student participation stressed. Required for secondary health certification. Prereq: 3410 or Principles in Personal Health or Elementary Nutrition.

4710 Workshop in School Health Education (3-6) For advanced students, teachers, school administrators, nurses and other paramedical school personnel. Lectures, demonstrations, films, field trips, and supervised research in special school health problems. May be repeated.

4810-20-30 Problems in School Health Education (1, 1, 1) Individual identification and study of current problems in school health education. Extensive reading of literature required.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5010 Problems and Practices in School Health (3) Comprehensive study and analysis of the principles, problems, systems, and trends of and in school health.

5020 Teaching of Sex Education and Human Sexuality (3) Analysis and explanation of
The Physical Education Division offers the following degree programs:

Master of Science degree in Physical Education (thesis and non-thesis programs)

Doctor of Education degree in Physical Education

3050 Rhythmic Analysis (2) Emphasis on the analysis of organic movement. Prereq: Consent of instructor.

3090 History of Dance and the Related Arts (2) A study of the history of dance in relation to other the arts. Lab.

3151 History of Dance and the Related Arts II (2) A survey of dance and the arts related to it tracing their development in the twentieth century.

3150 Tests and Measurements in Physical Education (3) Study of elementary statistics related to measurement. Critical examination of tests used to evaluate strength, sport skills, and physical fitness.

3430 Adaptive Physical Education Laboratory (1-3) Practical work, including student teaching, supplementing 4110.

3710 Camping (2) Theory and practice in leadership with practical experience in campground management. Lab.

3880 Social Recreation (3) Theory and practice in social recreation for camps, community centers, clubs, and schools. Course includes folk and square dance, quiet and active games, skills, stunts, other recreational activities, and program planning. Not for graduate credit for physical education majors.

4010 Advanced Dance Technique (2) Development and analysis of various dance vocabulary; emphasis on analysis and practice of dance techniques; solo and group work. Prereq: Intermediate Dance Techniques.

4200 Practicum in Dance Production (2) Prereq: Consent of instructor.

4060 Advanced Dance Composition (2) Creation and development of ideas, themes, and dance forms; solo and group work. Prereq: Beginning Dance Composition.

4070 Stagecraft for Dance Production (2) Equipment, light design, properties, sets, and stage management. Lab.

4110 Adaptive Physical Education (3) Classification of atypical students who require modified programs in physical education; activities and class organization which are suitable for required or special physical education classes.

4150 Creative Rhythms for Children (3) Methods and materials for grades 1-6. 3 hrs and 1 lab.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110 Administrative Problems in Health and Physical Education (3)

5120 Problems of the Curriculum in Physical Education (3)

5130 Methods in Physical Education (3) Character development, school age levels, and applications of learning procedures in physical activities at these levels.

5210 Principles and Philosophy of Physical Education (3)

5220 Readings in Physical Education (3) A comprehensive review of literature in physical education and related areas.

5230 Supervisory Problems in Physical Education (3) For students interested in supervision of physical education teachers.

5310 Analysis of Basic Motor Skills (3) Mechanical analysis of basic motor skills, emphasizing application of these skills to physical education and athletics.

5320 Seminar in Research Techniques in Physical Education (3) An evaluation of appropriate research techniques in physical education.

5410-20-30 Specialization Study in a Selected Physical Education Area (1-3, 1-3, 1-3) Advanced comprehensive study in a selected specialized area within the general fields of physical education. Prereq: Consent of instructor.

5500 Advanced Kinesiology (3) Action of muscles involved in fundamental movements, calisthenics, sports, and gymnastics. Prereq: Applied Anatomy and Physiology or equivalent.

5510 Selected Topics in Anatomy (3) Intensive study of various systems of the human body. Prereq: 5500 or equivalent. Not to be repeated with consent of instructor. S/NC only.

5550 Physical Rehabilitation (3) Comprehensive study of physical disabilities and rehabilitation techniques. Prereq: 5500 or equivalent.

5580 Physical Activity and Health (5) Research evidence of the relationship of physical activity to the following: longevity, weight control, cardiovascular diseases, low back pain and other disorders, mental health, growth, and aging. Applications for the maintenance of health will be emphasized. Prereq: Course in physiology of exercise or consent of instructor. 5 lectures per week. (Same as Public Health 5580.)

5600 Applied Physiology (6) Principles of physiology with special emphasis on the application of physiological findings to practical problems related to human function. Prereq: 1 yr General Chemistry, or consent of instructor.

5610 Advanced Exercise Physiology (4) Principles of energy transfer in man with special emphasis on the integration of organ systems in adapting to the requirements of muscular exercise. Prereq: or equivalent. Recommended: 1 yr of chemistry, physics, and mathematics. 3 hrs and 1 lab.

5620 Experimental Techniques in Applied Physiology (3) Laboratory interpretation of the methodology and instrumentation. Topics include respiratory and blood gas analysis, human calorimetry, blood chemistry, and pulmonary function tests. May be repeated with consent of instructor. S/NC only.

5650 Scientific Bases for Physical Education (3) Physiological, psychological, and sociological foundations.

5650-20-30 Seminar in Physical Education (1, 1, 1) Study of current issues and problems in physical education with emphasis on outstanding studies and research in the field.

5690-20-30 Problems and Projects in Physical Education (1, 1, 1-3) Problems of professional interest and value to the individual student, selected by the student and approved by the major professor. S/NC only.

6000 Doctoral Research and Dissertation

6010 Seminar in Physical Education (1) Research topics in the literature related to physical education. May be repeated with consent of the instructor. S/NC only.

6220 Independent Research (3) Selection of a topic, development of a procedure, and con-
duct of a study including the final writing of a research paper. S/NC only.

6410 Practicum in Kinesiology (3) Electromyography laboratory and film analysis of sports skills. Prereq: 5310, 5500 and first quarter Elements in Physics or equivalent. May be repeated with consent of instructor. S/NC only.

6510-20 Issues and Problems in Physical Education (3, 3) Critical examination and evaluation of current issues and problems in the area of physical education.

6510 Seminar in Exercise Physiology (2) Prereq: 5610. May be repeated with consent of the instructor. S/NC only.

6540 Research Participation in Applied Physiology (1-6) Advanced research techniques are studied under supervision of a faculty member whose research area coincides with interests of the student. Prereq: Consent of instructor. May be repeated with consent of instructor. S/NC only.

6810-20 Practicum (2, 2) Intern experience in areas of major interest. S/NC only.

Division of Recreation

MAJOR

Recreation

DEGREE

M.S.

Associate Professor:

M. L. Peters (Chairperson), Ph.D. Illinois.

Assistant Professors:

P. A. Boroviak, M.S. Tennessee; C. J. Johnson, M.S. Tennessee; K. L. Krick, Re.D. Indiana.

The Recreation Division offers the following degree program:

Master of Science degree in Recreation (thesis and non-thesis programs)

3100 Recreation Leadership Procedures (3) Principles and practice of recreation leadership; techniques and methods of working with individuals and groups in leisure activity.

3140 Philosophical Foundations of Recreation (3) Examination of recreation as personal experience; theories of play; philosophies of leisure and relationship to economy, ecology, health, government, culture, and self-realization; history of recreation movement.

3200 Planning Leisure Programs (3) Principles and methods employed in planning effective and well-balanced leisure time programs for varied groups in various settings.

3880 Social Recreation (3) (Same as Physical Education 3880.)

4130 Recreation Administration (3) Introduction to recreation administration, including planning, personnel, areas and facilities, program services, finances, and public relations. Prereq: Orientation to the Recreation Profession, 3160, 3140, or consent of Instructor.

4200 Survey of Recreation for Special Populations (3) Recognition of responsibility of recreation profession to minority groups whose leisure opportunities and needs may require special servicing.

4500 Specialized Study in a Selected Area of Recreation (1-9) Comprehensive study in a selected specialized area within the broad field of recreation. For recreation students only. May be repeated with consent of the division. Maximum 9 hrs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5130 Interpretation of Leisure (3) Examination of concepts of leisure including social, psychological, cultural, and philosophical; recreational uses of leisure. Prereq: 3140 or consent of instructor.

5140 Leisure Service Delivery Systems (3) An in-depth study of the various systems—public, private, and commercial—involved in the provision of leisure services for the community at large. Prereq: Consent of instructor.

5150 Current Issues in Recreation (3) Identification and consideration of some of the broad issues—social, environmental, ethical—which currently have the greatest impact on people's use of leisure, and implications for the recreation administrator. Prereq: Consent of instructor.

5240 Therapeutic Recreation (3) Concerned with the role of recreation in the lives and treatment of persons with disabilities—mental, physical, and medical. Considers possibilities for helping the ill and disabled realize their fullest potential. Prereq: Consent of Instructor.

5250 Implementations of Recreation Services for the Ill or Disabled (3) Policies and guidelines for organizing and implementing programs of recreation for the ill or disabled in treatment centers and other community agencies. Prereq: 4200 or consent of instructor.

5260 Leisure and Mental Health (3) A study of the relationship between leisure activity and mental health, with emphasis on its use in therapeutic recreation. Prereq: Abnormal Psychology or equivalent, and consent of instructor.

5300 Seminar in Recreation (1) Presentation and general discussion of students' research studies, projects, and theses in recreation. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs. S/NC only.

5340 Administration of Recreation Funds (3) The process of development and management of budgets for recreation agencies with special emphasis on obtaining federal funds appropriately for recreation, management of revenue received, and exploration of funding alternatives. Prereq: 4130.

5350 Organizational Policies for Recreation (3) Advanced study in the analysis of organizational policies and functions of management in recreation. Prereq: 4130.

5360 Management and Operation of Recreation Facilities (3) Provides students with knowledge and an understanding of the management process as it pertains to the operation of recreation facilities.

5440 Problems and Projects in Recreation (1-9) Individual research on a problem of special significance to the student. Research projects of a limited nature undertaken in lieu of thesis. May be repeated. Maximum 9 hrs. A new problem must be undertaken for each repetition.

5450 Specialized Study in Recreation (1-9) Advanced comprehensive study in a selected specialized area within the leisure and recreation field. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.
College of Engineering

F. N. Peebles, Dean
W. K. Stair, Associate Dean
W. A. Miller, Associate Dean

Graduate degree programs of the College of Engineering provide opportunities for advanced study leading to the Master of Science degree, the Master of Engineering degree, and the Doctor of Philosophy degree. For a listing, consult majors and degrees available on page 8.

OFF-CAMPUS GRADUATE INSTRUCTION BY VIDEOTAPE-ELECTROWRITER

Since 1966, the College of Engineering has made use of electronic communication techniques to reach students beyond the confines of Knoxville classrooms. These remotely-taught classes make the specialized talents of engineering college faculty available to students at off-campus centers and industrial sites. This effort makes use of video tapes prepared from a regular on-campus class in a specially-equipped classroom. The tapes contain a visual and audible record of a professor's lecture and discussions with the on-campus class. When the tapes are played back at remote locations, telephone/Electrowriter contact is established between the professor and the off-campus class to allow full discussion and questions before or after a tape is played. Periodic visits by the professor are made to each remote class.

Graduate courses have been offered to students at other campuses and established centers of the UT System (Chattanooga, Kingsport, Martin, Nashville, and Tullahoma). A limited number of graduate courses have also been made available to engineers in industrial plants. Such courses are also offered to students using classroom facilities at Jackson State Community College and Columbia State Community College.

The remotely-taught courses offered by UTK carry full graduate credit toward the master's degree under authorization of the regional accrediting agency, the Southern Association of Colleges and Schools.

YEAR-IN-JAPAN M.S. PROGRAM

This is a unique program allowing American engineering students to develop some understanding, both scientific and cultural, of Japan. It allows an M.S. candidate to obtain a degree from UTK while carrying out research work at a Japanese university. The program requires approximately two years, one year being spent in Japan and the remaining period being spent at UTK to fulfill the course requirements and to write the thesis or project report, as appropriate to the particular department. The program is administered in the framework of each department's regular graduate program except that the research is done in Japan.

Although the language of communication in Japan would be English, cultural understanding is one of the important objectives of the program and as such a participant would be asked to begin Japanese language study. At the option of the department, up to 8 hours of graduate credit may be allowed for language study, either at UTK or in Japan.

Financial support for living expenses in Japan and for the roundtrip transportation can usually be arranged through fellowships from the Japanese Ministry of Education.

Engineering Experiment Station

F. N. Peebles, Director
W. K. Stair, Associate Director

The Station is organized to conduct investigations in fundamental engineering science and to aid in the development of the state's resources and industries as far as funds available will permit.

The Station may also make special arrangements with any person or company to study any technical question within the capacity of its resources, and to report the results exclusively to the company requesting the study. In such case, the whole expense will be carried by the parties requesting the investigation.

Engineering Administration

MAJOR

DEGREE

Engineering Administration

Committee:

H. L. Loveless, Chairperson, J. F. Bailey,
F. A. Chamblin, J. R. McMillan, R. E. Shrieves, W. G. Sullivan, R. L. Young

A program of study leading to the degree of Master of Science with a major in Engineering Administration is offered. This program is aimed at providing education for graduate engineers in the organization and direction of work in engineering functions, at a level which requires understanding of such areas as marketing, finance, and industrial relations. It should be emphasized that this is an engineering program, aimed at preparing individuals for line management positions in construction, design, development, and manufacturing, where both technical and non-technical factors exert significant influence on the success of a given activity. The program does not provide the op-
portunity for in-depth study of any of the traditional areas of business administration, and students with such interests are advised to consider graduate programs available in the College of Business Administration.

To be admitted to the Graduate School as a potential candidate for a Master’s degree with a major in Engineering Administration, the applicant must submit reasonable evidence of ability to pursue graduate studies at an acceptable level of performance. In general, the applicant should have graduated from a recognized undergraduate institution in engineering with a satisfactory grade point average. In addition, applicants must satisfy one of the following experience requirements: (1) at least two years of engineering experience after graduation if a full-time student or (2) current employment in engineering work if a part-time student.

THE MASTER’S PROGRAM

Minimum requirements for the Master’s degree are the satisfactory completion of the following courses:

1. An Engineering Core, 27 hours of graduate credit consisting of Engineering Administration 5900, at least three courses chosen from Industrial Engineering 4150, 5110, 5520, and 5710, and a complement of engineering courses normally selected from the student’s undergraduate major department or from courses of other departments pertinent to the program.

2. A Business Administration Core, 15 hours of graduate credit consisting of Accounting 5610, Finance 5050, Marketing 5050, Industrial Management 5130 and Transportation 5210.

3. General Electives, 9 hours of graduate credit chosen from computer science, economics, engineering, management science, mathematics, psychology, statistics, and other program-related disciplines.

The program requirement totals 51 hours of graduate course credit. No thesis is required. A final oral and written examination must be passed on the work offered for the degree. Course prerequisites for the program are Accounting 5610 (or 2110), Computer Science 3150, Industrial Engineering 4520, and Statistics 3450 or their equivalents. None of these prerequisites may be counted as part of the 51 hours of credit offered for the degree. These course prerequisites will be waived upon presentation of evidence of competency in the course subjects. Other prerequisite courses may be required, depending upon the student’s background and the electives chosen.

5002 Non-Thesis Graduation Completion (3-16)
Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5900 Project Engineering Administration (3)
An in-depth study and formal report of an engineering administration topic, normally performed during the last quarter of work toward degree. For M.S. in Engineering Administration candidates only. May be repeated. Maximum of 3 hrs credit to be applied toward degree. Must register for 5900 until project is complete. S/NC only.

Departments of Instruction

Numbers in parentheses following the course titles indicate quarter hours credit offered.

Chemical, Metallurgical, and Polymer Engineering

MAJORS DEGREES
Chemical Engineering M.S., Ph.D.
Metallurgical Engineering M.S., Ph.D.
Polymer Engineering M.S., Ph.D.

Professors:
H. F. Johnson (Head), D.Eng. Yale; D. C. Bogue, Ph.D. Delaware; B. S. Boyle, Ph.D. Massachusetts Institute of Technology; C. R. Brooks, Ph.D. Tennessee; E. S. Clark, Ph.D. California (Berkeley); L. W. Crawford: Ph.D. Cincinnati; O. L. Culberson, Ph.D. Texas; G. C. Frazier, Ph.D. Johns Hopkins; J. M. Holmes, Ph.D. Tennessee; H. W. Hsu, Ph.D. Wisconsin; S. H. Jury, Ph.D. Cincinnati; C. D. Lundin, Ph.D. Pennsylvania; R. N. Lang, Ph.D. Polytechnic; C. J. McHargue, Ph.D. Kentucky; C. F. Moore, Ph.D. Louisiana; B. F. Oliver, Ph.D. Pennsylvania State; J. J. Porana, Ph.D. Northwestern; J. W. Prados, Ph.D. Tennessee; J. E. Spruiell, Ph.D. Tennessee; E. E. Stansbury, Ph.D. Cincinnati; C. O. Thomas, Ph.D. Tennessee; R. A. Vandevenner, Ph.D. Illinois Institute of Technology; J. S. Watson, Ph.D. Tennessee; J. L. White, Ph.D. Delaware; M. A. Wright, Ph.D. Wales.

Associate Professors:

Assistant Professors:

Lecturers:

THE MASTER’S PROGRAM

Minimum departmental requirements include the satisfactory completion of:

1. A major consisting of 18 to 27 quarter hours of graduate courses in chemical engineering, metallurgical engineering, or polymer engineering. The polymer engineering major must include Polymer Engineering 4920, 5110, 5230, 5520 and 5710.

2. One or two minors or collateral work, 9 to 18 hours total in engineering, chemistry, mathematics, physics, or other related fields.


4. Active participation in graduate seminars in the department. Resident students must register for the appropriate 5010 every quarter offered.

5. Final examination covering thesis, related fields, and graduate course work.

THE DOCTORAL PROGRAM

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

Department requirements consist essentially of the satisfactory completion of:

1. Graduate courses in chemical engineering, metallurgical engineering, or polymer engineering amounting to approximately 36 quarter hours, at least 12 of which must be in 6000 series courses. The polymer engineering major must include Polymer Engineering 4920, 5110, 5210, 5230, 5310, 5510, and Chemistry 5140.

2. Supporting courses in related scientific and engineering fields amounting to approximately 36 quarter hours, subject to approval by the student’s faculty committee. These related fields will normally include chemistry, mathematics, physics, and engineering.

3. The preliminary examination, usually given in parts, and covering such material as chemical, metallurgical, and polymer engineering operations and processes, thermodynamics, technology, mathematics, physics, chemistry, and other related fields.

4. Active participation in graduate seminars conducted by the department. Resident students must register for the appropriate 5010 every quarter offered.

5. Reading knowledge of a foreign language relevant to the candidate’s research program; selection of a foreign language to be made in consultation with the faculty committee. Appropriate languages are French, German, Italian, Japanese, Russian.

PROGRAM OPTIONS IN POLYMER SCIENCE AND ENGINEERING

M.S. and Ph.D. degrees with specialization in polymer science and engineering are possible through two routes—one in the department (through chemical or metallurgical engineering with an engineering emphasis and a second in a joint program with the Chemistry Department having a chemical emphasis).

The specialization program in this department requires, for the M.S. degree, a thesis in the field, completion of Polymer Engineering 4920, 5110, 5230, and either 5210 or 5210 plus active participation in the Polymer Seminar. The Ph.D. candidate must meet the above requirements, pass a special written examination in polymer science and engineering, and
complete an additional academic program to be specified by the student's committee. M.S. and Ph.D. degrees in the joint specialization program with the chemistry department require a thesis or dissertation in the field. Chemical and metallurgical engineering departmental requirements include completion of Polymer Engineering 4580 and 4590, Chemistry 5531 and 5140, plus active participation in the Polymer Seminar. Ph.D. students must also pass a special written examination as well as complete the above requirements.

Chemical Engineering

4310 Flow of Fluids (4) Differential and overall momentum balances, mechanical energy balances; flow in tubes, piping systems, and packed beds, metering devices, pumps. Prereq: Elementary Linear Algebra and Calculus of Several Variables, and Mass and Energy Relations. 3 hrs and 1 lab.

4320 Heat Transfer (4) Differential and overall energy balances; steady and unsteady state heat conduction in simple geometries; heat transfer by conduction, convection, and radiation. 3 hrs and 1 lab.


4620 Process Modeling, Simulation, and Control of Chemical Processes (3) Development of process models, experimental process identification, process computer simulation, conventional and digital control; design and implementation of control systems. Prereq: 3420 or equivalent background in basic control theory and differential equations.

5110 Chemical Engineering Principles (3) Basic principles of chemical engineering, design and analysis of chemical and materials processes. Prereq: Consent of instructor.

5130 Methods of Optimization (3) Principles and applications of various mathematical programming techniques to chemical process design and control; variational method; dynamic programming, and geometric programming. Prereq: 4130.

5210 Process Dynamics (3) Generalized analysis of recycle operations, steady state simulation and optimization of typical processes.

5250 Chemical Process Industry Economics (3) Analysis of the economic components of chemical processes, including design economics of the chemical enterprise, and of decision making for investment in capital facilities. Prereq: 4120-30, Math 3150.

5310 Thermodynamics of Heterogeneous Equilibrium (3) Phase rule; equilibrium between phases; composition relationship between phases; ideal and nonideal solutions. Prereq: Thermodynamics.

5320 Statistical Thermodynamics (3) Basic concepts of statistical mechanics and applications to evaluation of thermophysical properties. Prereq: 5310.

5410-20-30 Research and Design in Chemical Engineering (3, 3, 3) Selected diffusional operations, utilizing the stagewise and differential mass transfer bed concepts. Prereq: 5130.

5620 Differential Mass Transfer Operations (3) Equilibrium stage, concepts applied to mass transfer operations, emphasizing nonisothermal and multicomponent systems.

5630 Mass and Energy Flow in Biological Systems (3) Principles of biological systems, microbial active transports; structure and rheology of artificial organs. Prereq: 3440. 3450 or consent of instructor.

5670-82-83 Topics in Chemical Bioengineering (3, 3, 3) Special topics in chemical bioengineering. Prereq: Consent of instructor.

5810-20-30 Special Problems in Chemical Engineering (3, 3, 3) Chemical engineering problems requiring additional work in industrial practice. Prereq: Consent of instructor.

5910 Graduate Seminar (1) May be repeated. Prereq: Admission to graduate program.

5950 Engineering Analysis (3) Analytical formulation and solution of chemical, metallurgical and polymer engineering problems involving the deformation of solids, heat transfer and the motion of fluids. (Same as Metallurgical Engineering 5550 and Polymer Engineering 5560.)

5970 Chemical Reaction Engineering (3) Heat convection in fluids under viscous and turbulent flow conditions, mass transfer, numerical approach; simultaneous diffusion of momentum and heat. Prereq: 5110.

5990 Thesis

6000 Doctoral Research and Dissertation

6130 Process Optimization (3) Optimization of chemical process equipment and systems by various techniques; static and dynamic systems. Prereq: 5130.

6210 Advanced Diffusional Operations (3) A study of fixed and fluidized bed operations utilizing the stagewise and differential mass transfer bed concepts. Prereq: Consent of instructor.

6250 Venture Analysis in the Process Industries (3) The interactions among the line functions of a typical chemical company in the application of modern decision theory and mathematical models to achieve an optimum program of investment and operation in the face of external competition. Prereq: 5250.
6310 Thermodynamics of Irreversible Processes (3) An introduction to the treatment of irreversible chemical processes, transport processes, coupling phenomena, with special emphasis on the kinetic theory of gases, development of the equations of state, thermodynamic, and kinetic theory, development of the equations of state, heat transfer, and mass transfer processes. Prereq: 5510.

6320 Statistical Thermodynamics of Non-equilibrium System (3) A review of elementary kinetic theory, introduction to modern kinetic theory, development of the equations of state, and methods of interest to engineering students. Prereq: 5510.

6410 Stability Phenomena in Chemical Engineering: Discrete Systems (3) Study of instabilities arising in chemical process systems, including elements such as reactors and separation equipment. Emphasis on formulation of models, associated conservation equations, and methods of solution. Prereq: 5510.


6510 Applied Chemical Reaction Kinetics (3) Chemical reactions in gas and liquid phases as well as heterogeneous catalysis; catalyst effectiveness and the role of transport in heterogeneous catalysis; development of phenomenological description although mechanistic models are discussed. Prereq: 5510.

6520 Catalytic Reactor Design (3) Principles of kinetics, heat and mass transfer applied to the design and analysis of heterogeneous catalytic reactors. Prereq: 6510.

6610 Special Topics in Chemical Engineering (3) Advanced problems of current interest to chemical engineers. Prereq: Consent of instructor.

6710 Process Dynamics (3) Development of dynamic models of process equipment from conservation and rate laws; testing of models by frequency, step, and pulse response methods. Prereq: Consent of instructor.

Metallurgical Engineering

3110 Engineering Materials I (4) Introductory course correlating the atomic, crystal, and microstructure of solids with mechanical, physical, and chemical properties of engineering significance. 3 hrs and 1 lab.


3150 Engineering Materials V (3) Extension of 3110 with emphasis on the mechanisms and control of properties of engineering materials with aqueous, nonaqueous, and gaseous environment. Prereq: 3110 or Engineering Materials I, II, or III.


3220 Diffusion and Annealing (3) Introduction to solid state kinetics; point defects, solid solutions, diffusion equations and mechanisms, annealing of cold-worked structures. Prereq: 3210. Coreq: Introduction to Differential Equations.

3230 Phase Transformations (4) Thermodynamic and structural factors governing binary equilibrium. Ternary systems. Kinetics and thermodynamics of phase transformations in simple and complex systems. Prereq: 3220, 3 hrs and 1 lab.

3310 Biomedical Applications of Materials for Life Science (3) Principles of engineering materials; metals, polymers and ceramics; methods of fabrication of components; corrosion applications of prosthetic devices and dental materials. Prereq: General Chemistry or equivalent.

3520 Materials Behavior and Chemical Process Equipment Design (3) Mechanical, metallurgical and chemical considerations in design of chemical processing equipment. Prereq: Process Principles and Materials III or equivalent; 5510 or 5520. (Same as Engineering Mechanics 3520.)

3710 Metallurgical Applications in Manufacturing Technology (6) Fabrication methods and principles of mechanical/thermal processing for finished and semifinished articles; casting, powder metallurgy, plastic forming, joining, heat treatment. Prereq: Engineering Mechanics I or equivalent.

4240-50 Design and Analysis (3, 3) Design and laboratory sessions on the analysis of materials requirements and performance in engineering structures and components. Coreq: 4740, 3 labs.

4510-20 X-Ray Diffraction and Crystallography (3, 3) Lecture and laboratory work in crystallography, projections, x-rays, diffraction phenomena and techniques, introduction to structure determinations. The first quarter serves as an introduction to the subject. 2 hrs and 1 lab.

4540 Fracture-safe Design (3) (Same as Engineering Mechanics 4540.)

4610 Physical Properties of Materials (3) Introduction to electron theory of solids, types of bonding in solids; thermal, electrical and magnetic properties of materials; relationship between metallurgical structure and properties. Prereq: Physical Metallurgy II, 3 hrs or 2 hrs and 1 lab.

4710 Production Metallurgy (3) Thermodynamic and kinetic principles of casting, smelting, refining. Prereq: Thermodynamics.

4730 Mechanical Metallurgy I (3) Elastic behavior, description of stress, strain, and strain; constitutive relations. Effects of composition, microstructure, and loading on mechanical behavior. Failure by yielding. Prereq: 3110 or Engineering Materials I or Process Principles and Materials III. Suggested for mechanical engineering, engineering mechanics and engineering science students. 3 hrs, or 2 hrs and 1 lab.

4740 Mechanical Metallurgy II (3) Ductile and brittle fracture, creep and stress rupture, fatigue, and residual stresses. Effects of state of stress, loading rate, time, temperature and metallurgical structure. Prereq: 3120 or 3320, and 4730 or Mechanical Engineering 3850 or consent of instructor. Also suggested for mechanical, engineering, and industrial engineering, or engineering science students. 3 hrs, or 2 hrs and 1 lab.

4760 Casting and Welding (3) Principles and processes of casting and welding: heat transfer, solidification, non-destructive testing, gas-metal and slag-metal interactions, thermal treatments, associated stresses. Prereq: 3230, 3 hrs and 2 hrs and 1 lab.

4770 Mechanical Metallurgy III (3) Finite plastic strain. Plastic stress-strain relations. Principles of fabrication; forging, swaging, extrusion, rolling, deep drawing. Prereq: 4730 or consent of instructor. Also suggested for mechanical engineering, mechanical engineering, and industrial engineering science majors. 3 hrs, or 2 hrs and 1 lab.

5000 Thesis

5010 Graduate Seminar (1) May be repeated. Prereq: Admission to graduate program.

5050 Engineering Analysis (3) (Same as Chemical Engineering 5050)

5110 Point Defects and Dislocations (3) Theoretical and experimental analysis of point, line, and planar imperfections in solids. Prereq: 3230 or consent of instructor.

5120 Plastic Deformation I (3) Geometry and mechanisms of plastic deformation of single crystals; slip and twinning; work hardening; effects of temperature and alloying on short-term loading. Prereq: 5110.

5130 Plastic Deformation II (3) Plastic deformation of polycrystalline materials; theoretical and experimental analysis of texture formation resulting from deformation and annealing. Prereq: 5120.

5140 Diffusion and Annealing in Solids (3) Analysis of models and experimental observations relating to the phenomenological and mechanistic description of diffusion and annealing of point defects and cold work.

5150 Phase Transformations I (3) Analysis of models and experimental observations relating to the solid-state reactions involved in solidification, phase growth; solidification, precipitation, spinodal decomposition. Prereq: 5140.

5170-80 Plastic Deformation III (3, 3) Fundamental analysis and experimental observations relating to the mechanisms of deformation; fatigue, and fracture in materials. Prereq: 5130.

5210-30-30 Welding Metallurgy (3, 3, 3) Welding processes and the physical metallurgy of welding, including power supplies, heat flow, residual stress, solidification, and solid state reactions, for both simple and complex alloys. Current theories of cracking, hot cracking, and porosity formation are developed. Prereq: Physical Metallurgy.

5310 Solidification and Crystal Growth I (3) Solidification models related to solidification; crystal growth: dendrite, columnar, equiaxed, cellular, and Bastin growth; solidification, precipitation, spinodal decomposition. Prereq: 5140.

5410-20 Advanced X-Ray Diffraction (3, 3, 3) Review of mathematical techniques; generalization of diffraction theory, analysis of scattered intensity in reciprocal space; relationship of scattered intensity to thermal motion, order-disorder, particle size and lattice faults. Introduction to crystal symmetry, space group theory, and crystal structure problems; some laboratory work. Prereq: Mathematics 4610.

5510-20 Applied Properties of Solids (3, 3) Survey course in the properties of solids; crystallography, x-rays, properties of single
and polycrystalline materials, kinetics and thermodynamics of solid reactions, diffusion.

5440-50 Electron Microscopy I and II (3, 3) Kinematical and dynamical diffraction of electrons are developed and their application to electron diffraction patterns and contrast effect in transmission electron microscopy are discussed. Selected applications of metallurgical applications such as plastic deformation, fracture, precipitation, and phase transformations. Prerequisite: 5810-20.

5810-20 Radiation Effects on Materials (3, 3) The interaction of radiation with solid matter, radiation-induced changes in physical and mechanical properties, theory and experiment. The effect of radiation on solid state reactions. Phenomena associated with the use of engineering materials in radiation environments. Prerequisite: Mathematics 4540, Physics 3750 or consent of instructor.

5750 Corrosion (3) Analysis of corrosion processes in terms of polarization measurements and effect of stress, temperature, and localized conditions contributing to pitting, crevice, and stress corrosion.

5810-20-30 Special Topics in Metallurgy (3, 3, 3) Consideration of more recent advances in metallurgy and related fields.

5840-50 Metallurgy of Deformation and Fracture (3, 3) Theoretical and engineering analysis of the effect of stress, strain, strain rate, environment, temperature, and metallurgical structure on mechanical behavior in service, testing, and fabrication.

5910-20-30 Metallurgical Thermodynamics (3, 3, 3) Application of thermodynamic and physical methods to metals and metalurgical reactions. Relation of theory and experiment to the structure of liquid and solid solutions, and to alloy systems.

6000 Doctoral Research and Dissertation

6110-20-30 Theoretical Metallurgy (3, 3, 3) Study of those phases of solid state physics applicable to metallurgy; elasticity, introductory quantum theory, specific heats, electrical resistance, thermal conductivity, magnetic properties, theory of alloy formation. Prerequisite: 4610 or Physics 3750; Mathematics 4550 and consent of instructor.

620-20-30 Rate Process in Metallurgy (3, 3, 3) Considerations of rate processes in solids such as diffusion, recrystallization and grain growth, and phase transformations.

6320-30 Solidification and Crystal Growth (3, 3, 3) Fluid flow, magnetohydrodynamic effects in incompressible liquid conductors, morphology, stability of steady state coupled flow and mass transfer processes in liquid to solid transition, multiphase solidification, composites, nonsteady state dendritic phenomena, some nucleation phenomena. Prerequisite: 5310.

6410-20 Thermodynamics of Solids (3, 3) Classical and statistical thermodynamic analysis of the stability of solid solutions, compounds and ordered phases. Prerequisite: 5910-20-30 or consent of instructor.

6810 Mechanical and Physical Properties of Crystals I (3) The anisotropic behavior of crystalline materials treated by matrix and tensor techniques. Property classification and interpretation of deformation behavior. Prerequisite: Core curriculum in Metallurgical Engineering and Mathematics 4560 or 4710 or consent of instructor.

6820 Mechanical and Physical Properties of Crystals II (3) Continuation of Metallurgical Engineering 6810 with emphasis on transport phenomena and thermodynamics. Prerequisite: 6810 or consent of instructor.

6830 Seminar in Anisotropic Properties of Crystals (3) Selected topics of current interest in the area of anisotropic behavior of crystalline materials. May be repeated. Prerequisite: 6810 or 6820, or consent of instructor.

Polymer Engineering

4910 Applied Polymer Science (3) A first course in the physical properties of polymers. Prerequisite: Crystallography, general chemistry and calculus. Prerequisite: 5910-20 or consent of instructor.

4920 Polymer Processing (3) Rheological properties of polymer melts and solutions, thermoviscoelasticity, unit operations of fiber, plastics and rubber industries: dimensional analysis and scale-up, flow through dies and pipelines, screw extrusion, spinning of fibers, injection molding.

4930 Principles of Fiber and Textile Engineering (3) Chemical and crystalline structure of important fibers; melt, wet and dry spinning of man-made fibers; drawing and texitizing; preparation of yarn; dyeing; weaving and knitting. Emphasis on qualitative aspects.

4940 Plastics Fabrication Operations (3) Lecture and laboratory covering unit operations of the plastics industry. Types and mechanisms of operation of machinery used and the structures of fabricated parts. Operations include: extrusion, injection molding including structural foam, thermofoming, blow molding, rotational molding.

5000 Thesis

5010 Graduate Seminar (1) May be repeated. Prerequisite: Admission to graduate program.

5050 Engineering Analysis (3) (Same as Chemical Engineering 5050)

5110 Structural Characterization of Polymers (3) Experimental methods of determining the nature of transitions and structural characteristics of polymers most pertinent to plastics, fibers, and rubber applications. Methods of determination of tacticity, crystalline structure, orientation, morphology, including x-ray diffraction, nuclear magnetic resonance, and electron microscopy. Coreq: 4910 or equivalent.

5210 Non-Newtonian Fluid Mechanics (3) Tensor analysis; generalized equations of motion; survey of non-Newtonian technology. Prerequisite: 4610 or Mathematics 4560. (Same as Engineering Science and Mechanics 5230)

5230 Mechanical Behavior of Solid Polymers (3) Application of linear viscoelasticity and large deformation elasticity to solid polymers. Relation of microscopic properties to molecular structure.

5310 Polymer Solution Properties and Characterization (3) Molecular weight determination, chromatography, solution thermodynamics, phase separation; application to synthetic and natural organic amorphous behavior. Prerequisite: Undergraduate physical chemistry.

5510 Modern Research Tools and Instruments for Polymer Science (3) Laboratory course in methods of characterization of polymers. Includes gel permeation chromatography, intrinsic viscosity, spectral analysis, measurements of melt flow properties, calorimetry, and dynamic mechanical measurements. Coreq: 5310.

5710 Phase Transformations in Polymer Systems (3) Analysis of nucleation and growth of phases in polymer systems, statistical decom-
The Department of Civil Engineering offers two options for the Master of Science in Civil Engineering leading to the degree of Master of Science are offered to graduates of recognized undergraduate curricula.

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

CIVIL ENGINEERING

The Department of Civil Engineering offers programs in Civil Engineering and in Environmental Engineering leading to the degree of Master of Science. The student’s advisor will assist in planning the program of study to ensure that it includes the necessary design content. The thesis and non-thesis options noted under the Master of Science Programs are also available under these programs.

THE MASTER'S PROGRAM

Graduate programs in Civil Engineering and in Environmental Engineering leading to the degree of Master of Science are available to qualified graduates of ECPD-accredited undergraduate curricula in civil engineering or environmental engineering. At least one third of the program of study must be classified as engineering design. The student’s advisor will assist in planning the program of study to ensure that it includes the necessary design content. The thesis and non-thesis options noted under the Master of Science Programs are also available under these programs.

THE DOCTORAL PROGRAM

A graduate program leading to the degree of Doctor of Philosophy is offered in Civil Engineering. Major fields of study include environmental engineering, structural engineering, and transportation planning.

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

1. A minimum of 108 quarter hours credit beyond the Bachelor’s degree, exclusive of credit for the M.S. thesis. Of this number, a minimum of 36 quarter hours credit in Doctoral Research and Dissertation will be required.

2. A minimum of 36 quarter hours of graduate courses in the Civil Engineering Department, exclusive of thesis or dissertation credit, at least 9 hours of which must be 6000-level courses.

3. Supporting courses in related scientific and engineering fields, amounting to approximately 36 quarter hours, subject to approval by the student’s faculty committee.

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

5. Upon completion of at least one-half of all course work, each student must pass a preliminary examination.

6. After completion of the dissertation, prior to graduation, each student must pass a final examination administered by a faculty committee.
studies; basic considerations of traffic circulation and control; elements of urban transportation planning studies.

4660 Airport Planning and Design II (3) Integration and application of the principles of airport planning and design purposes of site selection and design of an airport facility through a comprehensive team project, also includes environmental evaluation of design. Prereq: 4620 or 2 hr lab.

4710 Portland Cement Concrete Mix Design (3) Properties and tests of portland cement concrete, methods of concrete mix design, normal and high strength, economic and technological use of concrete admixtures. Prereq: Materials of Construction. 2 hrs and 1 lab.

4720 Asphalt and Bituminous Concrete (3) Properties and tests of asphalts and asphaltic mixes, design of bituminous concrete. Emphasis on use of asphalt in transportation construction projects. Prereq: Materials of Construction. 2 hrs and 1 lab.

4731-32 Earthquake Resistant Structures I & II (4) (Same as Architecture 4731-32.)

4800 Introduction to Civil Engineering Systems 1100 (3) Description of civil engineering systems and their specific application to problems of transportation, environmental, water resource and materials design. Prereq: Senior standing or consent of instructor.

4850 Elementary Structural Matrix Methods (4) (Same as Engineering Science 4850 and Architecture 4850.)

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110-20 Statically Indeterminate Structures (3, 3) Deflections of beams and trusses; analysis by force methods and by slope-deflection in 5110; analysis by moment distribution and other displacement methods, secondary stresses in 5120.

5140 Statically Indeterminate Structures 1000 (3) Analysis of statically indeterminate linear and space frames. Prereq: 5110 and 5120.

5150 Matrix Formulation of Structural Problems (3) Review of matrix algebra, vectors, stiffness and force methods; formulating the flexibility analysis of plane trusses, general members, and structures composed of general members. Prereq: 4540 or consent of instructor.

5160 Analysis and Design of Plate Structures (3) Fundamental theorems of bending and buckling of plates; practical application of theory to analysis and design of bridge and building floors and structural plate components. Prereq: 5110.

5170 Introduction to Structural Dynamics (3) Analysis of free and forced vibrations, and transient response of structures having many degrees of freedom; elastoplastic behavior considered for structural systems; approximate design methods developed. Prereq: 5120, 5150.

5180 Finite Element Structural Analysis (3) Application of the finite element method to structural analysis; plane stress, plane strain, axisymmetric, and three-dimensional elements; use of typical computer programs. Prereq: 5150, and Engineering Mechanics 5820 or 5860. (Same as Engineering Mechanics 5180.)

5220 Pavement Design (3) Characteristics of pavement materials and pavements; design; design practices; construction and maintenance. Prereq: Engineering Properties of Soils.

5240 Advanced Properties of Materials: Cement and Concrete (3) Permeability and durability; volume changes and creep; elastic and thermal properties of concrete, special types of concrete; causes of failure. Prereq: 4710.

5250 Advanced Properties of Materials: Bituminous Substances and Mixes (3) Serviceability concepts; pavement failures and remedies; bituminous pavement maintenance techniques; other uses of asphalt products. Prereq: 4720.

5270 Planning and Transportation (3) Methods for preparation of transportation elements of comprehensive development plans. Analysis of relationships between various transportation modes and between transportation and other community features. (Same as Planning 5270.)

5310 Engineering Practice (3) Valuation and feasibility studies; depreciation and useful life; engineering economics.

5320-30 Engineering Practice Applied to Administration of Engineering Projects (3, 3) Factors of engineering administration; planning of governmental and industrial projects; cost estimates and methods of financing.

5420 Structural Model Analysis (3) Experimental methods of shear, moment, and stress analysis.

5430-50-70 Construction Management I, II, III (3, 3, 3) Management and organization of heavy and building construction projects. Prereq: 4450 or consent of instructor.

5460-70 Construction Estimating I, II (3, 3) Laboratory analysis of project. Costs, estimating techniques; market cost conditions and feasibility of design as it applies to costs. Prereq: 4430 or consent of instructor.

5550 Soil Mechanics—Plastic Equilibrium (3) Review of failure theories; earth pressure analysis, bearing capacity analysis, and slope stability analysis. Prereq: Physical Properties of Soils or consent of instructor.

5560 Soil Mechanics—Elastic Behavior (3) Stress-deformation characteristics, theory of consolidation, theories of settlement analysis. Prereq: Physical Properties of Soils or consent of instructor.

5570 Soil Mechanics—Seepage (3) Saturated flow through embankments, filter design criteria, seepage forces and velocities, subdrains, and embankment materials. Prereq: Physical Properties of Soils or consent of instructor.

5610 Behavior of Steel Structures (3) Behavior of structural steel members due to static, fatigue, and seismic loading. Prereq: 5110, 5120.

5730 Prestressed Concrete (3) Properties of prestressing materials and anchorage systems; methods of prestressing and posttensioning; analysis and design of members and continuous structures.

5740 Behavior of Reinforced Concrete Members (3) Ultimate strength and behavior of reinforced concrete members; relation between research results and current specifications for design. Prereq: 4120.

5760 Urban Systems: Engineering and Management I (3) The management of various urban systems usually under the responsibility of a city manager and/or city engineer. Includes organization; management administration; purchasing and equipment management and dealing with engineering consultants as each deals with municipal public works. Prereq: Graduate standing in Civil or Environmental Engineering or consent of instructor.

5785 Urban Systems: Engineering and Management II (3) Continuation of 5760 dealing with the management and engineering of urban streets, including lighting, cleaning and snow removal, water supply and waste-water drainage, solid waste, air pollution and regulations. Prereq: 5660.

5810 Traffic Engineering—Characteristics of the Theoretical and Practical Considerations of the characteristics of the driver-vehicle-roadway system; level-of-service concept of capacity. Coreqs: Statistics 3450 or 5311. 2 hrs and 1 2-hr lab.

5820 Traffic Engineering—Operations (3) Fixed-time and volume-density controllers; progressive systems; one-way operations; reversible flows; on- and off-ramps; computerized networks; legal aspects of operational controls. Prereq: 5810. 2 hrs and 1 2-hr lab.

5840 Geometric Design (3) Advanced theory and practice in the geometric design of highways. Prereq: Highway Engineering I.

5850 Functional Design of City Streets and Urban Freeways (3) The effect of street systems upon urban growth and development; classification and function of streets; design features, including cross section, intersections, utility considerations, planning, effect of mass transit; channelization; marketing; lighting; the freeway, frontage road, surface street system. Prereq: Consent of Instructor.

5860 Urban Transportation Planning (3) The use of various models for the prediction of traffic demands and their use; traffic forecasting; pavement planning; parking needs. Prereq: 5810.

5870 Public Transit Planning (3) The planning process as required for the study of potential urban transit systems; the role of public transit in its various roles and how it fits the community's need; user preferences; modal split models; and the total social, political, economic and technical impacts of public transit. Prereq: Highway Engineering I or graduate standing.

5890 Traffic Accident Reconstruction (3) The importance of proper accident data collection and analysis is discussed as a basis of designing accident prevention or control programs. Emphasis is on examining the many contributing factors to an accident. Proximate and secondary accident causes will be discussed as they may relate to roadway improvements. Prereq: 4650 or 5810 or consent of instructor.

5900 Special Problems in Civil Engineering (1) Study of a specific special problem or special problems. May be repeated. Maximum 9 hrs. S/NC only. Prereq: Consent of Instructor.

5910 Special Topics (3, 3, 3) Analysis and design of certain civil engineering structures not included in other courses such as arches, long span and movable bridges, complex trusses.

5900 Doctoral Research and Dissertation

5910 Behavior of Steel Bridges and Buildings (3) Behavior, analysis, and design of plate girders, columns and composite members subjected to static and dynamic loading. Prereq: 5120 or 5270.

5940 Behavior of Reinforced Concrete Beams and Frames (3) Ultimate strength and behavior of statically indeterminate reinforced concrete structures; applicability of elastic analysis to framed structures; limit analysis. Prereq: 5120 and 5740.

5970 Behavior of Reinforced Concrete Slabs (3) Behavior, analysis, and design of reinforced concrete slabs; deflection problems; structural systems; Code methods; yield-line theory. Prereq: 5740, 5910 or Engineering Mechanics 6310.
8630 Traffic Flow Theory (3) Special problems in traffic engineering, using queueing theory, Markov processes, Monte Carlo methods, and simulations of various conditions and/or designs. Prereq: 4540 or Mathematics 3150; 5820.

8680 Statewide Transportation Planning (3) Preparation of comprehensive transportation plans. Introduction to probabilistic models, functional classification, programming and scheduling. Emphasis on government policies, decisions, especially as they affect air and highway investments. Prereq: 5860.

8670 Future Transit Technology and Research (3) New transit systems and new technology are identified and evaluated. Also considered are the possible research areas in both technology and the planning process and possible research designs. Prereq: 5870.

8680 Planning Models for Transportation Systems I (3) An analytical analysis of trip generation employing mathematical, statistical, and computer science techniques. Also an introduction to modal split, trip distribution, and trip assignment will be made. These statistical procedures are integrated into the urban transportation planning process. State-of-the-art and New modeling techniques are investigated. Prereq: 3220, Mathematics 3150 and Statistics 3450.

8690 Planning Models for Transportation Systems II (3) An analytical analysis of modal split, trip distribution, and trip assignment. Mathematical, computer science techniques are used in the modeling process. These models are integrated for use in the urban transportation planning process. Prereq: 8680.

9610-20-30 Special Topics in Civil Engineering (3, 3, 3) Selected advanced problems of current interest. Prereq: Consent of instructor. NOTE: Not all of the above courses will be offered in any one year.

Environmental Engineering

3000 Introduction to Environmental Engineering (3) Introduction to man's interaction with the air, water, and land environment in which he lives; role of engineering in environmental protection.


4150 Urban Water Management (3) Introduction to urban water modeling; evaluation of optimum urban water policies; formulation of system constraints and analysis of decision-making process; management of storm water for beneficial use. Prereq: 3000 and Elementary Hydrology.

4210 Water Resources Engineering Design (3) Elements of water resource structures and systems, including reservoirs, dams, control works, and open channel design. Dam safety control, environmental impact of reservoir projects. Prereq: Consent of instructor.

4220 Water Resources Engineering Development (3) Principles of water resource development and single or multipurpose planning; economics in alternative decisions; principal water uses; multiobjectives; evaluation procedures for water and resource projects; Tennessee water law principles; special topics of current interest. Prereq: Consent of instructor.

4330 Hydrologic Design (3) Application of frequency analysis and design cash flows to hydrologic design of water resources system; unsteady surface runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow quantity and quality. Prereq: Elementary Hydrology.


4520 Elements of Water and Wastewater Treatment Systems Design (3) An introduction to the unit operations and processes employed in the physical, chemical, and biological treatment of water and wastewater. Application of unit operations and processes design criteria for water and wastewater treatment plants. Prereq: 3000 and Hydraulics.

4530 Sanitary Engineering Laboratory (3) Physical, chemical, and bacteriological analysis of water and wastewater. Prereq: 4030. 3 labs.

4600 Solid Waste Management (3) Quantities and characteristics of solid wastes; collection methods in the urban environment. The impact of solid waste management problems. The framework will be set for the next course. Prereq: 5270, Mathematics 3150 and Statistics 3450.

4700 Air Pollution-Air Resources Management (3) An introductory course on the concepts of air pollution; analysis of the relationship among emission sources; meteorology and topographic factors; control, legal aspects, and economic considerations; engineering approaches for air pollution control.

4810 Water Law (3) Survey study in water law, including case studies and water law doctrines (Same at Water Resources Development 4810.)

4820 Environmental Engineering Law (3) Legal aspects of water and air pollution, drainage, land use controls and environmental impact statements with emphasis upon federal, state regulations, recent legislation and court decisions, and enforcement. Prereq: Senior standing.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student enrolls at a university facility or faculty degree before degree is completed. May not be used toward degree requirements. May be repeated. Sr/NC only.

5100 Water and Urban Welfare (3) Evaluation of social, economic, and environmental impact on planning and management of urban water systems. Emphasis upon conflict and choice, reconciliation between environmental and developmental values, measurement of social well-being, and quality of life parameters. Procedures for analyzing multilevel policy alternatives with selected case studies. Prereq: Consent of instructor.

5160 Planning and Utilities (3) Planning for adequate water supply and sewage waste disposal for urban development, and the problems of utility service policies. Not for civil engineering majors. (Same as Planning 5160 and Water Resources Development 5160.)

5200 Water Resources Systems (3) Control, utilization and management of water in water resources engineering. (Same as Water Resources Development 5200.)

5210 Advanced Water Resources Engineering (3) Complex problems encountered in water resources engineering such as water hammer, surges, wave action, and regression analysis to hydrologic design of water resources systems; unsteady surface runoff and streamflow modeling; urban peak runoff design using kinematic wave theory; evaluation of effects of land use changes on streamflow quantity and quality. Prereq: Elementary Hydrology.

5232 Sediment Transportation (3) Sediment processes and their control. Analysis of suspended load movement; erosion, scour, transportation and deposition of sediments by flowing water; lifting of reservoirs and related topics. Prereq: 5230.

5234 Flood Damage Reduction (3) Survey of national, regional, local flood problems; hydrologic design criteria; traditional flood control measures, land use controls and adjustments; floodproofing, flood insurance, and other flood damage reduction elements; interdisciplinary approach in floodplain management; case studies. Prereq: Consent of instructor.

5261 Basic Principles of Remote Sensing (3) Introduction to the applications of remote sensing in agriculture, engineering, forestry, meteorology, land use planning, and resource management; properties of electromagnetic radiation including wave theory, physical and geometric optics, interference, polarization, reflection and matter; current data handling technology. Prereq: Consent of instructor.

5262 Remote Sensing Data Acquisition (3) Theory of active and passive sensors, their array, specialized sensors, data collection; description of remote sensing platforms, including the Earth Resources Satellite Communication System, mission planning. Prereq: 5261 or consent of instructor.


5301 Stormwater Modeling I (3) Interpretation of hydrologic data using methods of systems analysis. Hydrologic components are analyzed as linear and non-linear systems and integrated into mathematical models of watershed response. Methods are presented for optimizing model parameters and synthesis for alternative cases. Prereq: Consent of instructor.

5302 Stormwater Modeling II (3) Continuous streamflow records are interpreted using methods of systems analysis to determine frequency, time and time series analysis. Hydrologic design of water resources systems using streamflow records with emphasis on autoregressive and fractional gaussian noise models. Prereq: Consent of Instructor.


5330 Descriptive Hydrology (3) Occurrence and description of elements of the hydrocycle; its effects on earth and its relation to man. Not for civil engineering majors. (Same as Water Resources Development 5330.)

5400 Introduction to Environmental Systems (3) Consideration of models of air and water quality, water resources, solid waste disposal, and location of central facilities; it is aimed at exposure to current literature on environmental management and assessment procedures, waste management, and suspended load movement; erosion, scour, transportation and deposition of sediments by flowing water; lifting of reservoirs and related topics. Prereq: 5230.
5501 Water and Wastewater Treatment Theory I (3) Theory of unit operations employed in sanitary engineering. Prereq: 4520.

5502 Water and Wastewater Treatment Theory II (3) Theory of physical, chemical, and biological processes employed in sanitary engineering. Prereq: 5501.


5530 Environmental Engineering and Natural System Behavior (3) Course centers about the relationship between environmental engineering and natural system behavior by focusing on eutrophication and the limiting nutrient concept in relation to research on the subject and its translation into law and wastewater engineering practice. Course conduct is in the seminar-open discussion format which actively involves all student participants. Prereq: Graduat e standing or consent of instructor.

5551 Water Quality Management (3) Water quality control, objective, methods, and philosophies; water quality criteria; effect of various uses on water quality; receiving water characteristics and assimilation capacity; regulatory standards; economic considerations. Prereq: 3000 or consent of instructor.

5551 Environmental Management of Water Quality (3) Water quality management and the control of pollution resulting from agricultural and industrial use upon water quality; legal, administrative, and economic aspects, waste assimilative capacity and wasteload allocation; and the engineering management of water quality via nonpoint-source pollution, biological, physical, chemical, and advanced treatment processes. Prereq: 3000 or equivalent.

5582 Microbiology for Sanitary Engineers (3) A study of microorganisms and microbiological processes, which are significant in sanitary engineering, including basic microbiology, detection and identification, enzyme, metabolic reactions, energy transfer, synthesis and growth; aerobic and anaerobic biological treatment processes. Prereq: Graduating standing.

5593 Advanced Sanitary Engineering Laboratory (1-3) Advance laboratory techniques in the analysis of water and wastewater. Application of modern instrumental procedures for trace chemical, and biological analysis. Prereq: 4550. 3 labs.

5600 Solid Wastes (3) Magnitude and characteristics of the solid waste problem; methods for control and disposal of solid wastes, including sanitary landfill, incineration, composting, proposed new technologies, and recycling. Prereq: Graduate engineering major or consent of instructor.

5610 Solid Waste Disposal (3) Engineering design course in solid waste disposal. Problems in the areas of landfill design and costing, incinerator design and costing, and special topical areas. Prereq: 5600.


5700 Planning and Air Pollution Control (3) The influence of atmospheric and air pollution, area development, and urban growth. Social, economic, and political processes involved in air pollution control.

5710 Air Pollution Control Engineering (3) Emission control systems for industrial and power generating processes, stack sampling methods, air pollution dispersion, and pollutants. Prereq: 4700 and Fluid Mechanics.

5720 Air Pollution Particle Collection Theory (3) The mechanics of particles suspended in a gaseous medium including particle motion, coagulation, and aerodynamic capture of particles. Prereq: 4700 and Fluid Mechanics.

5725 Air Quality Modeling and Impact Assessment (3) Development of techniques to assess the potential impacts of major tracity projects and industrial air pollution sources. Application of atmospheric dispersion models and the meteorological and air quality data. Prereq: Graduate standing, Computer Science 3150.

5730 Air Pollution Control Device Design (3) Design and evaluation of systems used to control the emission of atmospheric and particulate pollutants. Comprehensive design of specific devices and systems. Prereq: 5720.

5735 Industrial Source Sampling (3) Review and application of sampling methods gaseous and particulate air pollutant emissions from industrial processes. 2 hrs and 1 lab. Prereq: Graduate standing.

5740 Dynamical and Physical Meteorology (3) Theoretical boundary layer processes which are significant in sanitary engineering including clear air turbulence in shear zones in the free atmosphere are suggested. Prereq: 5740.

5760 Diffusion in the Atmosphere (3) Movement and dilution of natural or man-made material released into the atmosphere. Basic theory is developed and observations reviewed. Specific topics include the rise of buoyant plumes, the interaction of plumes with the atmospheric boundary layer, mean wind and temperature profiles are derived and related to observations. Methods of estimating surface fluxes, energy spectra, and cospectra are outlined. It is shown how the theories can be applied to describe changes in turbulence in air flow in urban areas. Mechanisms of formation of clear air turbulence in shear zones in the free atmosphere are suggested. Prereq: 5740.

5900 Special Problems in Environmental Engineering (1-9) Study of environmental engineering problems to fulfill the special problem requirement in the non-thesis program. Enrollment limited to environmental engineering students in the non-thesis program. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5910-20-30 Special Topics (3, 3, 3) Problems and topics related to current developments in the field of environmental engineering not included in other courses.

5990 Environmental Engineering Seminar (1) Discussions on all phases of environmental engineering including reports on current research at The University of Tennessee, Knoxville. Course credit not applicable to graduate degree program. Prereq: Graduate active standing in environmental engineering. May be repeated. S/NC only.

6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) (Same as Engineering Mechanics 6110-20).


6500 Industrial Waste Treatability and Process Control (6) Sources and characteristics of industrial wastes; treatment alternatives related to ultimate disposal, treatability and process control studies of physical, chemical, and biological processes. Prereq: Laboratory-scale treatment units. Field trips, 2 hrs and 4 labs. Prereq: 5513 and 5593.


910-20-30 Special Topics in Environmental Engineering (3, 3, 3) Selected advanced problems of current interest in environmental engineering. Prereq: Consent of instructor.

Note: Not all of the above graduate courses will be given in any one year. Prerequisite to all graduate courses: Consent of instructor.

Electrical Engineering

MAJOR

DEGREES

M.E., M.S., Ph.D.

Professors:


Associate Professors:

A. O. Bishop, Ph.D. Clemson; R. C. Gonzalez, Ph.D. Florida; E. L. Hall, Ph.D. Mississippi; H. P. Nett, Ph.D. Auburn, P.E.; M. O. Pace, Ph.D. Georgia Institute of Technology; T. W. Reddoch, Ph.D. Louisiana State; D. Rosenberg, Ph.D. New York; H. M. Scull (Emeritus), M.S. Columbia, P.E.; F. W. Symonds, Ph.D. Nottingham (UK).

Assistant Professors:

M. B. Smith, M.S., Vanderbilt; J. W. Waller, Ph.D. Tennessee.

THE MASTER'S PROGRAM

Graduate work leading to the Master of Science degree 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. Graduate assistantships are available for outstanding students, who may obtain the Master's degree in one calendar year.

Specifiable departmental requirements include:

1. Electrical Engineering 5700-80 and 5710. Electrical Engineering 5710 is normally available in both fall and spring quarters. Students electing courses such as 5650-80, 5700-30, or 5750-80 which require 5710 as a prerequisite should register for 5710 in the fall quarter.

2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics
work in electrical engineering and 9 quarter hours in another approved area.

3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.

4. Master's thesis, totaling 9 quarter hours or more.

5. A final oral examination covering the thesis and related course work.


A graduate program leading to the Master of Engineering degree is available to qualified graduates of ECPO-accredited undergraduate curricula in electrical engineering or its equivalent.

Specific degree requirements which must be met include:


2. Nine quarter hours of graduate credit in mathematics consisting of Mathematics 4710, 4550, and 4250, or 4510-20-30. Other approved 4000-5000 level mathematics courses must be substituted for any of the above course material covered in undergraduate work.

3. An additional 18 quarter hours of 5000-level work in electrical engineering or 9 quarter hours of 5000-level work in electrical engineering and 9 quarter hours in another approved area.

4. Master's thesis, totaling 9 quarter hours or more.

5. A final oral examination covering the thesis and related course work.

D O C T O R A L P R O G R A M

The Ph.D. degree with a major in Electrical Engineering may be pursued in the areas of circuit theory, electronics, communication theory, electromagnetic theory, power systems, solid-state electronics, and control systems.

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

1. A minimum of 72 quarter hours of course work excluding thesis, research, and dissertation credit.

2. A minimum of 36 quarter hours credit in doctoral dissertation.

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

4. Satisfactory performance on both a written and an oral preliminary examination.

5. Participation in departmental seminars.

The 72 quarter hours of course work must satisfy the following requirements:

a. A minimum of 36 quarter hours of work in electrical engineering at the 5000 and 6000 levels.

b. A minimum of 12 quarter hours of 6000-level course work. At least 3 quarter hours of this work must be in an area other than the student's major area.

c. At least 12 quarter hours of mathematics at the 4000-level or above.

Mathematics (or Physics) 5810-20-30 is usually required.

Courses required in the electrical engineering undergraduate curriculum cannot be used in either the M.S. or Ph.D. programs. In addition, 4000-level courses in electrical engineering may not be used if 5000-level courses are available in the same area.

Graduate course work in 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 providing special opportunities for academic and research work in areas pertinent to atmospheric and space flight are also available at the Space Institute, Tullahoma.

3010 Transient Analysis (3) Analysis of transient responses of linear systems and systems; Laplace transform methods and classical differential equation methods for system analysis; complex frequency concept and pole-zero concepts; applications to engineering problems. Prereq: Circuits III.


3050 Basic Field Theory (3) Forces between charges, electric and magnetic fields, Gauss's law and divergence, potential and line integrals, material bodies, polarization, magnetic circuits, Maxwell's equations, dynamic potentials. Prereq: Multivariable calculus and linear algebra.

3060 Propagation I (3) Plane waves, reflection, guided waves, transmission lines, standing waves, impedance, impedance matching, graphical methods, rectangular wave guides. Prereq: 3050. 4 labs.

3080 Energy Conversion (3) Magnetic circuits, transformer theory and operation, principles of electromechanical energy conversion with emphasis on input-output characteristics; steady-state analysis, power system components, and d.c. machinery. Prereq: 3040. 4 labs.

3090 System Energy Operation (3) Synchronous machines, transmission-lines, and transformers as power system elements; power system representations, per unit calculation, symmetrical components, and fault studies. Prereq: 3080. 4 labs.


3110 Basic Electrical Engineering—Circuits and Fields (3) For non-electrical engineering majors. Prereq: 3110. 4 labs.

3120 Basic Electrical Engineering—Electronics (3) For non-electrical engineering majors. Prereq: 3110. 4 labs.

3130 Basic Electrical Engineering—Machinery (3) For non-electrical engineering majors. Prereq: 3110. 4 labs.

3180 Logic Design of Digital Systems (3) Introduction to boolean algebra and design of combinational circuits and synchronous circuit implementations. Design of clocked sequential circuits and other systems containing memory. Introduction to computer architecture and system components to include basic structure and function of arithmetic, storage, input-output, and control systems. Instruction set capabilities and machine language programming. Prereq: Computer Science 3150. 4 labs.

3190 Planning and Engineering (3) Engineering applications of physical electronics, plasma effects and devices. Topical include electrostatic precipitators and plasma light sources, laser operation and applications (electro-optics), and MHD, controlled thermoelectric and other techniques of advanced power production. Prereq: Fundamentals of Physics, Astronomy, Waves and Optics, Modern Physics. 4 labs.

3720 Linear Systems Analysis (3) Review of steady state and transient response; long frequency, gain phase, and pole plots; block diagram transformation; signal flow graphs; analogous systems; properties of second order systems; introduction to feedback theories. Prereq: Mathematics 3150. Coreq: 3180. Occasional labs.

3810 Electronics I—Basic Electronic Processes (3) Current conduction in semiconductors and high vacuum diodes and transistors, characteristics of diodes; rectifiers and diode switches. Prereq: Circuits II, 3040 concurrently. 4 labs.

3820 Electronics II—Basic Electronic Devices (3) Characteristics and equivalent circuits of vacuum tubes and transistors with application to amplifier and control circuits. Prereq: 3810. 4 labs.

3830 Electronics III—Basic Electronic Amplifiers (3) Vacuum tube and transistor dc coupled amplifiers; tuned amplifiers; basic power amplifiers; bias stability, feedback. Prereq: 3810 and 3320. Coreq: 3720. 4 labs.

4210 Direct Electrical Energy Conversion (3) Basic principles, typical devices and applications for the production of electrical energy by thermoelectric effects, thermionic conversion, magnetohydrodynamics, solar cells, and fuel cells. Laboratory demonstrations. Prereq: 3050, 3190, 3810, and Mechanical Engineering 3530.

4380 Microwave Circuits and Electronics (3) Circuits represented by wave scattering, locators, gyrotrons, couplers, microwave vacuum diodes and klystrons, crossed field devices, parametric amplifiers, analyzer of independent conductors, varactor semiconductors. Prereq: 3060. 4 labs.

4990 Propagation II (3) Metal tube, dielectric rod, and stripline waveguides. Waveguide resonators and other loading components. Desigm of structures utilized for microwave power transmission and for microwave integrated circuits. Prereq: 3060. 4 labs.


4200 Electromagnetic Field Translators (3) Pulse propagation on lines, reflection of pulses. Time domain radiation of pulses from antennas. Prereq: 3060. 4 labs.


4370 Introduction to Feedback System Design (3) Mathematical formulation of control sys-
tem; stability theorems; root-locus method; optimum gain adjustments; compensation networks; introduction to compensation. Prereq: 3720. Lab optional.

4410 Power System Components and Control (3) Analysis of power system components and their interconnection. Studies in control of power systems as applied to system response, including as voltage and reactive power. Prereq: 3090.

4420 Power Systems Analysis (3) System studies including load flow, faults, and sta-
bility. Prereq: 3090.

4430 Transmission, Distribution, and Protec-
tion (3) Studies in underground and d.c. trans-
mission; consideration of over-voltages and insulation requirements; system protection against faults. Prereq: 3090.

4460 Bioelectric Instrumentation (3) Nature and origin of bioelectric potentials, trans-
ducers, amplifier requirements, recording sys-
tems, and noise problems.


4830 Digital Image Processing (3) Principal methods for coding, storing, and processing images by means of digital computers. Com-
putational algorithms for image operations.

5000 Thesis

5070-80 Modern Transform Methods (3, 3) Laplace transform and complex variable theory; Z-transform, difference equations and distri-
buted parameter systems.

5110 Introduction to Network Analysis (3) Topological considerations in writing network equations. Transient and steady-state analysis using circuit and state transition methods. Prereq: 3180. 4 labs.

5120 Network Synthesis and Design (3) Fre-
quency response and passive components for monolithic and hybrid circuits. Design of linear and digital monolithic and hybrid circuits packaging, reliability, and large scale integration. Prereq: 3830.

5190 Bioengineering Systems III Instrumenta-
tion and Analysis (3) Bioengineering Instrumentation and the process by which information is gathered and transmitted from a biological system under test and the process by which this information is treated, as to signal analysis and modeling, in order to maximize the yield of meaningful information about the original biological sys-
tem. Prereq: 4660 or consent of instructor.

5200-50-60 Advanced Electrical Machinery (3, 3, 3) Fundamental processes of electromechanical energy conversion; application in conventional devices. Differential equations for rotating ma-
chines; Park's transformation and the twoaxis model, with emphasis on the transient behavior of isolated and interconnected rotat-
ing machines. Prereq: 4780 or equivalent.

5230 Advanced Electrical Machinery Applica-
tions (3) Linear motors; pole amplitude modu-
lization and other speed control techniques; variable frequency operation. Prereq: 5210.

5240-50 Control Systems (3, 3, 3) Analysis and design of continuous and discrete control systems using classical and modern tech-
iques. Discussed are feedback theory; system modeling; stability analysis; system response to
5410 Basic Requirements for Plasma Fusion (3) An historical study of fusion systems in nature. The Lawson break-even criterion. Inertial fusion systems—the hydrogen bomb, laser fusion, and electron-beam fusion. Magnetically-confined plasma systems, including the tokamak, mirror-maps, and exotic magnetic systems. Confinement, stability, and heating. The possibility of fusion-fission hybrids. Prereq.: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5350 Engineering of Fusion (3) Materials in a thermonuclear environment. Magnetic field production and control. Breeding and breeding of Tritium. Radiological Safety. Cost of Controlled Fusion Power. Prereq.: Consent of instructor or plasma engineering or plasma physics background or employment in fusion work.


5370 Advanced Direct Electrical Energy Conversion I (3) Theory, latest devices and applications for production of electrical energy by the solid state means of thermoelectric and photovoltaic effects. Prereq.: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5380 Advanced Direct Electrical Energy Conversion II (3) Theory, latest devices and engineering applications for production of electrical energy by exothermic and endothermic means of thermionic, magnetohydrodynamic, and electro-gas-dynamic effects. Prereq.: 4020 or Mechanical Engineering 4150 or equivalent, or consent of instructor.

5390 Advanced Direct Electrical Energy Conversion III (3) Prereq.: 5370 and 5380, or equivalent.

5410 Power System Networks (3) Sequence impedances for transmission lines, machines, and networks. General properties of system networks. Characterizations such as Z$_{mm}$, Y$_{mm}$, and others. Computer methods are emphasized. Prereq.: Graduate standing or consent of instructor.

5420 Fault and Load Flow Studies (3) Analysis of a power system under both shunt and series connected conditions. Computer methods for fault studies are included. The load flow problem is formulated with computer methods emphasized. Prereq.: 5410 or consent of instructor.


5440 Distribution Systems (3) Electric power distribution with particular reference to utility systems. System growth and load forecasting and regulation. Prereq.: 4410, 4420, 4430 or equivalent.

5450 Selected Topics in Power Systems (3) Courses will be offered to meet special needs of students. Possible topics: (1) power systems reliability, (2) interconnected system theory, (3) power plant operation, (4) electric power systems reliability, (5) power systems and wind turbines, (6) power systems and integrated power systems. Prereq.: Consent of instructor. May be repeated with consent of department.

5510-20-30 Linear Active Circuits (3, 3, 3) Analysis and design of linear amplifiers; includes a mathematical treatment of active devices and linear, time-invariant linear systems as sources of distortion, wide-band and pulse amplifiers, and a detailed treatment of feedback amplifiers using potentiometers and feedback circuits. Topics include amplifier, audio, video, pulse, driver, operational, and distributed amplifiers. Coreq.: Mathematics 4510 or 4710.

5540 Thick-Film Hybrid Microcircuits (3) Processing and fabrication techniques for prototype production of hybrid thick-film integrated circuits; all aspects from circuit design through packaging. Properties of thick-film pastes; consideration of cost-effective design techniques. Project oriented, includes biweekly laboratory.

5570-80-90 Electronic Switching Circuits (3, 3, 3) Switching circuits using active devices; includes clipping circuits, clamping circuits, comparator circuits, logic circuits, multivibrators, thermal circuits, and switching circuits. Consideration of cost-effective design techniques. Project oriented, includes biweekly laboratory.


5615-25 Introduction to Switching Theory and Logic Design (3, 3) Boolean algebra and applications. Combinational switching circuits. Sequential machines. Information structures and sub-systems. For computer science majors and those without prior experience in hardware and logic design. Prereq.: Elementary linear algebra and calculus of several variables. 4 labs per quarter.


boundary and radiation conditions, sources. Prereq: 5820.

5870 Introductory Microwave Networks (3) Circuit equivalents for n-port, junctions, obstacles, loading and fillings. One way and two way devices, directional devices, parameter measurements, reflection charts. Prereq: 5810. Coreq: 5820.

5940-50 Advanced Small Computer Systems (3, 3) Real-time applications, memory and CPU organization, interface software, and peripheral devices of minicomputer and microprocessor system are studied. Courses are project-oriented and supported by hardware and software interface design. Prereq: 4850 or equivalent or consent of the Instructor. (Same as Computer Science 5940-50.)

6000 Doctoral Research and Dissertation


6260 Modern Control System Design (3) Design of optimum control systems via variational calculus, maximum principles, dynamic programming, and gradient methods. Prereq: 5240-50 or equivalent.

6270-80-90 Special Topics in Control Systems Theory (3, 3, 3) Advanced problems of current interest to control system engineers. Discussion of new developments as found in current literature. Prereq: 5240-50-80 and consent of instructor.


6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) (Same as Physics 6500-10.)


6600 Electromagnetic Diffraction and Scattering (3) Diffraction of electromagnetic waves by spheres and cylinders, the ground wave problem, applications of diffraction to modern approximate methods, creeping waves. Prereq: 5810-20 and Mathematics 4250 and 4550.


6760 Coding Theory (3) Presentation of the mathematical, statistical, and probabilistic codes. Included are coding metrics and bounds, linear codes, linear feedback shift registers, convolutional codes, burst-error-correcting codes and decoding methods. Prereq: 5090 or consent of instructor.


6910-20-30 Advanced Sequential Machine and Automata Theory (3, 3, 3) Finite-state models; algebraic structure of sequential machines including decomposition, partition-pairs and semigroups, regular languages and identification experiments; measurement and control of sequential machines; regular expressions and machines; specific applications; reliability. Threshold logic. Random processes in sequential machines. Prereq: 5610-20-30. Coreq: Mathematics 5610.

Note: All of these courses will not be offered during any one year.

Engineering Science and Mechanics

MAJOR DEGREES

Engineering Science M.S., Ph.D.


Graduate programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in Engineering Science are available to graduates of recognized curricula in engineering, mathematics, or one of the physical or biological sciences. Program options include solid mechanics, fluid mechanics, biomedical engineering, and other engineering sciences. In the biomedical and engineering science option, interdisciplinary programs are arranged to meet individual needs or interests. Each applicant will be advised as to any prerequisite courses before entering a program; the student's program of study must be approved by his/her advisory committee, and must comply with the requirements of the Graduate School. The student's major professor may be selected from a department other than the Department of Engineering Science and Mechanics.

The flexibility and interdisciplinary aspects of the program options are intended to be of particular interest to prospective students currently employed in research, development, or design activities and whose interests in continuing education (either full-time or part-time) lie at one of the interfaces between science and engineering, or can best be met by interdisciplinary study in engineering. The department's course offerings and research activities are also intended to meet the needs of students who seek preparation for employment in engineering areas requiring specialization in mechanics, or in related interdisciplinary studies such as biomechanics.

THE MASTER'S PROGRAM

Two M.S. plans are offered: Plan I requires a thesis, while Plan II does not. The second plan is offered to meet the needs of engineers currently employed in industry, or those who plan to teach in community colleges and technical institutes. It will be available, however, to any student who, in the opinion of his/her advisory committee, can benefit from additional course work more than from work on a thesis.

In Plan I a minimum of 45 quarter hours, including the thesis, is required. In Plan II a minimum of 48 hours is required. The requirements include the following:

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<tr>
<th>Course</th>
<th>Hours</th>
<th>Credit</th>
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<tr>
<td>Plan I</td>
<td>12</td>
<td>48</td>
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<tr>
<td>Plan II</td>
<td>9</td>
<td>45</td>
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Engineering courses (Major 18 credits; option may include but is not restricted to courses offered by the engineering science and mechanics department.) Related courses (May include additional courses in mathematics, computer science, or the physical and life sciences as well as engineering courses.)

The requirements include:

1. A minimum of 108 quarter hours credit beyond the Bachelor's degree, except courses under Plan II may include advanced laboratory work or special problem work, for example Engineer-

THE DOCTORAL PROGRAM

General policies and requirements of the Graduate School relating to admission, residence, language, research examinations, faculty advisory committee, and admission to candidacy apply to this program. Specific departmental requirements for the Ph.D. degree include:

1. A minimum of 90 quarter hours credit beyond the Bachelor's degree, ex-
1. Approval of his/her advisory committee.

2. A minimum of 36 quarter hours in engineering graduate courses, exclusive of thesis and dissertation credit. These courses will normally be numbered 5000 and above, with at least 12 quarter hours of 6000-level courses, which constitute one or two areas of concentration selected by the student. The number of courses in this group to be taken will depend on the program selected by the student and the approval of his/her advisory committee.

3. A minimum of 18 quarter hours in mathematics or computer science in courses numbered 4000 and above, exclusive of a first course in ordinary differential equations.

4. A minimum of 9 quarter hours of courses numbered 5000 and above, offered in departments other than mathematics, computer science, and the student's major department and which are not included in the areas of concentration covered under item 2.

5. Active participation in graduate seminars and colloquia.

6. Preliminary examination consisting of a written qualifying examination and an advanced examination. The qualifying examination covers areas of engineering science and mathematics, for the most part at a level and scope expected of well-qualified recipients of a Bachelor's degree in engineering. The advanced examination requires demonstration of special competence in the areas of concentration selected by each student under item 2.

7. Submission of a written proposal for dissertation research to the student's advisory committee. Oral defense of the proposal is normally required when the student takes the advanced portion of the preliminary examination.

8. Submission of a dissertation which meets the requirements of the Graduate School, the department, and the student's advisory committee.

3311 Mechanics of Materials (4) Concepts of stress and strain; stress-strain relations and Mohr's circle; static analysis of members; area moment of inertia; stress and displacement analysis of axially-loaded members; torsion; bending. Not for departmental graduate credit. Prereq: Basic Mechanics I. Coreq: Multi-variable calculus and linear algebra.

3410 Introduction to Biomedical Engineering (4) Designed to introduce the student to the field of biomedical engineering and to provide basic terminology and background knowledge for further courses in the field. Subjects include anatomy, physiology, biotechnology, genetics, and biochemistry. Basic principles of human body functions and systems. Coreq: Multi-variable calculus and linear algebra or consent of instructor.

3420 Introduction to Clinical Engineering (3) Designed to train students in life sciences, health professions, and engineering in use and development of clinical instruments. Body systems are introduced, and instruments used in care of those systems are explained and demonstrated. Prereq: 3410 or consent of instructor.

3420 Perspectives on Medical Ceramics (3) Discusses the development of implant material from both an engineering and biological viewpoint. Demonstrates results of combined efforts of physician and biomedical engineer. Audiovisual aids and readings used to illustrate topics. Prereq: 3410 and Engineering Materials I.

3439 Medical Ceramics Laboratory (1) Surgical, orthopedic, and laboratory experiments to illustrate design and application parameters. Design project or paper required. Coreq: 3430.

3520 Materials Behavior and Chemical Process Equipment Design (4) (Same as Metallurgical Engineering 3520.)

3700 Dynamics (4) Kinematics of rigid bodies; mass moments of inertia; coulomb friction; kinetics of rigid bodies using force, mass, acceleration; Newton's laws of motion. Not for departmental graduate credit. Prereq: Elementary Statics and Dynamics or Basic Engineering Mathematics I. Coreq: Multivariable calculus and linear algebra.

3710 Intermediate Dynamics (3) Introduction to three-dimensional dynamics of particles and rigid bodies, dynamics with varying mass; kinematics of rotating coordinate systems; LaGrange's equations. Prereq: Dynamics and 2nd year Linear Algebra and Calculus of Several Variables.

4420 Engineering Aspects of Infection Control (3) Biomedical engineer's role in infection control will be related to hospital and clinical facilities. Further, prerequisites, measurement methods, and basic bacteriological and mycological tests will be demonstrated. The course identifies new and critical role for biomedical engineering in health care systems, and includes an analysis of hospital facilities and monitoring systems. Prereq: 3410 or consent of instructor.

4430 Orthopedic Biomimetics (3) Introduction to engineering principles and applications in orthotics and rehabilitation. Topics include statics, kinematics, and dynamics of biological systems; and includes analysis of hospital facilities and monitoring systems. Prereq: Consent of Instructor. Coreq: Multi-variable calculus and linear algebra.

4500 Applied Mechanics for Life Scientists (4) Concise and broad coverage of basic principles and concepts of mechanics. Fundamental concepts, statics, dynamics, vibrations, continuum mechanics and properties of materials. Applications in engineering and medicine. Prereq: Analysis and Calculus of a Single Variable or consent of instructor.


4529 Biomedical Fluid Mechanics I Laboratory (2) Measurement and recording of flow rates and parameters in biological systems. Coreq and/or term paper required. Coreq: 4520.

4530 Biomechanics (3) Discusses objectives, review foundations and present developments in areas of mechanical properties of living tissues, biomechanics of injury and prosthetics, material compatibility of prosthetic devices and biomechanical problems related to impact. Prereq: 4500 or consent of instructor.

4540 Fracture-Safe Design (3) A critical review of mechanical properties of materials that are indicative of fracture resistance, including transition temperature, R-curves, stress intensity factors, and J-integrals; the use of these properties in design. Prereq: Mechanics of Materials and Engineering Materials I. 3 hrs or 2 hrs and 1 lab.

4610 Experimental Stress Analysis (3) Basic concepts; theory, techniques, and instrumentation of resistance strain gages; theory and techniques of the strain gage. Prereq: Introduction to stress analysis methods. Prereq: Mechanics of Materials, Circuits II, or Basic Electrical Engineering—Circuits and Fields. 2 hrs and a 3-hr lab.

4620 Dynamic Data Acquisition (4) Instrumentation of measuring systems for dynamic events and responses; signal conditioning; oscillographs, oscilloscopes, and magnetic tape recording; telemetry and data transmission; data processing. Prereq: 3311, 3700, Electrical Engineering 3120. 3 hrs and a 3-hr lab.

4630 Introduction to Biomechanics (3) Introduction to the biomechanics of the musculoskeletal system. Prereq: Basic Mechanics I. Coreq: Linear Algebra and Calculus of Several Variables.


4810-20 Engineering Analysis (4, 3) Integration of fundamental methods of analysis with emphasis on application to realistic engineering problems. Prereq: 3311, Fluid Mechanics and Computer Science 3150.

4850 Elementary Structural Matrix Methods (4) Prereq: Mechanics of Materials, Deflections and Statically Indeterminate Structures, Mathematics 3150. (Same as Civil Engineering 4850 and Architecture 4850.)

4910 Special Engineering Science Topics (3) Problems related to recent developments of metals, and materials practice. Open to juniors or seniors with consent of instructor. May be repeated. Maximum 6 hrs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110-20 Fluid Dynamics (3, 3) Kinematics of fluids, vorticity, rate deformation, plane and axisymmetric flows, boundary-layer approximations, nonviscous flow, potential theory, complex potentials, conformal mapping. Prereq: 5800.

5130 Introduction to Turbulence (3) Macroscopic effects, analogies, statistical treatment, correlation functions and differential equation; application of turbulent jets and pipe flow. Prereq: 5800.

5180 Finite Element Structural Analysis (3) (Same as Civil Engineering 5180.)

5220 Mechanics of Viscous Flow (3) Role of viscous forces in flow phenomena; application of the Navier-Stokes equations; emphasis on
5320 Non-Newtonian Fluid Mechanics (3) (Same as Polymer Engineering 5230.)


5410-20 Theory of Elasticity (3, 3) Stress, strain, rigid body motion; torsion and bending of prismatic bars; axisymmetric stress distribution; stress concentration; plane stress, plane strain. Prereq: 5800.

5430 Thermal Stresses (3) Review of heat conduction; thermoelastic equations; thermal stresses in beams, rings, plates, and shells; thermal buckling problems. Prereq: 5410 or 5310-20-30, and Heat Transfer.

5440 Theory of Linear Viscoelasticity (3) Introduction to the concepts of linear viscoelasticity and creep; stress concentration; plane stress, plane strain. Prereq: 5410 or 5310-20-30. (Same as Chemical Engineering 5810.)

5540 Theory of Elementary Stress Concentration (3) Stresses in beams, plates, and shells; stress concentration; plane stress, plane strain. Prereq: 5800.

5550 Fracture Mechanics (3) Theories of fracture mechanics; introduction to fracture mechanics parameters. Prereq: 5800, Metallurgical Engineering 4730 or Mechanical Engineering 5540.

5630-40 Photonic Elasticity (3, 3) Introduction to physical optics, wave motion, polarized light, photoelasticity; equipment and techniques, application to two-dimensional elasticity of solids; quasistatic problems; vibrations problems; dynamic problems; stability problems. Prereq: 5410 or 5310-20-30.

6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) Critical survey of literature on advanced convective momentum, heat, and mass transfer; boundary layer theory based on the Navier-Stokes equations; boundary layer stability analysis; phenomenological theories of turbulence; turbulent boundary layer flow; high speed flow of phenomena in nonreacting and reacting systems. Prereq: 5110-20-30 or equivalent. Mathematics 4610, 4540-50, 4710. (Same as Environmental Engineering and Mechanical Engineering 6110-20.)


6310 Theory of Plates (3) The classical theory of bending of plates of various shapes; thick plates; plates of variable thickness; buckling and large deflection problems. Prereq: 5310-20-30.

6320 Theory of Shells (3) The classical membrane and bending theories for shells of various shapes; buckling; inextensional deformation. Prereq: 5310-20-30.


6340 Theory of Plasticity (3) Yield conditions; strain hardening; nonassociated flow; plastic potential; uniqueness theorems; extremum and variational principles; problems in perfectly plastic or finite plastic deformations; piecewise linear plasticity. Prereq: 5410 and Mathematics 4550.

6510 Photoelasticity (3) The stress-optic law in three dimensions and index ellipsoid, rotational effects in three-dimensional photoelasticity, techniques and applications of three-dimensional photoelasticity, scattered light method, dynamic photoelasticity, photometaelasticity and photoviscoelasticity, recent developments in photoelasticity. Prereq: 5640, 5420 and consent of instructor. 2 hrs and 3 labs.

6710 Impact and Stress Waves in Solids (3) Mechanical Properties; wave propagation in elastic solids; impact and waves in elastic rods, beams, and plates; contact problems in impact of elastic bodies; dynamic loading in viscoelastic and plastic materials; dynamic properties and materials. Prereq: 5410. Coreq: Mathematics 5630.

6800 Advanced Continuum Mechanics (3) Prereq: Chemical Engineering and Metallurgical Engineering 5410, or Metallurgical Engineering 5840 or equivalent. (Same as Polymer Engineering 6210.)


6910 Special Topics in Engineering Mechanics (3) Selected advanced problems of current interest in mechanics, worked either as a group or individually. Prereq: Consent of instructor. May be repeated with consent of department.

Note: Not all of the above graduate courses will be offered in any one year.

Industrial Engineering

MAJOR DEGREE

Industrial Engineering

M.E., M.S.

Professors:
J. N. Snider (Head), Ph.D. Ohio State, P.E.;
D. C. Douret, M.S. Tennessee, P.E.;
H. P. Emerson (Emeritus), S. B. Massachusetts Institute of Technology, P.E.;
R. M. LaForge, (Emeritus), M.S. Georgia Institute of Technology, P.E.;
H. L. Lovelace, M.S. North Carolina State, P.E.;

Ph.D.

Associate Professors:
J. R. Buchan, M.S. Georgia Institute of Technology; W. W. Claxombe, Ph.D. Virginia Polytechnic Institute, P.E.;
W. H. Hardison, M.S. Virginia Polytechnic Institute, P.E.

Assistant Professors:
E. L. Dappor, Ph.D. Virginia Polytechnic Institute; M. L. Eaton, M.S. Clarkson, P.E.;
M. K. Goodman, M.S. Tennessee, P.E.

THE MASTER'S PROGRAM

A graduate program leading to the degree of Master of Science is open to graduates of recognized undergraduate curricula in industrial engineering or to graduates of other engineering curricula who take up to 15 quarter hours of prerequisite course work. A non-thesis option with 45 hours of course work plus a 3-hour design project is available.

Graduate work in Industrial Engineering provides for concentrations in operations research, human factors, systems engineering, reliability, work measurement, facility planning and engineering economy. Either one or two minors can be elected in Engineering, Mathematics, Psychology, Business, Computer Science, Statistics or Economics.

MBA. DEGREE

This professional degree program is intended as a culmination year in a five year baccalaureate-master program which emphasizes engineering design and professional practice. Admission requirements include those presented above plus the requirement of a bachelor's degree from an ABET-accredited engineering program. This 45-quarter hour program requires 18 hours of course work in an industrial engineering core, 9 hours of technical methods electives, 9 hours of industrial engineering design electives and a 9-hour thesis or design project.

4060 Material Requirements System Design (3) Theory and application of material requirements planning, production planning, inventory analysis, planning, and control, and systems design and implementation. Design of the material require-
4080 Forecasting Methods in Industrial Engineering (3) Application of statistical fore-casting techniques to industrial engineering problems. Includes moving averages and exponential smoothing, linear and polynomial regression models, autocorrelated time-series analysis, Delphi methods and other selected forecasting methods. Prereq: 4860.

4150 Project Control with CPM and PERT (3) A study of project planning and control based primarily on "critical path" techniques, including resource allocation, time-cost trade-off algorithms, multi-project control, and computer programs. Prereq: Statistics 3450.


4170 Automatic Process Control (3) Characteristics of automatic controllers; elementry open and closed loop analysis, and applications to industrial control systems. Introduction to Differential Equations and Dynamics.


4240 Predetermined Time Systems (3) Work design and measuring using a predetermined time system such as methods time measurement, basic motion time-study, or work factor. Theory and application. Prereq: Work Measurement.

4250 Work Measurement Applications (3) Application of learning curves, queuing theory, standard data methods and incentive systems to the design of industrial work situations. Prereq: Work Measurement.

4252 Engineering Economy (3) Methods and principles for evaluating the design and installation of equipment. Decisions among engineering alter-natives, involving capital recovery, economic life, and value of time. Prereq: or coreq: of return on invest-ment. Not available for graduate credit for industrial engineering students.

4530 Case Studies in Engineering Economy (3) Extension of basic engineering economy principles to actual problems faced by com- petitive firms and regulated industries. Case studies taken from literature form basis of classroom discussion. Out-of-class assignment is made which involves working with local companies to evaluate, make or buy options, leasing versus cash purchases, equipment replacement studies, energy source economies, etc. Prereq: 4520.

4540 Industrial Development (3) Factors other than mechanical or chemical which enter into the successful establishment of manufacturing enterprise. Cost and location studies and market surveys and the commercial feasibility of new plants or projects.


4630 Health Systems Engineering (3) A study of the system characteristics and the means by which they may be improved through the application of modern industrial engineering principles and techniques. Prereq: Work Methods and Design.


4910-20-30 Special Industrial Engineering Topics (3, 3, 3) Open with consent of instruc tor. May be repeated.

4950 Industrial Safety (3) Development of organizational techniques for plant control of accidents with emphasis on OSHA Rules and Regulations.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not other-wise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used to meet degree requirements. May be repeated. S/NC only.

5110 Work Design (3) Advanced methods analysis embodying the design and improve ment of work content, worker-man environment response and management participation. Prereq: Motion and Time Study or Work Methods and Design.

5210 Advanced Work Measurement (3) Character- istics of some of the better known time measurement methods and suitable man-hours for industrial systems. Prereq: 4860 or equivalent.

5240 Facilities Planning and Design (3) Modern materials handling techniques, computer- aided layout techniques, applications of oper ations research models, and the use of these to design a manufacturing facility. Prereq: Production Facilities Planning or consent of instructor.


5260 Information Systems Design (3) Systems engineering techniques used in information systems design. Topics include the system model, analysis and evaluation of information systems, information objectives and design criteria. Use of optimization and simulation in system design will be emphasized.

5340 Applied Decision Theory (3) Application of the theory of decision making to problems in industrial engineering. Approaches to de-cision making under conditions of incomplete information, Bayesian and Neyman-Pearson statistical decision models, utility functions, value of information, linear and quadratic loss analysis and parallel and sequential decision processes. Prereq: Statistics 3450.


5520 Advanced Engineering Economy (3) Re-view of basic engineering economy principles.


5600 Human Factors Engineering (3) Study of the characteristics of man which influence the design of tools, equipment, environments and products. Particular attention given to the modeling of man as a process or system controller. Prereq: Consent of instructor.

5610 Human Factors Engineering (3) The human operator, his performance characteris-tics and his engineering environment. Emphasis is given to the formal description of the human operator's transfer characteristics through both quasilinear models and models describing the operator as an information processor. Prereq: 4860 or 5600.

5700 Optimization Methods in Industrial Engineering (3) An introductory course in opera-tions research techniques, including: Linear programming, network programming, integer programming, non-linear programming, dynamic programming, decision theory and simulation. Prereq: Statistics 3450. Not available in 5710, 5720, and 5730. Applications of classical optimization theory, N-di-mensional geometry, formulation of problems, to selected areas of operations research. Prereq: Computer Science 3150 and Matrix Algebra.

5710 Linear, Quadratic and Dynamic Program- ming (3) An introduction to mathematical pro- gramming. Topic includes linear programming, quadratic programming, and dynamic pro- gramming. Applications include computer solu-tions to programming problems. Prereq: Com- puter Science 3150 and Matrix Algebra.


5730 Game Theory and Random Processes (3) Additional topics in operations research in- cluding game theory with applications to de-cision making in a competitive environment, and random processes. Application of queuing, inventory models and decision making. Prereq: 5360.


5830 Health Systems Engineering II (3) Specific functions of health systems are ana- lyzed for analysis, control and improvement of the function and the total health system. Prereq: 4830.


5860 Industrial Systems Engineering (3) Static variables and the use of computer simu-lations of continuous and discrete systems. Computer methods for systems analysis. Introduction to system optimization techniques. Case studies in systems design. Prereq: 4860 or equivalent.
5900 Design Project (1-9) Study of an industrial engineering topic to fulfill the design project requirement in the nonthesis program. Enrollment limited to industrial engineering students in non-thesis program. May be repeated. Maximum 9 hrs.

5910-20-30 Special Topics in Industrial Engineering (3, 3, 3) Special problems for students who are qualified to do individual or group research projects. Prereq: Consent of Instructor. May be repeated. Maximum 9 hrs.


6520 Operations Research Models in Engineering Economy Decisions (3) Review of traditional capital planning and budgeting techniques. Analysis and application of operations research approaches to capital budgeting problems with emphasis on mathematical programming and computer simulation. Interrelated projects, uncertain cash flows, and choice of capital investment criteria are considered. Prereq: 5520, 5710.

6730 Nonlinear Programming (3) Development of optimization techniques for static and dynamic problems subject to various constraints. Emphasis will be given to applying optimization theory to solve nonlinear optimization problems. Topics include variable metric methods, search methods, constrained nonlinear programming, and penalty function methods. Prereq: 5700.

6750 Dynamic Programming (5) Techniques for solving multistage optimization problems as a sequence of single-stage optimization problems. Emphasis will be given to the computational as well as the theoretical aspects of dynamic programming. Decision making under certainty and under risk will be considered. Prereq: 5710.

6770 Advanced Topics in Optimization of Dynamic Systems (3) Advanced topics in multistage optimization theory. Topics include state dependent dynamic programming, adaptive optimization theory, and other selected topics. Prereq: 6730.

6910 Advanced Topics in Industrial Engineering (3) Selected topics of current interest. Topics will cover those not covered in other graduate courses and will provide a forum for advanced graduate students to study individually or in a group as appropriate, and will generally be directed and conducted by a qualified and experienced academic faculty member. May be repeated with consent of department.

Mechanical and Aerospace Engineering

MAJORS DEGREES
Aerospace Engineering M.E., M.S., Ph.D.
Mechanical Engineering M.E., M.S., Ph.D.

1. A minimum of 36 quarter hours of course work which includes at least 18 quarter hours of graduate (5000-level or above) courses in mechanical and/or aerospace engineering and normally 9 quarter hours of course work (4000-level or above) in mathematics.

2. A minimum of 9 quarter hours credit in Selected Engineering Problems (5900). A written report must be presented for each problem investigated.

3. Participation in the departmental seminar program.

4. Passing a comprehensive written final examination on all work submitted for the degree and an oral examination on all work (including problems) submitted for the degree.

THE DOCTORAL PROGRAM

Admission into the doctoral program will be granted to those applicants who have demonstrated superior achievement in their engineering backgrounds.

The student must satisfactorily complete an approved program of study which normally includes:

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or problems.

2. A minimum of 36 quarter hours of credit in doctoral dissertation.

3. A minimum of 18 quarter hours in mathematics in courses numbered 4000 or above.

4. A minimum of 36 quarter hours in mechanical and/or aerospace engineering courses numbered 5000 and above, with at least 12 quarter hours of 6000-level
courses. These are exclusive of thesis, problems or dissertation credit.

5. Participation in the departmental seminar program.

GRADUATE CREDIT FOR UNDERGRADUATE COURSES

Jrnon (3000-level) and senior (4000-

low) mechaniacs and aerospace engi-

neering courses may be taken for grade-

credit by non-mechanical or non-aerospace

engineering majors, if approved by the

student's major department. Mechanical or

aerospace engineering majors may not

necessarily use more than one 4000-level

engineering course to meet their advanced
degree requirements. Non-mechanical or

non-aerospace engineering graduate stu-
dents should consult with instructors

regarding prerequisites for undergraduate
courses.

Mechanical Engineering

3000 Energy—An Overview (4) Introduction to available energy resources, recovery and utilization; techniques including conservation schemes; emphasis on the resources-environment-man interaction associated with energy, primarily for non-engineering students.

3110 Applied Engineering Thermodynamics (3) Energy and laws governing energy transformations; fundamentals of thermodynamic properties and applications to engineering problems. Prereq: College physics and calculus.

3311 Engineering Thermodynamics (3) Energy and laws governing energy transformations; thermodynamic properties.

3330 Engineering Thermodynamics (3) Properties of gases and gas mixtures; chemical reactions; equilibrium; applications to mechanical engineering problems.

3410 Fluid Flow (3) Development of continuity, momentum and energy principles for fluid systems; applications to mechanical and aerospace engineering problems.

3440 Heat Transfer (3) Heat transfer problems, heat conduction, thermal radiation.

3520-30-40 Thermal Sciences (3, 3, 3) Fundamental principles of thermodynamics and transport phenomena as applied to engineering design. To be taken in sequence.

3610 Mechanics of Machinery—Kinematics (3) Mechanics of motion, graphical and analytical methods; instantaneously at velocities, accelerations.

3620 Mechanics of Machinery—Dynamics (3) Newton's laws; work, energy, impact; single degree vibrating systems.


3650 Introduction to Machine Design (3) Ductile-brittle behavior of materials under static and cyclic loading. Stress concentration, design factors and theories of failure. Changes in material behavior in processing and fabrication, 2 hrs and 1-2 hr lab.

3860 Manufacturing Processes (3) Selection of processes as related to the design of machine parts, cutting, heat and cold forming, metal removal and welding. Manufacturing tolerances and surface finishes. 2 hrs and 1-2 hr lab.

3910 Engineering Analysis (3) Advanced analytical techniques for problems of aerospace and mechanical engineering. Emphasis on approximate methods.

4140 Energy Conversion Systems (3) Laws governing energy transformations and their application to systems. Thermodynamic cycles and analysis.

4150 Energy Conversion Systems (3) Operating and design characteristics of new technology energy conversion systems, selected direct conversion techniques.

4160 Energy Conversion Systems (3) Economic and technical design parameters as applied to power plants for public utilities or industrial applications. Selected design and layout problems, including the effects of variable heat flux, heat exchanger applications.

4450 Lubrication (3) Hydraulic theory of lubrication of sliding bearings; application of Navier-Stokes equations to infinite and finite bearings; analytical and numerical solutions; applications to design.

4719-91 Experimental Mechanical Engineering (3, 3) Experimental methods and measurement of force, length, time, temperature, pressure, transport rates, and physical properties. Planning, conducting, analyzing, and reporting experimental data. Conducted concurrently with 5140. To be taken in sequence.

4740 Solar Energy Utilization (3) Nature and characteristics of solar radiation, collector design, heat transfer to solar energy, solar energy collection and use; design analysis of solar energy collectors and methods of storage selected. Prereq: Engineering Thermodynamics 3440 or consent of instructor.

5000 Thesis Engineering (3, 3, 3) Problems related to design, research, and development. Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110 Conduction Heat Transfer (3) Analysis of one-dimensional heat conduction by analytical and numerical techniques. Prereq: Undergraduate heat transfer, Engineering Analysis, and Mathematics 3155.

5120 Convection Heat Transfer (3) Equations of the Navier-Stokes fluid flow equations, convection analysis of internal and external flows including the effects of variable heat flux, surface temperature, and fluid properties. Prereq: 5310 or equivalent.


5140 Phase Change Heat Transfer (3) Prereq: 5120.
5210 Classical Thermodynamics (3) A thorough study of macroscopic thermodynamics with emphasis on first and second law analysis, equilibrium criteria, and the thermodynamics of phase relationships. Prereq: Undergraduate thermodynamics.


5230 Special Topics in Thermodynamics (3) Prereq: Consent of instructor.

5310 Intermediate Fluid Mechanics (3) Vector descriptions of fluid mechanics; derivation of basic equations of one-dimensional potential flows; viscous flows with emphasis on boundary-layer theory. Prereq: Undergraduate fluid mechanics.

5410-20-30 Research in Mechanical Engineering (3, 3, 3) Design of experiments; data analysis; experimental investigation.

5510-20-30 Mechanical Engineering Design (3, 3, 3) Design of mechanical engineering units and systems.


5610-20-30 Experimental Stress Analysis (3, 3, 3) Theory of elasticity; experimental methods; photoelasticity, strain gages, lacquer coatings.

5640-50-60 Advanced Machine Design (3, 3, 3) Design of bearings, gears, shafting; lubrication.

5670-80-90 Dynamics of Machinery (3, 3, 3) Dynamics of machinery; vibrations; balancing; flywheels and governors.

5710 Metal Machining (3) Analytical approach to the mechanics of machining. Detailed treatment of basic phenomena-plastic flow, fracture, friction and wear. Prereq: Undergraduate metallurgy and materials behavior, and heat transfer.


5840-50-60 Turbomachinery Systems (3, 3, 3) Theory and practice of design, development and systems integration of turbomachinery components. Prereq: First year graduate standing and consent of instructor.

5870 Dynamic Modeling and Simulation (3) Methods of modeling physical systems including mechanical, thermal, hydraulic, pneumatic and electromechanical systems. Techniques for experimentally determining system parameters. Analog and digital computer simulation techniques. Prereq: Undergraduate dynamics, heat transfer, and fluid mechanics.

5900 Selected Engineering Problems (3-9) Selection of individual engineering projects to fulfill the requirement of the Problems Program. Enrollment limited to students in the Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

5950 Seminars (1) Discussions on all phases of mechanical engineering, including reports on current research at The University of Tennessee, Knoxville. May be repeated. S/NC only.

5990 Special Topics in Mechanical Engineering (1-3) May be repeated.

6000 Doctoral Research and Dissertation

6110-20 Advanced Topics in Fluid Mechanics and Convective Transfer (3, 3) (Same as Engineering Science and Mechanics 6110-20.)

6130-40 Advanced Radiation Heat Transfer (3, 3) Radiation heat transfer in absorbing, emitting, and scattering media. Introduction of thermal radiation and conduction and convection heat transfer; radiation heat transfer in hypersonic flow; radiative characteristics of luminous flames and nonuniform gases; scattering by planetary atmosphere. Prereq: 5110-20-30; Mathematics 4550.

6420 Selected Topics in Thermodynamics (3) Comparison of macroscopic and microscopic approach; equilibrium of the pure substance; metastable states. Prereq: Consent of instructor.

6430 Selected Topics in Thermodynamics (3) Prereq: 5240, Mechanical Engineering 5310, Mathematics 4550.


6510 Fundamentals of Aerodynamics (3) Newton's Law: work-energy impulse-momentum, Lagrange equations, central forces, gyroscopic effects. Applications to aerospace systems.

6620 Engineering Vibrations (3) Multiple degree of freedom systems with lumped and distributed parameters. Prereq: Consent of instructor.

Aerospace Engineering

3520 System Dynamics (3) Analytical models for aerospace vehicle vibration and stability analysis; introduction of linear dynamical systems theory. Dynamic characteristics and stability of systems.

3510 Dynamics (3) Newton's Law: work-energy impulse-momentum, Lagrange equations, central forces, gyroscopic effects. Applications to aerospace systems.

3620 Mechanical Vibrations (3) Free and forced vibrations of single and multiple degree vibrating systems, balancing of rotating machinery.

3630-40 Structural Analysis of Aerospace Vehicles (3, 3) Fundamentals of structural analysis as applied to configurations of aerospace interest. Introduction to aeroelasticity phenomena. Must be taken in sequence.

4110 Aerodynamic Fundamentals (3) Atmosphere, dynamics of atmosphere, properties of perfect gases, fluid flow types, airfoil theory, wing theory, drag. For non-aerospace engineering majors only.

4120 Aircraft Propulsion and Performance (3) Propellers, propulsion systems for aircraft, static performance and special performance problems, maneuvers, control surfaces, stability and control. For non-aerospace engineering majors only.

4210 Compressible Flow (3) One-dimensional internal flow; shock and expansion waves; friction and nonadiabatic flows.

4220 Low Speed Aerodynamics (3) Potential flow theory; kinematics and dynamics of perfect fluids; analysis and design of aerodynamic bodies.

4230 Viscous Flow (3) Boundary layer theory; laminar and turbulent flow; compressibility effects; numerical solution methods.

4240 Astronautics (3) Propulsion, trajectories, guidance, control, and atmospheric reentry of space vehicle systems.

4250 Propulsion (3) Principles of propulsion devices; turboprop, ramjet, and rocket engines.

4260 System Design (3) Synthesis of aerospace system. Design report on the system.

4471-91 Experimental Aerodynamics (3) Experimental methods and measurement techniques for force, length, time, temperature, pressure, transport rates and physical properties. Planning, conducting, analyzing, and reporting experimental data. Prereq: 4210-20-30 and satisfying test standards and other specifications.

4510 Airfoil Performance (3) Introduction to airfoil and wing characteristics, drag; propulsion, static performance and maneuvers; theory and design of control surfaces; stability.

4810 Selected Topics in Aerospace Science (3) Current problems in aerospace science; topics in science and engineering required for an understanding of the several areas of aerospace science.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. Prereq: S/NC only.

5110 Fundamentals of Aerodynamics (3) Kinematics and dynamics of perfect fluids; potential flow about a body; conformal mapping; hodographs. Prereq: Mechanical Engineering 5310, Mathematics 4250.

5120 Experimental Methods in Fluid Mechanics (3) A study of experimental techniques with laboratory experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests (supersonic and subsonic), water tunnel experiments, supersonic flow measurements, boundary-layer measurements. Prereq: 4210-20-30 or Mechanical Engineering 5310.


5210-20 Aerodynamics of Compressible Fluids (3, 3) One-dimensional flow; waves; small-perturbation theory, slender body theory; similar rules; method of characteristics. Prereq: 4210 for 5210 and 5210 for 5220.

5240 Dynamics of Viscous Fluids (3) Equations of viscous fluid flow; laminar and turbulent flow, transition, boundary-layer theories; exact and approximate solutions. Prereq: Mechanical Engineering 5310 or equivalent.

5250 Introduction to Hypersonic Flow (3) Boundary layer flow; simulations; Newtonian flow theory; blunt body; viscous interactions; free molecule and rarefied gas flow. Prereq: 5220.

5260 Selected Topics in Aerodynamics (3) Further study of transonic, supersonic and hypersonic flow theories.


5310 Magnetohydrodynamics (3) Review of electromagnetic field theory; chemical kinetics, thermodynamic and thermophysical properties
of gas plasmas; governing equations and applications. Prereq: 4220 and Mathematics 4710.

5240-50 Atmospheric Entry (3, 3) Motion and heating along ballistic and lifting trajectories; dynamic stability and aerodynamic systems. Prereq: 5220. Recommended: 5240.


5540-50 Aerospace Vehicle Stability and Control (3, 3) Introduction to aircraft stability and control. Static and dynamic longitudinal, directional, and lateral stability and control. Coupled modes. Motion with free and fixed control surfaces throughout the flight speed range. Automatic stability and control. Application to missiles. Prereq: 4230 and 5530.


5570 Aerospace Vehicle Flutter and Vibration (3) Flutter and vibrations of aerospace vehicles. Development of the structural and aerodynamic operators. Stability criteria for airfoils operating at supersonic speeds. The study of two- and three-dimensional wings of control surfaces, and empennages over a wide flight speed range. Prereq: 4230 and 5530.


5610 Applied Acoustics (3) Energy flow in acoustics, general equations of sound propagation in a nonhomogeneous moving medium, sound waves due to turbulence, vertical sound, pseudosound, propagation and absorption of sound in ducts, instrumentation and measuring techniques. Prereq: Consent of instructor.

5620 Aerocoustics I (3) Special topics and recent research results in the field of aeroacoustics. Topics to be covered include: turbulence, shock waves, vortical sound, and general theoretical developments, as well as empirical equations. Prereq: 5610.

5810 Aviation Systems: An Overview (3) Aviation systems present and future, analyzed with emphasis upon the systems approach. Consideration of the socioeconomic base, aerospace space and propulsion technology, meteorology, air traffic control, airport-community interface and technological trends and developments pertinent to the present status and future development of air transportation. For non-aerospace and non-mechanical engineering majors only. Prereq: Aircraft Propulsion & Performance.

5820 Air Vehicles (3) Current capabilities and future requirements for air transport vehicles. Consideration of parameters significant for air vehicle type selection. Integration of the vehicle into the aviation system. For non-aerospace and non-mechanical engineering majors only. Prereq: 5810.

5900 Selected Engineering Problems (3-9) Selected problems in aerospace engineering to fulfill the requirement of the Problems Program. Prereq: Consent of advisor. May be repeated. S/NC only.

5950 Seminars (1) Discussions on all phases of aerospace engineering, including reports on current research at The University of Tennessee, Knoxville. May be repeated. S/NC only.

5990 Special Topics in Aerospace Engineering Credit to be arranged; 3 hrs maximum each quarter. Prereq: 5530.

6000 Doctoral Research and Dissertation

6310 Magneto-hydrodynamics I (3) Electromagnetic field equations; motion of a single charged particle, statistical description of a plasma, the Boltzmann equation, conduction and diffusion in ionized gases. Prereq: 5240 or registration therein. Mathematics 5610, Physics 4220.

6320 Magneto-hydrodynamics II (3) Continuum magnetohydrodynamic equations. Alfven, shock waves, exact solutions for magnetohydrodynamic channel flows, one-dimensional model of channel flow, the magnetohydrodynamic boundary layer. Prereq: 6310, Mathematics 5620.

6330 Magneto-hydrodynamics III (3) Engineering applications of magnetohydrodynamics with particular emphasis on propulsion and power generation. Prereq: 6320, Mathematics 5630.

6410 Physical Gasdynamics (3) The fundamentals of high-speed, high temperature flow of a gas from the molecular point of view, molecular collision models, and simple kinetic theory: equilibrium properties of gases and gas mixtures as obtained from steady-state kinetic theory, thermodynamics, and statistical mechanics. Prereq: 5220 and Mechanical Engineering 5220.

6420 Physical Gasdynamics (3) Continuation of 6410; flows of gas mixtures in local thermodynamic and chemical equilibrium; physical and chemical basis of rate equations; flow with vibrational and chemical nonequilibrium. Prereq: 6410.

6810 Advanced Boundary Layer Theory (3) Derivation and critical review of the governing equations. Asymptotic solutions; similarity methods; boundary layer transformations. Approximate integral methods to include compressibility and heat transfer. Application to attached and separated flows; shock-wave-boundary layer interaction. Prereq: 5220, Mechanical Engineering 5120, and Physics 5630.

6910 Advanced Topics in Gasdynamics (3) Selected advanced topics in gasdynamics. The selection of topics will be based on the particular interests of the students registering for the course. Representative topics may include nonequilibrium transport phenomena, radiation processes, nonequilibrium dynamical flows, advanced kinetic theory, perturbation techniques. Prereq: Consent of instructor.

Nuclear Engineering

MAJOR DEGREES

Nuclear Engineering

M.E., M.S., Ph.D.

Professors:


Associate Professors:


Assistant Professors:

E. M. Katz, Ph.D. D. Tennessee; L. Miller, Ph.D. D. Texas A & M, P.E.

THE MASTER'S PROGRAM

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

The student must complete a program of study of 45 quarter hours which has been approved by the student's advisory committee and which includes the following:

1. A major consisting of a minimum of 18 quarter hours of graduate courses in nuclear engineering.

2. A minor of 9 quarter hours in mathematics.


4. Final examination covering the thesis and graduate course work.

An alternate program is available for the Master of Science degree which involves engineering practice rather than a thesis. The student must complete a program of study which includes the following:

1. Thirty-six quarter hours of course work similar to the requirements for the regular Master of Science program (see above).

2. Twenty-four quarter hours of Nuclear Engineering 5980, Nuclear Engineering Practice. A student usually registers for 5 hours of Nuclear Engineering 5990 each quarter and investigates problems assigned by a member of the faculty. At the end of each quarter the student submits a written report and makes an oral presentation of the work.

3. Final examination covering graduate course work and practice school problems.

MASTER OF ENGINEERING PROGRAM

A graduate program in Nuclear Engineering leading to the degree of Master of Engineering is available to those graduates with an accredited engineering degree or one which satisfies ECPD basic level criteria.

In addition to Graduate School requirements the following degree requirements must be met:

3. Nine hours of course work, 18 of which must be in nuclear engineering.

2. A minimum of 9 hours of design project, thesis, or 24 hours of Nuclear Engineering Practice (5980). Documentary proof of significant engineering experience may be submitted in lieu of the design project, thesis or Nuclear Engineering Practice, but in this case 45 hours of course work are required.

4. Nine hours of course work submitted must be from out of department.

A. A minimum of one-third of the program must be in engineering design, and one-third in one of, or a combination of, advanced math, computer sciences, basic sciences, or engineering sciences.

5. A candidate must pass a final oral examination on all work presented for the degree.

THE DOCTORAL PROGRAM

Students in the field of nuclear engineering desiring to study for the degree of Doctor of Philosophy must have a Bachelor of Science in Engineering with a major in Nuclear Engineering. The written and oral examinations will be similar to those taken by students working for the Master of Science degree in Nuclear Engineering.
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of Science or Master of Science degree from a recognized university, with a major in engineering or physics, and present at least a B average. All candidates will be required to demonstrate general competence in the preliminary examination in the areas of engineering science, mathematics, and physics. At the same time, all candidates will be required to demonstrate specified knowledge in certain areas.

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

1. A minimum of 72 quarter hours credit beyond the Bachelor's degree, exclusive of credit for the M.S. thesis or Nuclear Engineering Practice.
2. A minimum of 36 quarter hours of credit in doctoral research.
3. A minimum of 45 quarter hours in nuclear engineering courses numbered 5000 and above (or the equivalent), with at least 12 quarter hours of 6000-level courses. These are exclusive of thesis or dissertation credit.
4. A minimum of 18 quarter hours in mathematics or computer science in courses beyond nuclear engineering undergraduate requirements. Must be numbered 4000 or above.
5. A minimum of 9 quarter hours in courses numbered 5000 or above from a department other than nuclear engineering. The choice depends on the student's overall program and should expand his/her knowledge in a given field.

6. A reading knowledge of one foreign language will be determined by the student's doctoral committee.

4.110-20-30 Introduction to Nuclear Reactor Theory (3, 3, 3) Nuclear structure: radioactive decay laws; neutron interaction; fission process; chain-reaction systems; diffusion equations; neutron moderation; reactivity coefficients; perturbation theory. Prereq: Physics 3730 or consent of instructor.
4.210-30 Nuclear Engineering Laboratory (3, 3, 3) Radiation detection and counting instrumentation; counting statistics, half-life and decay schemes, gamma spectrometry, cross-section measurements, analog computation, diffusion properties of neutrons, critical loading experiments, control rod calibration, statistical weight, shielding, xenon poisoning, prompt critical reactor behavior, fission density and adjacent flux. Prereq or coreq: 4110 or equivalent.
4.550 Reactor Simulation Laboratory (3) Simulation of reactor design and operation with analog computer; reactor kinetics; single and multiple-velocity neutron coefficients, poisoning control rod calibration; power reactor; subcritical assembly. Prereq: 4120.
4.710 Energy Transport (3) Development of differential and integral energy conservation equations; conduction, convection, and radiation heat transfer; applications to nuclear reactor fuel elements and heat exchangers. Prereq: Momentum mass and energy transport.
4.720 Reactor Thermal Design (3) Hydrodynamics and heat transfer in systems; boiling crises; fuel element thermal design; steam generator design. Prereq: 4710.
4.730 Nuclear Reactor Design (3) First order reactor design, integration with non-nuclear heat transfer and power conversion system, economic evaluation; optimization procedures; description of typical systems. Coreq: 4130.
4.820 Reactor Kinetics and Controls (3) Derivation of kinetic equations; basic kinetic parameters; transient response with feedback; control and protective systems. Prereq: 4110.
4.840 Nuclear Reactor Safety (3) Presentation of safety concepts and criteria; credible accidents; fission product release and transport; computerized reactor accident analysis; engineering safeguards. Prereq: 4120; Coreq: 4730 or consent of instructor.
4.930 Nuclear Fuel Management (3) Discussion of problems associated with processing of nuclear materials fuel cycle analysis; burnup calculation. Prereq: 4120.
5.000 Thesis
5.002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student is enrolled and/or faculty time before degree is completed. May not be used toward degree requirements. Must be repeated S/NC only.
5.110-20-30 Transport Processes in Nuclear Engineering (3, 3, 3) Momentum and heat transport; development of conservation equations: elementary theory of turbulence; heat transfer and flow through conduited; conduction; radiation; reactor core thermal analysis. Prereq: 4720 or equivalent; Mathematics 4170, 4550.
5.210 System Dynamics (3) Transient analysis, Laplace transforms, frequency response, stability (linear and nonlinear), and sensitivity analysis by design. Dynamic analysis of distributed systems. Prereq: Consent of instructor.
5.220 Reactor System Dynamics (3) Application of methods of general system dynamics to reactor systems; emphasis on the neutronic and non-neutronic processes. Dynamics, stability, and control of zero power reactors and power reactor systems. Prereq: 5210, 4130 or equivalent.
5.240 Reactor Instrumentation (3) Principles and applications of instrumentation and systems for the operation, control, and safety of nuclear reactors; role of instrumentation in public health and safety; engineered safeguards for nuclear power plants. Prereq: 4550, or consent of instructor.
5.310-20-30 Nuclear Systems Reliability (3, 3, 3) Principles of system reliability analysis as applied to nuclear systems. Both qualitative and quantitative methods are included. Coreq: Statistics 3450.
5.510-20 Nuclear Systems (3, 3, 3) Detailed study of nuclear power systems including various reactor types; flow diagrams, thermo-
College of Home Economics

Lura M. Odland, Dean
Grayce E. Goertz, Associate Dean
Virginia S. Anagnost, Assistant Dean

Graduate study programs lead to the degree of Master of Science in Child and Family Studies; Consumer Studies and Housing; Public Policy; Crafts, Interior Design, and Housing; Food Science; Food Systems Administration; Home Economics Education; Nutrition; and Textiles and Clothing. Graduate study programs lead to the degree of Doctor of Philosophy in Home Economics with three options: interdisciplinary, food science, and nutrition. Graduate programs provide advanced specialized training needed for college and university teaching, for leadership positions in governmental and professional agencies, in the various professions in business, for secondary school and adult teaching, for research and for extended services.

GENERAL REQUIREMENTS FOR GRADUATE STUDENTS

Requirements for graduate study are prescribed by the Graduate School and by the student's major department. Students lacking adequate preparation may be required to take additional courses at the undergraduate level as prerequisites to graduate study. A student deficient in English may be required to take courses as necessary to remove the deficiency.

APPLICATIONS FOR ADMISSION

Two copies of the student's transcript and an application for admission are submitted directly to the Graduate School. In addition, a College of Home Economics application and three letters of reference are sent to the Associate Dean of the College of Home Economics. (Forms may be obtained from the college.)

The Graduate Record Examination scores for the aptitude test including the quantitative, verbal and analytical sections are required for the application for admission in the interdisciplinary doctoral program and the Master's program in Child and Family Studies.

In submitting applications for admission to graduate study in home economics, students are requested to indicate choice of major area of study.

GRADUATE ASSISTANTSHIPS AND FELLOWSHIPS

Information and application forms regarding graduate assistantships, fellowships and general requirements for admission to graduate study may be obtained from the department head in the area of the student's major interest or from the Associate Dean of the College of Home Economics for the interdisciplinary doctoral program.

PROGRAMS LEADING TO THE DEGREE OF MASTER OF SCIENCE

Thesis Option:

Majors and minors are offered in the following areas:

Child and Family Studies
Consumer Studies and Housing:
- Public Policy*

Non-Thesis Option:

- Requirements include Crafts, Interior Design, and Housing 5515 or Child and Family Studies 5170; Child and Family Studies 5760; 5180; Agricultural Economics 5340 or Agricultural Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5600.

Consumer Studies courses to be selected from Child and Family Studies 5140, 5170, 5180, 5700, 5800, 5900; Crafts, Interior Design, and Housing 5120; Food Science 4040; Textiles and Clothing 5180; Agricultural Economics 4710; Economics 4320; and Home Economics 5600. Three-hour course in research methods or statistics. Twenty-four hours in consumer studies or housing to include 9 hours of Child and Family Studies 5000 or Crafts, Interior Design, and Housing 5600.

Twelve hours in an area of home economics other than the area (consumer studies or housing) chosen above.
Minimum 27 hours in and 9 hours outside College of Home Economics. Minimum of 37 hours 5000-6000 level courses and total minimum of 45 hours. Courses may be used to meet more than one requirement but all minimum requirements will need to be met.

Requirements include those listed under the thesis option for the major in Consumer Studies and Housing; Public Policy except that 21 hours are needed in consumer studies or housing to include Home Economics 5960 (6 hours), or Child and Family Studies 5500 or Crafts, Interior Design, and Housing 5600.

Total 45 hrs
shall consist of 45 credit hours with a minimum of 24 hours in the major field and 18 hours at the 5000 and 6000 level. A minimum of 27 hours of 5000- and 6000-level courses is required in the program. Some majors may require 9 additional hours in one collateral area. Request for the non-thesis option must be made in writing by the student to the department head not later than the end of the first term in residence.

DOCTORAL PROGRAMS

The doctoral program in Home Economics provides three options for study: Interdisciplinary, food science, and nutrition. The interdisciplinary option is available in all departments in the College. The doctoral program with a major in Home Economics requires:

1. A minimum of 96 quarter hours in courses beyond the Bachelor's degree exclusive of credit hours for the Master's thesis to include a minimum of 12 quarter hours of 6000-level courses.
2. Selection of an option and fulfillment of the requirements as supervised by the faculty committee.
3. The faculty committee for each doctoral student shall determine whether a reading knowledge of a foreign language is required.
4. Written preliminary examinations.
5. Doctoral research and dissertation (minimum 36 hours; maximum 48 hours) may be included in the 96 hours presented for the degree.
6. A final examination.

Option Requirements:

Interdisciplinary option:

1. Home Economics 6110-20, 6210.
2. Twenty-four to 36 hours from at least two departments in the College of Home Economics representing one of the concentrations as selected by the student.
3. Emphasis may be on: normal developmental processes, in individuals and families; socialization through childhood, adolescence, and adulthood; behavior in diverse environmental and cultural settings; interaction processes within families; community services and planning to meet development needs of individuals and families.
4. Additional courses will complement the option emphasis and dissertation research area.
5. Doctoral research and dissertation will be based on a problem within the interdisciplinary option concentration.

Food science option and food science with concentration in food systems administration:

1. Three hours in research methods from Food Science 5510 or 6520 or Food Systems Administration 5210; 6 hours from Food Science 5610-20-30-40, 6110, Food Systems Administration 6110; and Zoology 5350 (Biometry) or equivalent.
2. Twenty-four hours in 5000- and 6000-level courses in food science or in food systems administration.
3. Nine hours in a collateral area (upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area may be substituted for 5000 and 6000 courses in food science or in food systems administration).
4. Minimum of 4 hours of credit in doctoral seminar.

Nutrition option:

1. Thirty hours of 5000 or 6000 courses in nutrition exclusive of research and Zoology 5350 (Biometry) or equivalent.
2. Nine hours in a collateral area (upon approval of student's faculty committee, 4000, 5000, and 6000 courses in collateral area beyond the 9 hours may be substituted for 5000 and 6000 courses in nutrition).
3. Minimum of 4 hours of credit in doctoral seminar.

SPECIAL WORKSHOPS

Workshops on special topics of current interest are offered periodically by the different departments in the College of Home Economics. These are of special interest to those desiring to work for advanced degrees. Announcements are sent upon request.

Each summer the craft workshop program in Gatlinburg, Tennessee, is made possible through cooperative efforts between the Crafts, Interior Design, and Housing Department and the Pi Beta Phi Arrowmont School of Crafts. The program provides advanced instruction in designer-created crafts through classes taught by nationally known craftspersons. Cooperation with national and local craft organizations has so stimulated the work of craftspersons throughout the area that their work has gained national recognition. See also page 92.

GRADUATE PROGRAMS FOR HOME ECONOMICS EXTENSION

Graduate programs at both the doctoral and Master's levels are available for students interested in home economics extension. At the doctoral degree level, programs of study may be planned in the interdisciplinary or the food science or the nutrition options. A Master's degree major in Consumer Studies and Housing: Public Policy is particularly suitable for students interested in home economics extension, although Master's programs may be planned in any subject matter area of home economics with agricultural extension education as a collateral area. Additionally, four-week courses are offered in February each year for students particularly interested in home economics extension. Interested in a graduate program and/or the four-week courses should contact the Associate Dean of the College of Home Economics.

Departments of Instruction

Numbers in parentheses following the course titles indicate quarter hours credit offered.

Child and Family Studies

MAJORS DEGREES

Child and Family Studies

Consumer Studies

Housing: Public Policy

MAJORS M.S. M.S. Ph.D.

Professors: R. L. Highbarger, Ph.D. Iowa; J. L. Kulipers (Head), Ph.D. Michigan State.


Assistant Professors: M. E. Kainowski, Ed.D Massachusetts; B. C. Miller, Ph.D. Minnesota; M. L. Rawlings, Ph.D. Pennsylvania State; H. M. Reed, M.S. Tennessee; P. Scott, Ph.D. Tennessee; L. Southworth, Ed.S. Tennessee; S. Twardosz, Ph.D. Kansas.

4110 Student Teaching in Preschool Settings (6) Increasing responsibility for planning and guiding groups of young children under supervision of head teacher; includes 2 hr weekly seminar. Prerequisite: Introduction to Early Education, Program Planning for Preschool Children, Creative Experiences for Preschool Children.
Child Development I. Coreq: Student Teaching of Preschool Children.

4210 Family Finance (3) Analysis of alternate ways of dealing with financial problems encountered during the family life cycle.

4220 Conserving Time and Energy in the Home (3) Application of management principles to the evaluation of employment, work centers and work procedures in terms of time and energy demands. Adaptations for the handicapped.

4230 Infant Development (3) Development during prenatal period and during first 2 years of life. Prereq: Human Socialization or Family Systems: Human Development, physiology or equivalent.

4260 Adult Development and Aging (3) Adult life in our society. Adjustment to internal and environmental changes through middle and aging years. Prereq: Human Socialization or Family Systems: Human Development or equivalent or consent of instructor.

4350 Advanced Child Development (3) Survey of selected theories relevant to child development. May be repeated with consent of instructor. Research literature and research methodology. Prereq: 6 hrs psychology and 6 hrs child development or equivalent.

4420 Learning Experiences with Parents (3) Dynamics of parent-teacher interaction. Emphasis on a variety of techniques for developing communication and working relationships between parents through experiences in a variety of settings. Prereq: Observation and Experience in Preschool Programs or 4110 or equivalent.

4430 Family Relationships (3) Interpersonal relationships among family members and societal roles. Prereq: Intimate Relationships or Family Development.

4610 Child in the Community (3) Needs of children; community agencies meeting these needs; visits to agencies contributing to the welfare of children. Prereq: Human Socialization, Family Systems: Human Development or equivalent.

4620 Administration of Programs for Young Children (3) Planning for the staff, housing, feeding, scheduling, and financing for day care of infants and young children, nursery school programs, and specialized programs for young children. Prereq: Program Planning for Preschool Children, Music and Literature for Preschool Children, or 4110.

4630 Field Work in Child, Family and Consumer Studies (3-15) Opportunity for students to be active in child, family, or consumer agencies; focus on children, families, and/or consumer concerns. Hrs arranged. May be repeated. Maximum 15 hrs.

4710 Contemporary Developments (1-3) A student or staff initiated course for study of a special topic or topics pertinent to the field; topics selected for study to be determined by students and instructor with departmental approval. Elective credit only. Prereq: Consent of instructor. May be repeated with consent of department head. Maximum 9 hrs.

4810 Afro-American Families (3) Historical background; contemporary family structure and relationships; emerging needs and programs. Prereq: 4 hrs in social sciences.

4830 Consumers and the Market (3) Factors important to homemakers as family purchasing agents; standardization of goods; grading, labeling, advertising; consumer practices affecting costs; specific household commodity information. Prereq: Principles of Economics.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student has completed and has met with the faculty before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5060 Practicum (1-12) Field experience in selected agencies that apply theoretical knowledge on solutions to problems in consumer studies.

5110 Field Work in Family Life (3) School and community programs concerned with education for family living. Prereq: Consent of department head. May be repeated. Maximum 9 hrs.

5140 Consumption and Standards of Living (3) Economic and welfare aspects of consumption. Analysis of factors associated with changes in the family's standard of living. Review of major consumption studies. Prereq: Crafts, Interior Design & Housing 4520 or consent of instructor.

5150 Assessment of Family Behavior (3) Use and interpretation of methods of measurement related to the study of the family. Current methodological issues in the study of the family. Prereq: 5410 and 5530 or consent of instructor.

5160 Management of Time and Energy in the Home (3) Developing and selecting labor-saving methods and developing the able-bodied and the handicapped. Survey work in literature. Current trends and methods of research. Prereq: 4220 or consent of instructor.

5170 Consumer Economics (3) Consumer functions in the economy; structure of consumer markets; government action relating to consumers; factors affecting prices of consumer goods.

5180 Family Financial Consultation (3) Analysis of family expenditure patterns, consideration of common financial difficulties, and avenues by which families are assisted. Field experience in family counseling and counseling services. Prereq: 4210 or 4530 or 5170.

5190 Standards in Consumer Protection (3) Product and performance standards in consumer protection. Theoretical and operational questions relating to standards, including analysis of costs and benefits to consumers. Prereq: 4830, 5170 or consent of instructor.

5210 Theories of Child Development (3) Major theories of child development. Prereq: 4550 or equivalent.

5220 Family Life Programs (3) School and community programs in family life; survey and evaluation; students concentrate on type best suited to their experience and future professional orientation. Prereq: 3 hrs child development, 3 hrs family relationships, 3 hrs sociology, 2 hrs and 1 lab.

5310 Theory and Research on Human Sexuality (3) Cultural, social, and psychological dimensions of human sexuality. Review of major contributions from anthropological, sociological, and personality theory and research.

5410 Advanced Family Relationships (3) Problems in modern family life; individual adjustments, group relationships. Prereq: Family Development, 4430, or consent of instructor.

5420 Parents and Children (3) Discussion of common problems of young children faced by parents and teachers with particular emphasis on methods available to modify problem behavior.

5430 Families in Crisis (3) Interpersonal transactions in disordered family behavior. Prereq: 5410 or equivalent.

5510 Survey of Research in Child and Family Studies (3) Review, evaluation, discussion of research literature; locating, abstracting, reporting research studies. Prereq: 5530 or equivalent.

5530 Research Methods in Child and Family Studies (3) Survey of current methods and procedures used in study of child and family behavior; basic methodology of the behavioral sciences. Recommended as prerequisite to beginning thesis work in this area. Prereq: 9 hrs child and family studies.

5540 Dependent Student Program Model (3) Analyze and evaluate curriculum program models for young children; prepare a student for Child and Family Studies or preschool education.

5550 Supervision in Preschool Programs (3) Emphasis on guidance of students working in nursery school agencies. Guiding students through seminar discussion, individual conferences and various evaluation techniques. Prereq: 5540. 3 hrs and 1 lab (2 hrs).

5610 Theories of Management in the Family Environment (3) Examination of fundamental management concepts, their development and application to current family situations.

5620 Nursing School Administration (3) Organizing and operating schools and play groups for preschool children. Housing, staff, schedules, programs, financing. Prereq: 4110 or equivalent.

5630 Seminar in Infant Development (3) Theory and research relating to development during infancy. Prereq: 4230.

5640 Teaching Child and Family Studies (5) Seminar and practicum in techniques for teaching child and family studies in colleges and universities; techniques of planning and development and family relationships. Prereq: Consent of instructor. S/NC only.


5840 Family Planning Programs (3) Community and family planning programs. Internship in planned parenthood programs and clinic. May be repeated. Maximum 9 hrs.

5900 Seminar in Child and Family Studies (1-3) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6250 Advanced Topics (3) Comprehensive individual study and group discussion of topics related to current problems in the area. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6310 Individual and Family Development—Physiological Determinants (3) Selected aspects of "family member" physiological potential, development, and status. The family's contribution to members' physiological potential for growth and development and to the realization of human potential. Prereq: 6 hrs in advanced child and family studies. 4 hrs nutrition, 2 hrs physiology, or equivalent.

6320 Individual and Family Development—Cognition (3) Processes through which the human individual learns to recognize his world. Emphasis on cognitive processes involved in development across the life span with focus on research findings and methodology. Prereq: 5210, 5530, 5550, or equivalent.
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>6320</td>
<td>Individual and Family Development: Socialization</td>
<td>(3) Processes of socialization throughout the life cycle. Focus on the family as a primary socializing agent. Prereq: 5210, 5410 or equivalent.</td>
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<tr>
<td>6410</td>
<td>Theories of Family Interaction</td>
<td>(3) Review of theories and concepts of family interaction. Emphasis on critical evaluation of theoretical formulations of contemporary research on family behavior. Prereq: 5410 or equivalent.</td>
</tr>
<tr>
<td>6450</td>
<td>Conceptual Frameworks for the Family</td>
<td>(3) Theoretical perspectives for understanding families. Exploration and applications of frameworks both theoretical and research level. Historical to contemporary development of family studies. Prereq: 5410 or consent of instructor.</td>
</tr>
<tr>
<td>6540</td>
<td>Seminar in Programs for Infants and Preschool Children</td>
<td>(3) Exploration of research related to programs for infants and young children. Evaluation of various program models for education of infants and young children, methods of working with parents, and student training programs. Prereq: 5210, 5540 or equivalent.</td>
</tr>
<tr>
<td>6710</td>
<td>Elements of Consumer Choice</td>
<td>(3) Analysis of consumer decision making, beginning with the theory of consumer choice, impact of affluence on consumers and consideration of dynamic aspects of consumer behavior, including the roles of aspirations, expectations, uncertainty and information. Prereq: 5170 or consent of instructor.</td>
</tr>
<tr>
<td>6720</td>
<td>Consumer Protection</td>
<td>(3) Consumer protection, including regulatory agencies, standards, information disclosure, and other consumer protection legislation. Assumptions involved in these efforts and relative success of different strategies. Prereq: 5170, 5190 or consent of instructor.</td>
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**Crafts, Interior Design, and Housing**

**MAJORS**

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<th>DEGREES</th>
<th>Majors</th>
<th>Interior Design, and Housing</th>
<th>M.S.</th>
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</table>

**CONSUMER STUDIES AND HOUSING**

- **Public Policy**
  - **Home Economics**
    - **Ph.D.**
      - **Professors:**
        - R. G. Blakemore, Ph.D., Florida State
        - J. Falmes, M.A., Florida State
    - **Associate Professors:**
      - W. Moran, M.S., Wisconsin
      - R. Pierotti (Director, Pi Beta Phi Arrowmont School of Crafts), M.M., Utah
    - **Assistant Professors:**
      - S. Blain, M.F.A., Wisconsin
      - R. Dehner, M.F.A., Wisconsin
      - J. Darrow, Ed.D., Illinois State
      - A. R. Parkas, Ph.D., Minnesota
    - **Lecturers:**
      - B. Adams, Washington, D.C.
      - A. Anderson, Ph.D., Ohio State
      - M. Bartel, Ed.D., Kansas
      - K. Bates, B.S., Massachusetts School of Art
      - E. Cardwell, Ed.D., Columbia
      - C. Cook, M.F.A., Wisconsin
      - M. Craft, M.F.A., Southern Illinois
      - M. F. Davidson, M.Ed., Duke
      - L. Davis, M.F.A., Cranbrook Academy of Art
      - F. Gerber, B.S., New York State College of Agriculture
      - P. Grayson, Kingsport
      - T. Tarroll, R. M., Orlando
      - F. Himan, B.F.A.
      - Syracuse
      - E. Iveson, M.F.A., Rhode Island School of Design
      - A. Isola, M.A., Rhode Island School of Design
      - E. Lambert, M.F.A., Cranbrook Academy of Art
      - A. Leisch, M.Ed., Louisville
      - H. Linder, Phoenix
      - Arizona
      - O. Linder, B.A., Adrian
      - W. Lockhart, Ed.D., Texas Tech
      - J. Michaels-Pague, Milwaukee Area Technical College
      - E. Moty, M.F.A., Tyler School of Art
      - M. Murphy, M.F.A., Kansas
      - R. Pfeifer, M.A., Indiana
      - E. Regensteiner, M.F.A., Art Institute of Chicago
      - C. Rodriguez, M.F.A., Florida State
      - S. M. R. Revor, M.F.A., Art Institute of Chicago
      - J. Rushfelt, M.F.A., Kansas
      - J. Schrader, M.F.A., Cranbrook Academy of Art
      - M. Shazhman, Ed.D., Columbia
      - B. Smith, B.S., Douglass College
      - S. Snyder, M.F.A., Ohio State University
      - M. Whisnant, M.S., Tennessee
      - J. Wellken, B.A., California (Berkeley)
      - H. Worrall, M.F.A., Cranbrook Academy of Art
      - D. Wyckoff, Ed.D., Columbia

**TO BE ADMITTED TO THE GRADUATE SCHOOL**

To be admitted to the Graduate School in the craft program a student must have a professional knowledge of media and technique. Work with creative design concepts is emphasized at the graduate level; media and technique are important only in so far as the experimentation with these contributes to the student's personal and creative orientation of the designer-designer. Courses are, therefore, based on theory or philosophical concepts in order to facilitate the development of visual sensitivity in relation to design. Major emphasis will be on the visual image as a personal interpretation of the media. Because the philosophical orientation of the student varies widely, progression from one level to another is based on the understanding and communication of visual concepts.

A student's course of study includes intensive training in the chosen areas of specialization such as metalwork, ceramics, weaving, textile design, or interior design as well as courses dealing with the broader aspects of design. All student programs include: Seminar in Design (5040), Advanced Design Studio (5050), and research methods; in addition, crafts majors include Exhibition Design (4140), and an interdisciplinary program in Consumer Studies, Housing, and Public Policy is available to students with interest in the social science approach to housing. Courses dealing with the design aspects of housing may be elected.

**PI BETA PHI ARROWMONT SCHOOL OF CRAFTS**

Graduate students in the area of crafts have an unique opportunity to participate in the summer program at the Pi Beta Phi Arrowmont School of Crafts, Gatlinburg, Tennessee; credit is granted through the University of Tennessee, Knoxville. Instructors at the school are nationally and internationally recognized designer-designers who offer, in many instances, different approaches to those of the resident faculty; this further enriches the student's program of study. Craft courses are not offered on the Knoxville campus in the summer quarter. Therefore, students attending UT during the summer for crafts study are required to attend the Pi Beta Phi Arrowmont School of Crafts and to pay the additional registration, tuition, and laboratory materials fees required by that school.

**ACQUISITIONS AND EXHIBITIONS**

For crafts and interior design majors, the department reserves the right of acquisition and exhibition of work completed in its studios under the guidance of the faculty. Prospective graduate students should submit a portfolio of their under-graduate studio work to the department. This portfolio may include slides or original work.

**5110 Home Wiring and Lighting Requirements**

(3) Service of electricity in modern homes; evaluation of lighting and wiring plans in terms of family desires and need for equipment. 1 hr and 2 labs.

**5130 Contemporary Design**

(3) Furnishings and interiors; economic, technological and sociological influences on the development of design; changing living conditions; interrelation of architecture and furnishings. Significant designers and their work.

**5140 Exhibition Design**

(4) Display of craft and interior design problems in relation to materials, props and special exhibition areas. Emphasis on knowledge and application of the design principles of form, space, color and materials, design construction, display and evaluation for two- and three-dimensional displays. Annual student exhibit, with training in the design and evaluation of the exhibits. Prereq: Introduction to Related Arts or equivalent.

**5155 Interior Space Planning I**

(6) Analysis, planning and design of the office environment; includes contract specifications.

**5156 Interior Space Planning II**

(6) Studio problems involving large scale nonresidential interior spaces such as restaurants, transportation facilities, stores, institutions. Prereq: 4155 or consent of instructor.

**5310 Crafts in America**

(3) Craft movement; factors that contributed to growth and development. Educational, social, economic, recreational and therapeutic values of crafts. Place of craftsperson in society as producer, teacher, designer for industry.

**5320 Family Housing Problems**

(3) Housing requirements of families. Reading and judging house plans; effective use of space; maintenance problems; housing regulations and restrictions; site selection and neighborhood development; financing procedures. Prereq: Principles of Economics.

**5330 Care and Repair of Household Equipment**

(3) Care of equipment to give maximum service in relation to operation and service cost; understanding of common repair problems. Prereq: Equipment in the Home. 1 hr and 2 labs.

**5410 Craft Media**

(4) Possibilities and limitations of craft media; understanding educational and social values of craft work. Designing and executing craft problems using inexpensive materials and tools. 3 labs.

**5420 Leather Design**

(4) Relationship of design to function, techniques and materials. Creating leather objects of original design. 1 hr and 2 labs.

**5430 Plastics**

(4) Possibilities and limitations of various plastics; methods of fabrication; relation of design to function, processes, types of material and use of tools. 1 hr and 2 labs.

**5000 Thesis**

Non-Thesis Graduation Completion (3-15)

Required for the non-thesis student not otherwise registered during any quarter when such a 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.
Unity of aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in enameling and consent of department head. Each course may be repeated one time.

5345-56-60 Plastics I, II, III (4, 4, 4) 5346—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in plastic. 5356—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in plastic. 5366—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in plastics and consent of department head. Each course may be repeated one time.

5347-57-67 Ceramics I, II, III (4, 4, 4) 5347—Initial development of theory for investigation of aesthetic concepts in two- and three-dimensional forms in ceramics. 5357—Advanced experimentation using aesthetic concepts in the development of two- and three-dimensional forms in ceramics. 5367—Experimentation in unifying aesthetic concepts in preparation for the graduate exhibition. Prereq: Previous work in ceramics and consent of department head. Each course may be repeated one time.


5358 Ceramics—Glaze Calculation (4) 5358—Experimentation with various types of clay bodies and glazes for reduction and oxidation firing atmospheres. Prereq: Previous work in ceramics and consent of department head. May be repeated. Maximum 8 hrs.

5410 Advanced Problems (3) Individual development of techniques and appreciation. Prereq: 9 hrs of related art or equivalent.

5510 Environmental Factors in Interior Design (3) Study of human factors and associated research techniques as they relate to the design of interior architectural environments—emphasis on the derivative design implications from anatomy, physiology, anthropometry, and the behavioral sciences. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5520 Environmental Factors in Interior Design (3) Study of systematic design methodology as applied to the design of microenvironments using human factors information. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5530 Environmental Factors in Interior Design (3) Human factors design methodology applied to the analysis, synthesis and evaluation of research-oriented interior design projects. Prereq: 3 hrs of research-oriented design research project to be carried out by 2 or 3 members. Prereq: 6 hrs behavioral science, and 6 hrs natural science or consent of instructor.

5610 Furniture Design (3) Analysis of human factors data in the design of body support, task support, and storage of furniture and other interior design products. Prereq: 5040, 6 hrs of graduate level psychology, or consent of instructor.

5613 Housing Management (3) Role and functions of the housing management specialist in dealing with problems of private and assisted living. Prereq: Consent of instructor.
4240 Nutrition in Disease II (3) Interdisciplinary lectures and discussions on the metabolic processes of normal and diseased organs and/or tissues and the dietary or behavior modifications required. Prereq: 4230. Designed for senior students in the coordinated undergraduate program in dietetics.

4430 Diet and Drug Therapy (3) Effect of drug therapy on absorption and utilization of nutrients, and effect of diet on absorption, utilization and toxicity of drugs. Prereq: Science of Nutrition or consent of instructor.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110 Advanced Physiological Chemistry (4) Bioenergetics and related metabolism of nutrients. Prereq: 3330 or equivalent. 3 hrs and 1 lab.

5120 Advanced Physiological Chemistry (3) Nutritional factors in relation to body fluids, gas transport and endocrine function. Prereq: 3330.

5140 Foods and Nutrition: Physicochemical Principles (3) Introduction to thermodynamics; physicochemical properties of proteins, carbohydrates and lipids; chemistry of the colloidal state; chemical kinetics; specialized kinetics of enzymatic processes. Prereq: Nutrition 3330 and College Algebra or equivalent.


5310 Community Nutrition (3) Nutrition problems and practices in the community; supervision of food service in child development centers; public health nutrition; dietetics; public health nutritionists, and others in related fields. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

5320 Community Nutrition (3) Observations and participation in nutrition programs of local and state agencies. Prereq: 5310 and consent of instructor. 3 labs.

5330 Community Nutrition (3) Nutrition programs of state and federal agencies; preparation of material for nutrition education; supervised field work. Prereq: Consent of instructor. 3 labs.

5340 Field Study in Community Nutrition (1-12) Personal participation in and analysis of a state or regional community nutrition program. Location of the in-depth study to be selected in consultation with the instructor. Prereq: 5320 and consent of instructor. S/NC only.

5350 Mental Retardation or Other Developmental Disorders of Childhood (3) Multidisciplinary core course required of all full-time students in training at the Child Development Center, UT Center for the Health Sciences, Memphis. Prereq: Consent of the department head.

5410-20 Human Nutrition (3, 3) Functions of carbohydrates, proteins, fats, minerals and vitamins. Nutritional requirements of man throughout the life span and practical problems in meeting requirements. Prereq: 5 hrs Science of Nutrition; 5110.

5430 Physiological Bases for Diets in Disease (3) Developments in the dietary treatment of disease in which nutrition plays a major role. Prereq: Consent of instructor.


5450 Survey Methods in Human Nutrition (3) Food consumption, food practices and nutritional status of population groups. Prereq: 5210 or 5410-20. 2 hrs and 1 lab.

5460 World Food Supply and Human Nutrition (3) Food supplies and food practices as related to human nutrition throughout the world. Regional, national and international agencies concerned with food and nutrition problems. Prereq: 5210 or 5410-20.

5470 Nutrition and Aging (3) Nutritional problems of the aging individual. Emphasis on nutritional requirements, dietary intakes and the effect of nutrition on the role of biological aging. Prereq: 5210 or consent of instructor.

5480 Nutrition in Mental Retardation and Developmental Disorders (1-12) Orientation to, observation of and participation in the interdisciplinary diagnosis and treatment of the developmentally-handicapped child. Emphasis is given to the role of the nutritionist; includes clinical experience and lectures at the Child Development Center, Center for the Health Sciences, Memphis. Prereq: Consent of department head.

5700 Current Problems and Trends in Nutrition (1-3) Discussion of selected recent developments in field of nutrition and their implications for public health nutritionists, public health nutritionists, and others in related fields. May be repeated. Maximum 9 hrs. Prereq: Consent of instructor.

5900 Seminar in Food Systems Administration (1-3) May be repeated.

6000 Doctoral Research and Dissertation

6110 Proteins and Amino Acids (3) Lectures, reports and discussions. Prereq: 5410-20.

6120 Mineral Metabolism (3) Lectures, reports and discussions of functions of minerals in physiological processes. Prereq: 5410-20.

6130 Lipid Metabolism (3) Lectures, reports, and discussions. Prereq: 5410-20.

6140 Vitamin Metabolism (3) Lectures, reports and discussions. Prereq: 5410-20.

6210 Advanced Topics in Nutrition (1-3) Discussion of recent advances, concepts, research techniques and current problems. Prereq: 5410-20 or consent of instructor.

6900 Seminar (1-3) May be repeated. Maximum 9 hrs. S/NC only.

Food Systems Administration

4130 Food Systems Administration (3) Functions of management applied to food service systems. Prereq: Quantity Food Procurement, Production and Service.

4140 Food Systems Personnel Development (3) Development of training programs for food systems personnel. Prereq: 4130 or consent of instructor.

4150 Design and Layout of Food Service Systems (3) Physical facilities equipment for food service systems based on needs of the system. Procedures for purchasing equipment. Prereq: Quantity Food Procurement, Production and Service, or consent of instructor.

4240 Food and Lodging Managerial Cost Control (3) Cost analysis for control. Use of financial statements for decision making for food and lodging operations. Prereq: 4130; Fundamentals of Accounting.

4260 Food and Lodging Physical Plant, Planning and Maintenance (4) Feasibility, planning, development and construction of food and lodging physical plant and maintenance. Electrical, mechanical, heating, plumbing, air conditioning and fire protection systems. Types of building materials and construction. Interdisciplinary with home economics and architecture. Prereq: Quantity Food Procurement, Production and Service; 4150; or consent of instructor, 3 hrs and 1 lab. (Same as Architecture 4260.)

4270 Food and Lodging Information Systems (3) Qualitative and quantitative analysis of information systems for decision making in food and lodging operations. Prereq: 4130, 4250, and Electronic Data Processing.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5110-20 Experimental Quantity Food Study (3, 3) Analysis of foodservice environment, and service problems related to quality of food prepared in volume. Use of management tools. Prereq: 4130, Quantity Food Procurement, Production and Service, or consent of instructor.

5210 Methods of Food Systems Research (3) Research methods applicable to food systems administration. Prereq: 4130, Statistics 5211 or equivalent.

5220 Experimental Design of Food System Facilities (3) Experimental approach to environment in which food is prepared, held, and served in volume. Prereq: 4130.

5230 Food Systems Evaluation (3) Evaluation of management resources in food systems. Standards for control. Prereq: 4130, or consent of instructor.


5310 Administration of Food Service Delivery Systems (3) The role and responsibilities of the administrator in maintaining desired qualitative and quantitative standards in a food service delivery system. Prereq: Quantity Food Procurement, Production and Service or consent of instructor.

5500 Clinical Training in Health Care Agencies (3) Instructional and supervisory techniques utilized in clinical settings by nurses and dietitians for the training of entry-level health care providers. Prereq: Management of Health Care or 4140 or consent of instructor.

5700 Current Problems and Trends in Food Service Delivery Systems (3) The role and responsibilities of the administrator in maintaining desired qualitative and quantitative standards in a food service delivery system. Prereq: Quantity Food Procurement, Production and Service or consent of instructor.

5820 Problems in Food Systems Administration (1-3) May be repeated.

5850 Field Experience (3-9) Planned administrative experience in a food service system. Prereq: Consent of instructor.

5900 Seminar in Food Systems Administration (1-3) May be repeated.
Home Economics

MAJOR

DEGREE

Home Economics

Ph.D.

Professors: L. M. Oldland (Dean), Ph.D. Wisconsin, D.Sc. Rhode Island; G. E. Goerz (Associate Dean), Ph.D. Kansas State.

Associate Professor: J. L. Cunningham, Ph.D. Michigan State.

Assistant Professor: V. S. Anagnost (Assistant Dean), M.S. Tennessee.

5060 Practicum (1-12) Field experience in selected organizations that focus on interdisciplinary solutions to multilevel problems in society. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

5100 International Studies (1-15) Student- or faculty initiated course for study in a foreign country of topic(s) pertinent to field. Topic to be determined by student and instructor with department and college approval. May be repeated. Maximum 15 hrs.

5210 History and Philosophy of Home Economics (3) Historical development of home economics; survey of concepts and philosophy of interdisciplinary disciplines and analysis of current programs; emphasis on projection of future developments.

5220 Development of Community Services Programs (3) (Same as Agricultural Extension 5210.)

5230 Evaluation of Community Services Programs (3) Purposes of evaluation, clarification of objectives and procedures for determining progress.

5600 Home Economics in the Community (3) The role of home economists in the community and how interactions among professionals of all community resources can facilitate finding solutions for and/or solving problems of individuals, families and communities as related to the quality of life. Prereq: Advanced Standing in Economics, 4320. Prereq: Economics 5340 or Planning 5100 or Child and Family Studies 5700 or consent of instructor.


5800 Problems in Community Services (1-3) Problems in community service, special topics, including program and group discussion of topics related to current problems in human resource administration. Prereq: Consent of instructor.

6110 Manpower Planning and Training for the Public Service (3) Identification of manpower needs by skill levels; planning and evaluation of programs for personnel in food service industry. Prereq: 4140, 5210 or consent of instructor.

6310-20 Quantitative Methods to Control Re- lation. Prereq: Consent of instructor.

6500 Methodological Issues in Home Economics (3) Advanced methodology in home economics, with particular attention to interdisciplinary research methods and issues. Prereq: 1 graduate-level course in research methodology or consent of instructor.

6900 Seminar (1-3) May be repeated. S/NC only.

Home Economics Education

Graduate study in home economics education provides for an M.S. in Home Economics Education and opportunity for participation in the Ed.D. program in Vocational-Technical Education in the College of Education. (See page 62 for staff and course offerings.)

Textiles and Clothing

MAJORS

DEGREES

Textiles and Clothing

M.S.

Home Economics

Ph.D.

Professor: A. J. Treece (Head), Ph.D. Ohio State.

Associate Professors: M. Ford, Ph.D. Pennsylvania State; B. C. Goswami, Ph.D. Manchester (England); C. J. Noel, Ph.D. Notre Dame.

Faculty Associate: T. L. Vigo, Ph.D. Tulane.

Assistant Professors: R. P. Dowlen, M.S. Tennessee; M. F. Miller, Ph.D. Pennsylvania State.

Lecturer: A. L. Bullock, B.S. Mississippi College.

4210 Elementary Textile Microscopy (3) Introduction to microscopic techniques as applied to the study of textile fibers and fabrics. Prereq: Textiles II; Textile Chemistry. 1 hr and 2 labs.

4240 Design Analysis II (3) Creative interpretation of design terminating in finished garments developed through the media of draping. 1 hr and 2 labs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise enrolled. This course allows a student to use university facilities and/or faculty time before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5110 Textile Testing and Methods of Research in Textiles (3) Physical and chemical testing. Research methods. 3 labs.

5120 Advanced Problems in Textiles and Clothing (3) Refresher course; emphasis on new developments in textiles. Aids in selecting fabrics, agencies aiding consumer, and individual problems which students have met in the textile field. 2 hrs and 1 lab.

5130 Advanced Tailoring (3) Comparison of hand tailoring and machine tailoring in making suits, coats, or costumes. 3 labs.

5150 Principles of Design Analysis (3) Application of flat pattern theory to garment design incorporating relationships of fabric geometry, texture, hand, and surface ornamentation to design. Prereq: Consent of instructor. 1 hr and 2 labs.

5160 Review of Literature (3) Intensive survey and evaluation of recent literature; implications for further research.

5170 Social, Psychological and Economic Aspects of Clothing (3) Clothing as it relates to human behavior. Prereq: 6 hrs or equivalent from one or more of the following areas: sociology, psychology, economics.

5180 Advanced Textile Economics (3) Economic problems or problem areas of current importance in the textile and apparel industries—production, consumption and governmental policy. Prereq: 3420, 6 hours of economics or consent of instructor.

5210 Evaluation of Instructional Materials in the Field of Textiles and Clothing (3) Evaluating instructional materials to use in communicating information in the various areas of textiles and clothing. 1 hr and 2 labs.

5220 Historic Textiles (3) Development of the textile industry in the world with emphasis on fibers used, design and color.

5240 Practicum (1-9) Off-campus experience with business, industry, governmental agencies and civic groups; preplanned; supervised. Prereq: Consent of major advisor and department head. May be repeated. Maximum 9 hrs. S/NC only.

5250-60-70 Problems in Textile Chemistry (4, 4, 4) Theoretical and experimental study of chemistry of textiles including polymerization, reactions, dying, and finishing. 5250 must be taken first, 5260 and 5270 need not be taken in sequence. 5250—Emphasis on structure—property relationships and reactions of fibers. 5260—Kleem finishing. 5270—Emphasis on dyes and dying. 2 hrs and 2 labs. Prereq: 3420 or equivalent, one quarter of organic chemistry.

5310 Fashion Analysis (3) Fashion as a social and economic force; evolutionary theory of fashion operation. Prereq: 6 hours each of sociology and economics.

5320 Problems in Historic Costume (3) A variable content course with emphasis on the flow of styles in relation to cultural determinants. Prereq: 3420 or consent of instructor. May be repeated. Maximum 9 hrs.

5710-20-30 Current Programs and Trends in Textiles and Clothing (1-3, 1-3, 1-3) Pertinent developments and trends in textiles and clothing and their implications for new types of programs, techniques, and/or areas of research. Content and emphasis will vary according to changes in the field and needs of groups serviced. Prereq: Consent of instructor.

5800 Problems in Textiles and Clothing (1-3) Advanced study selected from the field of textiles and clothing. Prereq: Consent of department head and professor in charge of investigation. May be repeated. Maximum 9 hrs.
5900 Seminar in Textiles and Clothing (1-3)
Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6110 Selected Issues in Textiles and Clothing (3) In-depth investigation of advanced topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6140 Selected Behavioral Theories in Clothing (3) Role of clothing in the functioning of people, utilizing behavioral theories. Prereq: 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6150 Social-Psychological Theories of Clothing Consumption (3) Analysis and evaluation of social science theories of consumer behavior in relation to the areas of textiles and apparel. Prereq: Child and Family Studies 5170, 6 hrs of graduate level sociology or psychology, or consent of instructor.

6160 Textile Flammability (3) Factors affecting textile flammability as a consumer issue. Standards, regulations, test methods, economic impact. Prereq: 5120, 5160, 5250, or consent of instructor.

6170 Physical Performance Behavior of Textile Structures I (3) Fundamentals of yarns and fabric structures; relationship of structure to physical characteristics of textile materials. Prereq: 5120, or consent of instructor.

6910 Seminar in Textiles and Clothing (1-3) May be repeated. Maximum 6 hrs.
Intercollegiate Programs

Aviation Systems

MAJOR
Aviation Systems

DEGREE
M.S.

Professors:
B. H. Goethert, Ph.D. Berlin; E. C. Huebschmann, Ph.D. Texas; R. S. Sleeper, M.A. Harvard; M. A. Wright, Ph.D. Wales; J. M. Wu, Ph.D. California Institute of Technology; R. L. Young, Ph.D. Northwestern.

Associate Professor:
S. N. Chaudhuri, Ph.D. Indian Institute.

The University of Tennessee Space Institute offers this program leading to the Master of Science with a major in Aviation Systems. The Aviation Systems program is designed for those who possess Bachelor’s degrees in engineering or science and who wish to study under a “systems philosophy” toward careers in research and development or administration in various phases pertinent to aviation. The program features 18 quarter hours major field credit in various aspects of aviation systems, 6 or more quarter hours credit in each of the areas of research, development and administration, and electives which permit further specialization in either area.

To qualify for admission to this program, the applicant must possess a Bachelor’s degree in engineering or science from a recognized 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. Subject matter prerequisite to the program includes basic knowledge of computer utilization as represented by Statistics 3510 or equivalent, a background in statistics as represented by Statistics 3450 or equivalent, a basic understanding of aerodynamic fundamentals, aircraft propulsion and performance as represented by Aerospace Engineering 4110 and Aerospace Engineering 4120 or equivalent, a background in accounting as represented by Accounting 5710 or equivalent basic accounting courses, a basic knowledge of economics as represented by Introductory economics or equivalent. Satisfaction and non-thesis programs are available for fulfilling the requirements of the program. The thesis program involves satisfactory completion of the following minimum requirements:

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, 6 quarter hours in Industrial Engineering 5700 and Industrial Engineering 5710 and for the administration area, 6 quarter hours in Economics 5070 and Accounting 5810, for a total of 12 quarter hours.
3. Six quarter hours of electives selected from the major field, engineering and/or the areas in item 2.
4. Nine quarter hours in Aviation Systems 5000, Thesis, hence demonstrating the ability to conduct and report on an independent investigation.

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

1. Eighteen quarter-hour credits in the major field of aviation systems.
2. For the research and development area, 9 quarter hours in Industrial Engineering 5700, Industrial Engineering 5710, and Industrial Engineering 5720 and for the administration area, 9 quarter hours in Economics 5070, Accounting 5810 and Finance 5510, for a total of 18 quarter hours.
3. Six quarter hours of electives in one of the areas in item 2.
4. Six quarter hours of electives in the major field, engineering and/or the areas of item 2.

5. Satisfactory completion of 3 quarter hours in Aviation Systems 5100, Project in Aviation Systems.
6. Satisfactory completion of a comprehensive final written examination on all course work submitted for the degree and defense of the project course paper.

The thesis program involves 45 quarter-hour credits minimum while the non-thesis program involves 51 quarter-hour credits minimum.


Electives typical of those suitable for credit in the area of Aviation Systems, research and development include: Aerospace Engineering 5150-60-70; Computer Science 3510-20, 4550 and 5565-65-75; Industrial Engineering 4060, 4150, 4230, 5720, 5730, 6700, 6730; Mathematics 4220-30, 4510-20-30; Metallurgical Engineering 5810-20-30; and Statistics 3550. Electives typical of those suitable for credit in the area of aviation systems, administration include: Accounting 5810; Business Law 5110; Economics 5080; Finance 5100; Industrial Management 5130; Marketing 5100; Transportation 5100, 5130, 5210-20, and 5910.

5000 Thesis

5070 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 the com-
cy

munity, collection and distribution, demand requirement analyses, types of developments and their projections. Prereq: Aerospace Engineering 5810.

5080 Collection and Distribution (3) Capabilities and limitations of programs and developments for collecting and distributing passengers and freight to and from various types of airports, water, air and mixed transportation modes, present and future; requirements analysis, and model analysis of the system. Prereq: Aerospace Engineering 5810.

5090 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 and administrative and enforcement procedures. Prereq: Aerospace Engineering 5810.

5100 Project in Aviation Systems (3) In-depth study and formal report on an aviation systems topic, normally performed during the last quarter of work toward degree in non-thesis program. For aviation systems degree candidates only.

5210-20 Experimental Flight Mechanics (3, 3) Consideration of flight mechanics with emphasis on experimental techniques. Specialized, equipped airborne laboratory allows active student participation in a series of experiments demonstrating the acquisition of flight test data. Tests will be conducted covering a broad range of aircraft performance, stability and control characteristics. In addition to the development of the theory necessary to support the class experiments, test techniques, instrumentation and data reduction methods will also be the subject of the series of lectures included in the course. 5210 emphasizes performance and 5220 emphasizes stability and control. Prereq: Aerospace Engineering 4120.

5970 Special Topics in Aviation Systems (3) Current problems in aviation systems. Prereq: Consent of instructor. May be repeated with consent. See also course descriptions for Aerospace Engineering 5810, 5820, and Industrial Engineering 5840.

Computers and Bionics

Professors:
T. C. Helvey (Emeritus), D.Sc. H.C., University of the Atlantic*; R. S. Sleeper, M.A. Harvard.*

5110 General Systems and Cybernetics Fundamentals (3) Fundamentals of the theories of cybernetics, bionics, and general systems theory. General systems are presented with a review of the theories of information, automatic and manual systems, and computers, which are necessary for the understanding of the main topics.

5120 Cybernetic Biophysics (3) Interdisciplinary and systems aspects of the mechanism of the human body are presented which include the topology, chemistry, physics, and mental functions. Course presents primarily the engineering aspects of man; useful elective of all engineering programs.

5130 Applied Cybernetics and Bionics (3) Utilization of cybernetics and bionics for communication and control in large human systems and in the approach to man-machine symbiosis. Recommended for those having participated in 5110 and 5120; persons primarily interested in an overview of systems dynamics may take with the instructor's consent.

5140 Cybernetics of Human Behavior (3) Aspects of human behavior with emphasis upon open and closed feedback loop interactions with the environment. Systems aspect of cognition and mental functions, second order interaction in interpersonal communication. Recommended for engineers and persons interested in man-machine interactions.

5990 Cybernetics Seminar (3) The Graduate Program in Ecology offers Master of Science and Doctor of Philosophy degrees. This interdepartmental program provides advanced courses in contemporary ecology for students from undergraduate programs in basic and applied biology, social sciences, mathematics and engineering. Research opportunities in both fundamental and applied ecology are intended to prepare students for academic careers as well as professional positions in industry or government. The Environmental Sciences Division of the Oak Ridge National Laboratory and the Tennessee Valley Authority provide advisors and research facilities. The Great Smoky Mountains, Cumberland Plateau, valley and ridge topography, the Tennesse, and the rivers provide locally a spectrum of natural habitats and consequent biological diversity which is truly unique. In addition, faculty research programs provide opportunities to participate. Contact other faculty elsewhere on this continent and abroad.

ADMISSION REQUIREMENTS
Requirements for admission to this program are: (1) admission to the Graduate School; (2) at least 12 quarters of college chemistry, 9 quarter hours of college mathematics, and 4 quarter hours of ecology at the upper division level. Candidates for the doctoral degree are expected to take the Graduate Record Examination.

Application forms for admission should be obtained from the Graduate School of the University of Tennessee. Inquiries concerning the admission requirements should be addressed to the Director, Graduate Program in Ecology, University of Tennessee, Knoxville, Tennessee 37916.

ADVISORS
Advisors are selected from ecologists in several departments of the university who have competence in the area in which the student expects to work. Entering students should consult early with the Director of the program on the choice of a faculty advisor who will become the chairman of the student's faculty committee.

THE MASTER'S PROGRAM
The minimum 45 quarter hours of graduate credit shall include 18 hours of ecology courses (exclusive of thesis), of which 6 hours shall be in Ecology 5210-20-30 and at least 8 additional hours in ecology courses numbered above 5100; 9 hours of thesis in Ecology 5000, and 18 additional hours in ecology or supporting courses. To insure an inter-departmental program, the required minimum of 45 credits shall exclude no more than 18 hours of non-thesis courses from any one department of instruction.

The general requirements for this Master's degree are listed on page 19. A minor in ecology shall include Ecology 5210-20-30 (6 hours) and at least 3 additional hours in approved ecology courses.

THE DOCTORAL PROGRAM
The requirements for this degree are in general the same as those of the Graduate School with the following two exceptions: (1) each student's faculty committee shall consist of at least two members from the department in which the dissertation is being supervised and at least two from outside this department; (2) this doctoral program must include Ecology 5210-20-30 and a minimum of 9 quarter hours of courses numbered above 6000. A candidate for dissertation enrollment until the research proposal has been discussed and approved by the doctoral committee.

Shared Faculty

Courses
The following courses are those offered directly by the Ecology Program and those which, although listed in other departments, have been approved to satisfy Master's degree requirements. Additional ecology
Agricultural Biology
4010 Biology of Soil Microorganisms (4)
4510 Freshwater Fishery Biology (4)
4520 Management of Lakes and Ponds (4)

Agricultural Economics and Rural Sociology
4330 Land Economics (3)
5420 Advanced Land Economics (3)
5490 Rural Population Analysis (3)

Anthropology
4360 Field Work in Physical Anthropology (3-9)
4840 Zoolochoelogy (3)
4960 Primate Paleontology (3)
4970 Human Paleontology (3)
5970 Emergence and Early Evolution of Man (3)

Botany
4310 Plant Ecology (4)
5340 Plant Geography (4)
5350 Analysis of Plant Communities (4)
5510-20-30 Systems Ecology (3, 3, 3)
5830 Field Methods in Plant Ecology (4)
6320 Ecosystems of the World (3)

Ecology
5000 Thesis
5100 Special Problems in Ecology (1-3) Individual investigations in ecology. Prereq: May be repeated with consent of instructor. Maximum 3 hrs.
5210-20-30 Principles of Ecology (2, 2, 2) An interdisciplinary study of theories and problems in ecology. Comparisons between land, freshwater, and marine environments, including man's roles in the world's ecosystems. Must be taken in sequence. Prereq: 4 hrs of ecology at the upper division level.
5310 Ecology for Planners and Engineers (3) Ecological principles and the effects that man-caused changes have on living organisms, including man. Lectures and field trips. Designed for students in the Graduate School of Planning and Environmental Engineering.
5320 Implementation of Environmental Policy (3) The goals and problems of environmental legislation, especially the National Environmental Policy Act; the purpose, preparation, and evaluation of environmental impact statements and similar multidisciplinary studies. Prereq: 5210 or 5310, or Environmental Law.
5330 Marine Ecology (3) Relationships of marine organisms to the environment and their interactions with each other will be studied. Topics included are: trophic relationships in neritic, coastal and estuarine ecosystems; succession; deep-sea ecology; stability. Prereq: One previous ecology course.
6000 Doctoral Research and Dissertation
6100 Special Topics in Ecology (3) Seminars on advanced topics and recent developments in ecology. Prereq: Consent of instructor. May be repeated.
6110 Seminar in Animal Behavior (2)
6120 Seminar in Aquatic Ecology (2)
6130 Seminar in Physiological Ecology (2)
6140 Seminar in Community Ecology (2)
6150 Seminar in Radiation Ecology (2)
6160 Seminar in Systems Ecology (2)

Economics
4260 Economics of Resources (3)

Environmental Engineering
4530 Sanitary Engineering Laboratory (3)
4600 Solid Waste Management (3)
4700 Air Pollution-Air Resources Management (3)
5561 Aquatic Environment Pollution (3)
5593 Advanced Sanitary Engineering (3)
5700 Planning and Air Pollution Control (3)
5710 Air Control Engineering (3)

Forestry, Wildlife, and Fisheries
4005 Forest Ecosystems (3)
4450 Game Mammals (4)
4460 Game Birds (4)
5210 Seminar in Wildlife Conservation (3)
5220 Seminar in Forest Tree Biology (3)
5240 Seminar in Forest Genetics (3)
5460 Predator Ecology (3)

Geography
4720 Data Mapping (4)
4740 Remote Sensing: Types and Applications (4)

Geology
5550 Topics in Geography of Land-Surface Systems (3)
5510 Selected Topics in Climatology (4)
5740 Advanced Topics in Remote Sensing (3)

Geology
4230 Palaeoecology (4)
4240 Paleobotany (4)
4510 Principles of Geomorphology (4)
5290 Quaternary Problems (4)
5915 Regional Geomorphology (4)

Microbiology
4950 Microbial Ecology (3)
5829 Experimental Microbial Ecology (3)

Nuclear Engineering
5210 System Dynamics (3)

Philosophy
4710 Philosophy of Natural Science (4)
5550-60 Philosophy of Science (4, 4)
6550 Seminar in Philosophy of Science (4)

Plant and Soil Science
4320 Soil Formation, Morphology and Classification (4)
5240 Soil Productivity and Management (3)
5260 Pedology (4)
5810 Crop Climatology (4)
5820 Advanced Crop Physiology and Ecology (4)

Psychology
4800 Aspects of Urban Environment (4) S/NC only.
5750 Ethological Psychology (3)

Sociology
4110 Population Problems (4)
4330 Urban Ecology (4)
6100 Theory and Method of Human Ecology (3)

Zoology
4200 Ichthyology (5)
4240 Animal Ecology (4)
4560-70 Limnology (4, 4)
4760 Arachnology (4)
5570 Animal Populations (3)
5860 Geographic Distribution of Animals (4)

Industrial and Organizational Psychology
MAJOR

Organizational Psychology

DEGREES

Committee:
J. M. Larson, Jr. (Chairperson); R. D. Arvey; W. H. Calhoun; F. A. Chamblin; H. D. Dewhirst; R. L. Dipboye; M. E. Gordon; J. M. Lounsbury; J. W. Philip; E. D. Sundstrom; G. H. Whitlock.

(For complete Faculty Listing, see Departments of Industrial Management and Psychology)

The Master's and Doctoral programs are offered jointly by the Department of Psychology and the Department of Industrial and Personnel Management. They are designed to prepare students for personnel, managerial, and organizational research, for university teaching, and for consulting relationships with industry. The emphasis is upon applied research utilizing a thorough theoretical background, including classical and modern organization theory, organizational behavior, psychology, and industrial management. The programs are administered by a joint committee of the two departments, appointed by the Vice Chancellor for Graduate Studies and Research on recommendations from the two department heads.

It is intended that students entering the program will represent widely different undergraduate and graduate backgrounds, including psychology, business administration, engineering, science, and liberal arts. The first-year program provides the opportunity to take courses which will assist the student to attain a reasonable level of sophistication in areas of deficiency (Psychology 5550-60).

ADMISSION PROCEDURE

Applicants for admission should request forms and materials from both the Graduate Office and the Chairperson, Industrial and Organizational Psychology Program, 413 Stokely Center for Management Studies.
Two separate applications must be completed: one application for admission to the Graduate School and one application for admission to the Industrial and Organizational Psychology program.

**Deadline:** For fall entrance, all materials should be received by the Vice Chancellor for Graduate Studies and Research no later than March 15 if you wish financial assistantship consideration.

**Standards:** At least 9 quarter hours of college mathematics and one course in statistics are required. Ordinarily, an undergraduate grade-point average of 2.5 or above is required, with no evidence of special weakness in mathematics and physical sciences. Test scores of 500 or above also are necessary on the Graduate Management Admission Test, or on each section of the aptitude portion of the GRE. The advanced section for psychology is required.

**THE DOCTORAL PROGRAM**

I. **Course Requirements**

A. **Minimum course requirements**

1. Industrial Management or Psychology 5170, 5180, 5190 (Proseminar in Industrial and Organizational Psychology)

2. Statistics 5050-60-70 (Behavioral Statistics). Exemption by petition

3. Psychology 5070 (Academic Practicum)

4. Minimum of three 6000-level seminars to be selected from Psychology or Industrial Management 6250, 6260, 6270, and Industrial Management or Psychology 6380*

5. 36 hours of Psychology or Industrial Management 6000 (Doctoral Dissertation)

B. **Recommended electives**

1. For preparation for advanced section (61) GRE: Psychology Proseminar

2. For students who require preparation in psychometrics: Applied Psychometrics

3. For students who require preparation in management: Industrial Management 5110, 5120, 5230; Psychology 5170, 5180, 5190 (Proseminar in Industrial and Organizational Psychology)

4. For students who wish to pursue special research interests aside from their dissertation: Industrial Management 5250, 5260, 5270 (Readings in Organizational Psychology) Industrial Management or Psychology 6900 (Supervised Field Research)

5. Courses available in areas related to industrial and organizational psychology:
   a. Through College of Business Administration: Wage and Salary Administration (Industrial Management 5220)
   b. Through College of Liberal Arts: Psychology 6450, 6460, 6470 Industrial Sociology

II. **Program Requirements**

A. Attainment of a B average in the Proseminar in Industrial and Organizational Psychology. (Industrial Management or Psychology 5170, 5180, 5190)

B. Completion of a comprehensive examination in general psychology within no more than two years of entry by attaining a score of 650 on the GRE Advanced Test in Psychology.

C. Completion of a general preliminary examination in scientific methodology before beginning the third year of study. This examination covers the following specific areas: statistics psychometrics experimental design

D. Completion of a special preliminary examination in the area of the student's major research and professional interests. A student is expected to take this examination by the end of twelve quarters. This examination may be repeated once, normally no later than six months after the first attempt, at the discretion of the student's doctoral committee.

E. By the end of nine quarters a student is expected to choose a major advisor (Chairperson of Doctoral Committee).

F. Completion of an oral examination following the preparation of a doctoral dissertation. This examination covers the field of the doctoral research and related topics, and must be passed at least four weeks prior to the awarding of the degree.

G. Maintenance of at least 3.0 grade point average.

**THE MASTER'S PROGRAM**

I. **Course Requirements**

A. Industrial Management or Psychology 5170, 5180, 5190 (Proseminar in Industrial and Organizational Psychology)

B. Statistics 5050-60-70 (Behavioral Statistics) and applied psychometrics, 3 hours

C. Eighteen hours of additional course work to be selected primarily from among the 5000-level course offerings in industrial management and psychology (e.g., Industrial Management 5110, 5120, 6230; Psychology 5080 (Current Topics in Applied Psychology))

**Management Science**

**MAJOR**

**DEGREE**

**Management Science**

M.S.

Committee:
- G. E. Bell (Chairperson), Management Science
- R. W. Boling, Industrial Management
- J. S. Bradley, Mathematics
- R. L. Church, Civil Engineering
- R. S. Garfinkel, Management Science
- R. E. Rosenthal, Management Science
- S. Selkow, Computer Science
- G. C. Thompson, Statistics

**THE MASTER'S PROGRAM**

The M.S. program in Management Science is designed as preparation for a career in the application of quantitative techniques for the solution of management problems in large organizations. The program's flexibility also makes it appropriate as preparation for doctoral study in Management Science.

Management Science course work will expose students to both the theoretical development of quantitative techniques and their application to managerial decision making. In addition to the development of sufficient mathematical maturity for creative use of quantitative skills, the program allows concentrated study in an area of application within the College of Business Administration. With the widespread application of management science technology, the student may (with the approval of the Management Science Committee) choose an applied concentration in a field outside the College of Business Administration.

Applications are encouraged from all majors, but mathematical background equivalent to the completion of at least two years of college calculus and proficiency in a computer language (e.g., Computer Science 3150) is required. The program is designed to be completed in one calendar year of full-time study, but applications are also encouraged from prospective part-time students.

**Course Requirements**

<table>
<thead>
<tr>
<th>Quarter Hours</th>
<th>Management Science 5310-20-30-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved by advisor</td>
<td>12</td>
</tr>
<tr>
<td>Statistics 5110</td>
<td>3</td>
</tr>
<tr>
<td>Statistics elective (5000 level or above)</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics (4000 level or above)</td>
<td>6</td>
</tr>
<tr>
<td>Electives selected from mathematics, statistics, computer science, and/or management science</td>
<td>6</td>
</tr>
<tr>
<td>Electives in any area approved by advisor</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
</tr>
</tbody>
</table>

**Any student in the doctoral program may be required to prepare a Master's thesis by the Industrial and Organizational Psychology Committee. This policy will be implemented by the committee at such time as a review of the student's record suggests that additional data on the qualifications for pursuing a Ph.D. are required.**

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* May be repeated for additional credit.
A thesis option is available which substitutes 9 hours of thesis credit for the following 12 hours of course work: Management Science 5340, one 3-hour course in the applied concentration area and 6 hours of electives in any area. The Management Science Committee will work closely with the student in tailoring a program to his/her needs. The committee must approve a tentative overall program during the student's first quarter and must approve all courses on a quarter-by-quarter basis.

Recognizing the diverse backgrounds and needs of Management Science M.S. students, the Management Science Committee is prepared to waive some of the above requirements on an individual basis. For example, an undergraduate mathematics major with a strong background may be allowed to take 6 additional hours of electives in place of the mathematics requirement. On the other hand, a student lacking experience in rigorous senior-level mathematics courses will be asked to take such courses to fulfill the 6-hour mathematics requirement. The total course load will remain 48 hours for all non-thesis students and 45 hours for all thesis students; however, the number of hours of electives can be reasonably expected to vary between 6 and 18 as a function of prior background.

Prerequisites for Management Science Courses: The Management Science Program is interdisciplinary and students in other degree programs are encouraged to enroll in management science courses. Course prerequisites are designed to indicate the level at which courses are taught. Interested students whose prior course work does not match the prerequisites are encouraged to seek the instructor's guidance and consent to enroll.

For course listings and description of the Ph.D. program in Management Science, refer to the Department of Management Science, College of Business Administration.

University Studies
(Non-Departmental)

University Studies deal with important contemporary topics which are sufficiently comprehensive to require the study and attention of students and faculty from more than one college. They are open to all qualified members of the university community.

4100 Energy Needs and our Environment (3)
Not allowed for graduate credit for ecology majors.

Water Resources Development

MAJOR DEGREE
Water Resources Development M.S.

Floyd C. Larsen, Director,
Water Resources Research Center

Specific requirements for admission to this program are a Bachelor's degree in law, engineering, or one of the physical or social sciences from an accredited college or university, and evidence of ability to do work of graduate quality, as ascertained by undergraduate records. Also considered will be work record, if any, and letters of recommendation. The general policies and requirements of the Graduate School apply to this program.

The degree of Master of Science requires 45 quarter hours of graduate studies, including 9 hours of thesis work. The exact curriculum of each student is decided in consultation with a faculty committee, depending on the background and field of interest. If during the undergraduate work the student has, in the opinion of the faculty committee, sufficient training and education in one or more of the required courses, the student may substitute other elective courses. Electives will consist of advanced work in the student's specialty or in a related field.

3410 Principles of Ground Water Geology (3)
(Stat as Geology 3410.)

3565 Introduction to Public Administrative Organization & Management (4) (Same as Political Science 3565.)

4110 Managerial Economics (3) (Same as Economics 4110.)

4810 Water Law (3) (Same as Environmental Engineering 4810.)

5000 Thesis

5130 Planning Research Methods I (3) (Same as Planning 5130.)

5160 Planning and Utilities (3) (Same as Environmental Engineering 5160 and Planning 5160.)

5200 Water Resources Systems (3) (Same as Environmental Engineering 5200.)

5330 Descriptive Hydrology (3) (Same as Environmental Engineering 5330.)

5340 Hydrology of Agricultural and Forest Lands (3) (Same as Agricultural Engineering 5340.)

5410-20-30 Interdisciplinary Seminars (3, 3, 3)
Problems relating to comprehensive water resource development including flood management, hydroelectric power, navigation, recreation, alternatives in water resource planning, tomorrow in today's planning, project formulation and justification, direct and indirect economic consequences, state and local participation, and municipal and industrial uses of water developments.
The College of Liberal Arts offers programs leading to eight advanced degrees.* See page 9 for degrees and majors.

**Departments of Instruction**

Numbers in parentheses following the course titles indicate quarter hours credit offered.

### Anthropology

**MAJOR**

Anthropology

**DEGREE**

M.A., Ph.D.

**Professors:**

W. M. Bass (Head), Ph.D. Pennsylvania; C. H. Faulkner, Ph.D. Indiana; A. K. Gutsche, Ph.D. Michigan; F. W. Parmalee, Ph.D. Texas A. & M.

**Associate Professors:**

I. E. Harrison, Ph.D. Syracuse; R. L. Jantz, Ph.D. Kansas.

**Assistant Professors:**

J. M. Bishop, Ph.D. California (Berkeley); W. E. Klippel, Ph.D. Missouri; M. H. Logan, Ph.D. Pennsylvania State; G. F. Schnoedl, Ph.D. Washington State; F. H. Smith, Ph.D. Michigan.

**THE MASTER'S PROGRAM**

The formal requirements for the Master's degree include:

1. A minimum of three quarters of residence at the University of Tennessee.
2. A minimum of 45 quarter hours for graduate credit, including preparation of thesis. Thirty-six of these 45 hours must be in anthropology, 9 hours may be taken in closely related disciplines (at least one-half of the courses must be at the 5000 level).
4. A thesis. In addition to the two (2) copies required by the Graduate School, one bound copy of the thesis is to be presented to the department and one bound copy to the student's thesis advisor.

**THE DOCTORAL PROGRAM**

Although there is no minimum credit hour requirement for the Ph.D. degree, students in this program should plan to devote to its attainment no less than 3 years beyond the B.A. level, and to complete the following requirements:

1. Admission to Ph.D. program through passing the Graduate Evaluation Examination at completion of first year of study, or through departmental acceptance of a previously earned M.A. degree in Anthropology.
2. Formation of an advisory committee and establishment in consultation with that committee of a program of study. Delineation of field(s) of competence by the student and committee and subsequent presentation to graduate advisor.
3. Demonstration of competence in a foreign language as determined by the student's committee.
4. Successful completion of oral and written comprehensive examinations and admission to candidacy.
5. Successful completion of the dissertation and final oral examination.

**COURSES**

- **3070 Genetics and Society (3) (Same as Botany 3070).**
- **3410 Principles of Cultural Anthropology (3) Basic concepts and objectives in the study of culture. The range of cultural phenomena and approaches to its study. Prereq: Human Culture recommended.**
- **3440 Religion of Primitive Peoples (3) The religions of nonliterate peoples. The place of religion in their social and cultural systems. Prereq: Human Culture recommended. (Same as Religious Studies 3440.)**
- **3450 Community Studies in Complex Culture (3) Review of cross-cultural comparative urban and village communities and methodologies used in community studies. Prereq: Human Culture recommended.**
- **3510 Peoples and Cultures of Mainland Asia (3) Ethnographic survey of the indigenous cultures of mainland Asia. Cultural diversity and human ecology in areal perspective. Prereq: Human Culture recommended.**
- **3520 Peoples and Cultures of Africa (3) Ethnographic survey of the aboriginal cultures of sub-Saharan Africa. Cultural diversity and human ecology in areal perspective. Prereq: Human Culture recommended.**
- **3540 North American Indian (3) An ethnographic survey of the cultures of the Arctic, Southwest, Plains and Eastern Areas. Emphasis on the cultural differences of peoples occupying these areas during the precolonial period. Prereq: Human Culture recommended.**
- **3555 Cherokee Ethnohistory (3) Survey of sociopolitical aspects of internal affairs and external relationships from first European contact to present. Emphasis on eighteenth and nineteenth centuries.**
- **3560 Archaeology of United States and Canada (3) Survey of prehistoric peoples north of Mexico from initial occupation to European contact. Prereq: Prehistoric Archaeology recommended.**
- **3562 European Prehistory I (3) Cultural developments during the Paleolithic, Mesolithic, and Neolithic. Prereq: Prehistoric Archaeology recommended.**
- **3563 European Prehistory II (3) Cultural developments during the Metal Ages. From the close of the Neolithic through the Iron Age. Prereq: Prehistoric Archaeology recommended. 3562 and 3563 should be taken in sequence.**
3840 Ancient Civilization of Mesoamerica (3) Introduction to the archaeology of areas of advanced Indian culture in Mexico and Central America beginning with the earliest cultures and proceeding to contact with Europeans. Prereq: Human Culture recommended.

3860 Prehistory of Tennessee (3) History of archaeological research in Tennessee and surveys of prehistoric American Indian cultures identified through this research.

3870 Principles of Archaeology (3) Research strategies in archaeological excavation, interpretation, and explanation. Prereq: Prehistoric Archaeology or consent of instructor.

3700 Forms of Folklore (4) An introduction to the anthropological study of folklore.

3710 European Folk Cultures (3) Traditional aspects of European life, as expressed in technological, beliefs, art, and folklore, under changing historical and socioeconomic conditions.

3800 Language and Culture (3) Relationship between linguistic categories and patterns of culture. Prereq: Introduction to Linguistic Anthropology or consent of instructor. Recommended: Human Culture.

3811 Introduction to Museology (3) (Same as ART 3911).

3900 Human Osteology (4) Intensive examination of the human skeleton. Prereq: Human Origins and consent of instructor. 3 hrs and 1 lab.


3930 The Biology of Races of Man (3) Processes of racial differentiation; criteria of significant differences among existing stocks; influence of biology and culture in race formation; analysis of studies concerning blood groups, race mixture, constitution, growth and nutrition. Prereq: Human Origins recommended.

3950 Human Identification (3) Introduction to techniques used in identification of human skeletal material in forensic medicine.

4200 Contemporary North American Indian (3) Survey of Indian cultures from initial Euro-American contact through emphasis on cultural change, U.S. Government Indian policy, reservation life; contemporary Southeastern Indian culture; problems. Prereq: Human Culture or consent of instructor.

4210 Ethnographic Research Techniques (3) Methods of collecting, ordering and utilizing data. Prereq: Consent of instructor.

4240 Applied Cultural Anthropology (3) Applications of anthropological theory, methods and findings in programs of community and national development, public health, international aid, and military assistance. Examination of the roles of anthropologists, questions of values and ethics in intervention schemes, and of the organization of planned changes in applied programs. Intensive analysis of selected case studies. Prereq: Human Culture or consent of instructor.

4250 Medical Anthropology: Lecture (3) A survey of medical anthropology. Emphasis is on Western society and culture. Prereq: Human Culture or consent of instructor. Recommended: 4500, or an East Asian course.

4350 Field Work in Cultural Anthropology (3-9) A practical course in anthropological ethnographic fieldwork, reporting, survey and interview techniques, and the devising and carrying out of fieldwork projects. Prereq: 3 quarters of introductory anthropology and consent of instructor. May be repeated. Maximum 9 hrs.

4351 Field Work in Cultural Anthropology (3-9) A practical course in anthropological ethnographic fieldwork, reporting, survey and interview techniques, and the devising and carrying out of fieldwork projects. Prereq: 3 quarters of introductory anthropology and consent of instructor. Strongly recommended: 4210. May be repeated. Maximum 9 hrs.

4400 Cultural Ecology (3) Survey of concepts and methods in studying the dynamic interaction between cultures and their environments. Topics include ecological theory, methods of analysis, and application from selected case studies. Prereq: Human Culture, Human Origins or consent of instructor.

4410 Non-Western Education: Anthropological Approaches (3) Analysis of problems resulting from application of Western models of education in developing societies and in aboriginal communities within industrialized societies (e.g. American Indians).

4420 Dynamics of Culture (3) Culture change; innovation, diffusion and acculturation; cultural continuity and change; Prereq: Human Culture or consent of instructor.

4430 Personality and Culture (3) Analysis of relations among individual, society, and culture. Application of psychological techniques in cross-cultural studies. Case studies of different cultures and their influence on group behavior. Prereq: Human Culture or consent of instructor.

4440 Urban Anthropology (3) Survey of theoretical and applied urban anthropologists; examination of urban problems in the modern city. Prereq: Human Culture or consent of instructor.

4480 Cross-cultural Survey of Sex Roles and Behavior (3) Examination of sex roles and sex behavior from cross-cultural and diachronic viewpoints. Emphasis on scattered and scattered studies together and attempts to arrive at conclusions on questions as how sex roles are learned, the parameters of acceptable sexual behavior and degrees of tolerance for sexual deviation in various cultures.

4500 Peoples of China I: Chinese Society Before 1839 (3) An anthropological survey of Chinese society and culture during the pre- and early Western contact periods. Prereq: Human Culture or consent of instructor. Recommended: 3510 or an East Asian course.

4510 Peoples of China II: Chinese Society After 1839 (3) An anthropological survey of Chinese society and culture in the period of intense Western contact, rejection of the Western, and development of modern, communist Chinese society and culture. Prereq: Human Culture, or consent of instructor. Recommended: 4500, or an East Asian course.

4550 Indians of the Southeastern United States (3) Survey of Southeastern Indian cultures; emphasis on aboriginal adjustment to environment; lifeways of Southeastern Amerind groups prior to contact with European culture. Prereq: Human Culture, 3540, or consent of instructor.

4560 Cherokee Ethnology (3) Intensive survey of ideology and material aspects of Cherokee culture existing at time of first European contact.

4570 Peoples of Southeast Asia (3) Survey of representative ethnic groups and indigenous cultures of mainland and island Southeast Asia. Problems of contemporary culture changes. Prereq: Human Culture, or consent of instructor, or an East Asian course.

4580 Asians in the Americas Since 1800: Anthropological Perspectives (3) Character, factors, and motivations in Asian immigration to North, Central and South America. Assimilation, integration and enclave communities and major topics. Major focus is on United States.

4590 Peoples of Japan (3) An analysis of the cultural diversity and unity of the people of Japan. Prereq: Human Culture or consent of instructor, recommended 3510 or an East Asian course.

4600 Method and Theory in American Archaeology (3) The historical development of New World archaeology with emphasis on theory and field techniques. Prereq: Prehistoric Archaeology or consent of instructor.

4610 African Prehistory (3) Survey of cultural history in Africa, from earliest evidence to interactions with European contact. Prereq: Prehistoric Archaeology or consent of instructor.

4640 Zooroarchaeology (3) Basic osteological studies of vertebrate classes; emphasis on cultural aspects in his subsistence and culture. Identification, analysis and interpretation of archaeologically derived molluscan and vertebrate remains.

4650 Archaeology of Southeastern United States (3) Intensive study of the prehistoric American Indian. Special emphasis on Tennessee and the Carolinas. Prereq: 3510 or consent of instructor.

4720 American Folklore (3) Anthropological perspectives on the folklore of geographical regions and ethnic groups of the United States. Prereq: 3920 or consent of instructor.

4740 Southern Appalachian Folk Culture (4) Research-oriented course dealing with wide range of traditional culture in Southern Appalachia: settlement patterns, folk housing, economy, clothing, belief, speech, art, song, dance, and oral traditions and customs. Prereq: Consent of instructor. May be repeated.

4750 Mexican Folklore (3) Anthropological perspectives on the folklore of Mexico and the Spanish-speaking southwestern United States. Prereq: 3700 or consent of instructor and a reading knowledge of Spanish.

4870 Cherokee Language (3) Linguistic survey of structure of the Cherokee language.

4920 Physical Growth and Constitution (3) Comparative growth patterns throughout the life cycle of man, skeletal and dental maturity, sex differences in growth; human conformational types. Prereq: First quarter general anthropology. Strongly recommended: General Genetics or consent of instructor.

4950 Primate Studies (3) Survey of field and laboratory investigations of the evolution of anatomy and nonhuman primate behavior. Prereq: Human Origins or consent of instructor.
Art

MAJOR

DEGREES

M.A., M.F.A.

Professors:


Associate Professors:

W. C. Kennedy, M.F.A. Wisconsin; R. LeFevre, M.F.A. Rochester Institute of Technology; P. R. Livingston, M.F.A. Wisconsin; F. Martinson, Ph.D. Chicago; F. Moffat, Ph.D. Chicago; D. Peacock, M.F.A. Iowa; L. Smythe, Ph.D. North Carolina; F. C. Stewart, M.F.A. Claremont; R. P. Young, M.A. Columbia.

Assistant Professors:


Instructors:

E. Evans; M. B. Goldenstein, M.F.A. Nebraska; B. R. Wells, M.F.A. Indiana.

The Art Department offers two graduate degrees: Master of Arts and Master of Fine Arts. In order to become a candidate for either of these degrees, the applicant must first be admitted to the Graduate School and be accepted by the Art Department. The general requirements are that the applicant must have an undergraduate major in art or present evidence of outstanding proficiency. In addition to the general admission requirement, Art Department acceptance is based on recommendations and a portfolio of work.

Masters of Arts

Major areas consist of painting, communication design, printmaking, and sculpture. One year of residence is required.

Curriculum:

| Thesis | 9 hrs |
| Major area | 12 hrs |
| Drawing and composition | 3 hrs |
| Art history | 9 hrs |
| Electives | 12 hrs |
| Total | 45 hrs |

The thesis is a critical essay relevant to the field of concentration. The M.A. thesis may not be used to fulfill the project in lieu of thesis requirements for the M.F.A. A graduate exhibition is required. Final examination is oral.

Master of Fine Arts

The Master of Fine Arts is the terminal degree in studio art. Residence of at least five quarters beyond the baccalaureate degree is required. Residence is defined by the Art Department as: (1) a minimum enrollment of 6 hours per quarter, and (2) use of Art Department facilities, so that discussion and criticism is available to students.

Curriculum:

| Projects in lieu of thesis | 9 hrs |
| Major area | 27-33 hrs |
| Seminar in art history | 3 hrs |

*Art history 6-12 hrs  
Seminar in art criticism 3 hrs  
Art electives 9-15 hrs  
Total 63 hrs

Major areas consist of painting, communication design, printmaking, and sculpture. The candidate must complete a coherent body of work (project in lieu of thesis).

A graduate exhibit is required. Final examinations are oral.

List of graduate courses for M.A. and M.F.A. candidates:

- Projects in Lieu of Thesis (3, 3, 3)
- Drawing and Composition (3, 3, 3, 3, 3)
- Oil Painting (3, 3, 3, 3, 3)
- Watercolor Painting (3, 3, 3, 3, 3)
- Sculpture (3, 3, 3, 3, 3, 3)
- Communications Design (3, 3, 3, 3, 3)
- Art History Electives (3, 3, 3, 3)
- Art History (3, 3, 3)
- Seminar in Art History (3, 3, 3)
- Seminar in Art Criticism (3)

Graduate Minor in the History of Art

A graduate minor in art history may be arranged with the 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.

Classification of Art Courses

A. Studio Art:

- 3516, 3517, 4015, 4115, 4215, 4315, 4415, 4515, 4525, 4534, 4545, 4615, 4616, 4617.
- B. Art History:

  - 3705, 3715, 3716, 3725, 3726, 3735, 3736, 3745, 3755-56-57, 3765, 3775-76-77, 3811, 4855-56-57, 4875-78-77.

3515 Typography (4) Theories and techniques of typesetting and printing as a fine art medium. May be repeated. Maximum 12 hrs.

3517 Airbrush (4) Techniques and creative applications. May be repeated. Maximum 8 hrs. For all majors only.


3705 Northern European Painting: 1350-1600 (4) Painting and printmaking of the low countries, France, Germany, and England. Includes international style manuscripts, Van Eyck, Bosch, Dürer, Holbein, and Bruegel.


3725 Art of Southern Europe and New World in Seventeenth and Eighteenth Centuries (4) Emphasis on El Greco, Caravaggio, Zurbaran, Velazquez, Bernini, Tiepelo, Goya, artistic relations between Iberia and Latin America, and the urban development of Rome.

3726 Art of Northern Europe in Seventeenth and Eighteenth Centuries (4) Emphasis on Rembrandt, Vermeer, Hals, Rubens, Poussin, Callot, Georges de la Tour, Watteau, David, urban development of Paris and London, and pilgrimage churches of Southern Germany.

3735 History of Nineteenth-century Painting in Europe and America (4) Emphasis on Manet, Seurat through Cezanne.


3755-56-57 Studies in Art History (4, 4, 4) Concentration in selected areas. Prereq: 9 hours of art history or consent of instructor.

3756 History of North American Art (4) Survey of landmarks in painting, architecture, sculpture, and design from prehistory to 1900.

3766 History of Twentieth-century American Art (4) Analysis of developments in architecture, painting, sculpture, and design from 1900.

3775 Art of Indian Asia (4) History of Indian art with consideration of art of Central Asia and Southeast Asia.

3776 Chinese Art (4)

3777 Japanese Art (4)

3811 Introduction to Museology (3) Concepts, practices and theoretical development of museum studies. Art, anthropology and science. (Same as Anthropology 3811.)

4015 Individual Problems (4) May be repeated. Maximum 12 hrs. Prereq: Consent of instructor.
### Audiology and Speech Pathology

#### MAJORS

<table>
<thead>
<tr>
<th>Major</th>
<th>DEGREES</th>
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<tbody>
<tr>
<td>Audiology</td>
<td>M.A.</td>
</tr>
<tr>
<td>Speech and Hearing Sciences</td>
<td>Ph.D.</td>
</tr>
<tr>
<td>Speech Pathology</td>
<td>M.A.</td>
</tr>
</tbody>
</table>

**Professors:**
- H. L. Luper (Head), Ph.D., Ohio State; S. Adler, Ph.D., Ohio State; C. L. Alper, Ph.D., Ohio State; D. M. Lipscomb, Ph.D., Washington; H. A. Persson, Ph.D., Illinois; B. Silverstein, Ph.D., Purdue.

**Assistant Professors:**

**Assistant Professors:**
- B. Burchfield, Ph.D., Michigan State; W. M. Collins, Ph.D., Missouri; T. O. Davidson, M.A. Tennessee; C. J. Farrell, M.A. Tennessee; E. Ireland, Ph.D., Iowa.

#### 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. Within this broad coverage of speech pathology or audiology, it is possible for a student to specialize to some extent. For example, in the M.A. in Audiology program, a student may emphasize audiological assessment, aural habilitation-rehabilitation, medical or pediatric, or industrial audiology. Within the M.A. in Speech Pathology program, a student may emphasize language disorders, cultural language differences, or speech disorders such as aphasia or stuttering. Students interested in specializing beyond the typical broad M.A. program should consult the department office or their advisor for lists of suggested courses, practica and independent studies.

Students majoring in the two areas are expected to complete the academic requirements for clinical certification from the American Speech and Hearing Association, including the required number of clock hours of clinical practicum. An exception to this rule needs approval of the Department Curriculum Committee.

Enrollment in clinical practicum courses is required for all clinical experience. 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 option or the non-thesis option. Students in both programs are required to take 3110 and 5119. The Master's program with the thesis will include a minimum of 45 quarter hours of approved graduate credit, including 9 quarter hours of 5000 credit in the preparation of an acceptable thesis representing original independent work, and a final oral examination. At least one-half of those total courses must be at the 5000 or 6000 level, no more than 9 hours of which may be thesis courses. Students in the non-thesis option program must present a total of 48 quarter hours of approved graduate courses to receive the degree. A final written examination. A minimum of 24 quarter hours must be at the 5000 or 6000 level. The decision as to choice of the thesis or non-thesis program is normally made following completion of 5110 and a conference with the student's advisor.

#### THE DOCTORAL PROGRAM

The Ph.D. program in Speech and Hearing Sciences seeks to develop individuals for research or college teaching careers in the field of speech pathology, audiology, or speech and hearing science. This degree program is research oriented, with primary emphasis upon developing the scientific and cognitive skills which allow individuals to identify and independently study important questions concerning the human art of oral and aural communication. Students will be expected to master the accumulated knowledge in the area of:

1. Basic speech, hearing and language processes
2. Speech, hearing and language disorders
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 two or more calendar years of graduate study beyond the Master's degree with the first year being devoted primarily to formal course work and the last year to full-time research culminating in a doctoral dissertation.

Specific programs of study will be determined by the student in consultation with his faculty committee. In addition to the general Graduate School requirements, specific requirements for the degree of Doctor of Philosophy in Speech and Hearing Sciences will include:

1. Successful completion of course work in the study of one or more research tools, or other specific scientific methodological vehicles pertinent to the research interests of the candidate. The choice of research tool(s) is subject to departmental approval.
2. A minimum of 9 quarter hours of graduate credit obtained in course work in a cognate field outside the Department of Audiology and Speech Pathology. These hours are in addition to those required in Item 1 above.
3. Sufficient course work within the department but outside the area of specialization to give a broad foundation and understanding.
4. A comprehensive examination to demonstrate a general knowledge of the bases of audiology, speech and
language pathology, and speech and hearing science; advanced knowledge of the specifics of the area of specialization.

5. Research and dissertation to give at least 36 hours of graduate credit (8000 level).

6. A final oral examination.

4040 Appraisal of Speech and Language Disorders (4) Diagnostic procedures for children and adults with speech and language problems including observation and practice with diagnostic test. Prereq: Phonetics. (Same as Special Education 4040.)

4060 Speech Science II (3) Speech production; clinical applications of speech science research. 2 lectures and 1 2-hr lab per week. Prereq: Speech Science I.

4070 Free Association (4) Oral and written free association as a process for diagnosing and treating communication disorders. Includes a didactic self-analysis.

4190-200 Speech Development of the Hearing Impaired (3, 3) (Same as Special Education 4190-200.)

4210-20 Language Development of the Hearing Impaired (3, 3) (Same as Special Education 4210-20.)

4230 Introduction to the Education and Psychology of the Hearing Impaired (3) (Same as Special Education 4230.)

4310 Stuttering (4) Nature and treatment. Review and integration of various theories. (Same as Special Education 4310.)

4320-30-40 Clinical Practice in Speech Pathology (1-6, 1-6, 1-6) Prereq: Introduction to Speech Pathology, Phonetics, Articulation Disorders, 4040, and consent of instructor. 4320 may be repeated. S/NC only. (Same as Special Education 4320-30-40.)

4400 Voice Disorders (4) Etiology, diagnosis and treatment of organic and functional voice disorders. Prereq: Speech Science II. (Same as Special Education 4400.)

4450-50-60 Clinical Practice in Audiology (1-6, 1-6, 1-6) Prereq: 4720, 4939, or 4940. S/NC only. (Same as Special Education 4450-50-60.)

4520 Audiology (3) Independent study of special problems in speech pathology. Prereq: Consent of instructor.

4550 Problems in Speech Pathology (1-6) Prereq: Consent of Instructor.

4560 Problems in Audiology (1-6) Prereq: Consent of Instructor. May be repeated. Maximum 6 hrs.


4850 Speech and Language of the Culturally Different Child (3) Discussion of speech and language differences of children of various ethnic groups, of different ethnic and class membership and from different geographic regions; their causes, and their effects upon educational programs.

4700 Audiology for Educators of the Deaf (4) Fundamental aspects of hearing, including physics of sound, anatomy and physiology of the ear, audiology and rehabilitation of hearing loss and basic audiological techniques. May not be used to satisfy requirements of major in Audiology and Speech Pathology.

4720 Audiology II (4) Etiology and rehabilitation of hearing loss including pediatric and geriatric aspects, medical treatment and diagnostic audiometry. Prereq: Audiology I. (Same as Special Education 4720.)

4750 Noise in the Environment (3) Discussion of the extent to which the noise problem exists, introduction to methods of noise measurement, basic techniques in sound and vibration analysis, acoustical factors, and psychoacoustical concomitants in noise stimulation. A knowledge of acoustics is advisable.


4930 Aural Rehabilitation: Speechreading and Auditory Training (4) Speechreading as a receptive language process and development of maximum use of residual hearing in the acoustically handicapped. (Same as Special Education 4930.)

4938 Laboratory in Aural Rehabilitation (1) (Same as Special Education 4938.)

4940 Advanced Aural Rehabilitation: Acoustic Training (4) Development of maximum use of residual hearing in the acoustically handicapped. (Same as Special Education 4940.)

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5040 Advanced Clinical Practice in Audiology Study and Practice (1-6) Prereq: Consent of instructor. May be repeated. Maximum 12 hrs. S/NC only. (Same as Special Education 5040.)

5045 Practicum in Hearing Aid Orientation and Communication Counseling (1-6) Practical exposure to counseling the hard of hearing and their family members concerning use and expectations of hearing aids as well as suggestions for better use of communication skills. Prereq: Consent of instructor, 4720. May be repeated. Maximum 9 hrs. S/NC only.

5050 Practicum in Aural Habilitation (1-6) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5051 Practicum in Aural Rehabilitation (1-6) Enrollment by consent of instructor. May be repeated. Maximum 9 hrs. S/NC only.

5060 Anatomy and Physiology of Speech (3) Structure and function of the neuromuscular system involved in breathing, phonation, respiration, and articulation. Prereq: Speech Science II.

5070 Anatomy and Physiology of Hearing (3) Structure of the human ear, pathology of hearing impairment, and psychoacoustics of audition. Prereq: 4710.

5071 Physiological Acoustics (3) Techniques for electrophysiological measurement of auditory sensitivity and sound transmission by the ear, distortion in the ear, and the ear as an analytic mechanism. Prereq: 4710, 4720, Speech Science II, or approval of the Instructor.

5100 Comparative Anatomy of the Peripheral Auditory Structures (3) Tutorial laboratory course in gross and microscopic anatomy of the temporal bone employing microscopic dissection techniques. Prereq: 5070 or consent of Instructor.

5110 Introduction to Research in Speech and Hearing (3) Analysis of research techniques, application of statistics, and completion of a pilot research project.

5117 Instrumentation in Audiology and Speech Pathology (2) Principles of instrumentation used in audiology and speech pathology. Prereq: Basic Acoustics in Speech and Hearing.

5119 Laboratory in Instrumentation in Audiology and Speech Pathology (1) Laboratory assignments designed to familiarize the student with instrumental approach and hearing processes. Prereq: 5117.

5200 Seminar on Stuttering (3) Current significant research in the problem of stuttering. Prereq: 4310 or consent of instructor.

5201 Aphasia (3) A historical review of aphasia literature including their speech, functioning, aphasic classification and terminology, tests and rationale for testing, etiology, therapy considerations and prognosis for recovery. Prereq: 4500 or equivalent or consent of instructor.

5230-30-40 Advanced Clinical Practice in Speech Disorders (1-6, 1-6, 1-6) Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

5350-60-70 Advanced Clinical Practice in Speech Diagnosis (1-6, 1-6, 1-6) Prereq: 4040, 4540 or equivalent. 5350 may be repeated. Maximum 9 hrs. S/NC only.

5380 Cerebral Palsy (3) Study of cerebral palsy with emphasis on neurological foundations and speech and language training. Prereq: Articulation Disorders. (Same as Special Education 5380.)

5390 Cleft Palate (3) Etiology, diagnosis and clinical management of cleft palate speakers with emphasis on speech. Prereq: Articulation Disorders. (Same as Special Education 5390.)

5440 Hearing Aid Evaluation (3) Study of the procedures involved in assessment of needs of hearing impaired persons. The pertinent research in the areas of evaluation methods, binaural vs. monaural, prescription fitting, will be reviewed. Prereq: 4720.

5450 Sound Measurement and Analysis in Hearing Conservation (3) Study of noise measuring systems and their application to noise sources in the military and industrial setting. Prereq: 4710 or consent of instructor.

5460 Differential Diagnosis of Auditory Disorders (3) Theory and practice of advanced pure tone and speech audiometry; instrumentation and interpretation of audiometric findings with special reference to differential diagnosis. Prereq: 4720.

5470 Impedance Measurement in Audiology (3) Theoretical considerations behind the emergence of impedance measurement in the clinical measurement of hearing. The course will include practical experience in using several impedance measuring devices. Prereq: 4710, 4720, 5060 or consent of instructor.


5500 Seminar in Audiology (3) Study of significant research in various areas of audiology. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

5503 Seminar in Advanced Audiological Procedures (3) Theoretical and practical considerations of audiological procedures used for differeniating between cochlear versus retrocochlear auditory lesions, identifying central auditory lesions, and for identifying nonorganic hearing loss.
5505 Special Problems in Audiology (1-6)
Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5520 Seminar in Speech Pathology (3) Special study of current significant research in speech pathology. Topics vary from quarter to quarter. Prereq: 12 hrs in speech pathology. May be repeated with consent of department. Maximum 12 hrs.

5540 Seminar in Language Pathology (3) Nature, etiology and treatment of retarded language development in children. Prereq: Advanced Language Disorders. (Same as Special Education 5640.)

5550 Special Problems in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5569 Independent Study in Speech Pathology (1-3) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5600 Independent Study in Audiology (1-6) Special reading, consultation, and research activities in the field of audiology. May be repeated. Maximum 6 hrs.

5610 Practicum: Language Pathology in Children (3) A combination seminar and/or practicum involving the discussion and utilization of various tools and analyses of habilitative philosophies, specialties and techniques. Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

5651 Seminar in Language Differences (3) Study of significant research relevant to language differences of culturally different children.

5730 Seminar in Medical Audiology (3) Advanced study of auditory disorders commonly encountered in a medical environment with emphasis on etiology, pathology and evaluative procedures used to differentiate lesions of the auditory mechanism. Field trips may be required. Prereq: 4720 or equivalent.

5740 Seminar in Pediatric Audiology (3) Advanced study of the theoretical and practical considerations of procedures used to evaluate the hearing of infants and small children. Prereq: 4720 or equivalent.

5790 Seminar in Psycholinguistic Concepts in Speech Pathology (3) Psycholinguistic concepts and information theory utilized in studying the normal acquisition of language and certain disorders of language. Prereq: Speech and Language Development, Psychology 5110 or equivalent. (Same as Psychology 5790.)


6009 Doctoral Research and Dissertation

6010 Experimental Phonetics (3) Principles involved in acoustical and physiological analysis of speech sound production and perception. Prereq: 5119 or consent of instructor.


6070 Experimental Techniques in Cochlear Physiology and Neurophysiology (3) Prereq: 5070 or equivalent.

6080 Seminar in Speech Science (3) Seminar in areas such as speech physiology, acoustic analysis, recognition, perception and intelligibility of speech, communication theory, and psycholinguistic measurement of speech and language. Topics vary from quarter to quarter. Prereq: 6010 or consent of instructor. May be repeated. Maximum 9 hrs.

6090 Seminar in Hearing Science (3) Advanced study of various topics of the perception of the non-speech acoustic signal; detectability, pitch, loudness, differential threshold, adaptation, and fatigue. Prereq: 6020 or consent of instructor. May be repeated. Maximum 9 hrs.

6110 Experimental Design in Speech and Hearing (3) Analysis of experimental design in theses and related journals. Psychophysical methods for data acquisition. Generation of experimental designs based on parametric and nonparametric statistics. Prereq: 5110 or equivalent and consent of instructor.

6117 Theories of Hearing (3) The physiological process basic to the classical theories of hearing as related to sensitivity; loudness; pitch; and discrimination of acoustic stimuli. Prereq: 5070 or consent of instructor.

6119 Advanced Instrumentation in Speech and Hearing Science (3) Selection, use and calibration of instrumentation used in speech and hearing research. Prereq: 5117, 5119 or equivalent.

6160 Advanced Seminar in Audiology (3) Prereq: Consent of instructor. May be repeated.

6190 Advanced Seminar in Speech and Language (3) Topics vary from quarter to quarter but include advanced study of specific topics related to aberrations of voice, articulation, speaking time and rhythm, language development or use, and language symbolization. Prereq: Consent of instructor. May be repeated.

6260 Directed Research (1-6) Participation in on-going or non-dissertation research. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

6570 Directed Study in Speech Pathology (1-3) May be repeated. Maximum 9 hrs.

6580 Directed Study in Audiology (1-3) May be repeated. Maximum 9 hrs.

6590 Directed Study in Speech Science (1-3) May be repeated. Maximum 9 hrs.

6600 Directed Study in Hearing Science (1-3) May be repeated. Maximum 9 hrs.

Biochemistry

MAJOR

M.S., Ph.D.

Biochemistry

Professors:
K. J. Monty (Acting Head), Ph.D. Rochester;
J. E. Churchich, Ph.D. Sheffield (England);
T. P. St moll, Ph.D. Michigan; J. A. Toffal
Ph.D. Iowa State.

Associate Professor:
S. W. Hawkins, Ph.D. Chicago;
J. G. Joshi, Ph.D. Poona (India).

Assistant Professors:
R. Bryant, Ph.D. Illinois;
R. H. Feinberg, Ph.D. California (Berkeley);
L. Huang, Ph.D. Michigan State.

THE MASTER'S PROGRAM

Candidates usually should offer an undergraduate major in either biology or chemistry. Departmental requirements consist of the satisfactory completion of 45 credit hours of graduate work and the mastery of the subject matter of the following courses:

1. Introductory Organic Chemistry with laboratory (at least one year), Inorganic Quantitative Analysis* (e.g., at least one quarter of analytical chemistry), Organic Qualitative Analysis* (e.g., Chemistry 4510), Introductory Physics*, Differential and Integral Calculus*; at least three quarters of approved graduate courses in chemistry or physics, for example: Organic Reaction Mechanisms (e.g., Chemistry 5110-20-30-35), Quantum Chemistry (e.g., Chemistry 5340), Advanced Physics (Physics 5120-20-30), Infrared and Raman Spectroscopy (Physics 5440), Radiation Chemistry (Physics/Chemistry 5460), Advanced Thermodynamics and Statistical Mechanics (Physics 5110-20-30); plus minimum of three quarters of approved physical chemistry (e.g., Biochemistry 4210-20-30, Chemistry 3410-20-30) and at least 18 hours of biology beyond the introductory level.


3. Participation in Biochemistry 6410-20-30 and in the advanced biochemistry seminars during the entire period of residence.

4. Preliminary examinations are administered preferably at the beginning of the fall quarter of the student's third year and are designed to test in comprehensive fashion the mastery of the required formal course work listed in 1 and 2.

5. A dissertation reporting the results of original and significant research carried out during the term of candidacy.

6. A final examination which will be

* Though completion of these courses or the equivalent is required, they may not be taken for graduate credit.
concerned primarily with the student's dissertation.

Petitioning for Master's Degree: Students who have passed the preliminary examinations of the Ph.D. program may petition the department for award of a Master's degree. The additional requirements for such a degree shall be:
(a) the completion of at least 45 hours of approved course work for graduate credit, at least half of which must be at or above the 5000 level;
(b) the preparation of a research manuscript suitable for submission for publication in a major scientific journal;
(c) the 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.

4110-20 Cellular and Comparative Biochemistry (4, 4) Electrolyte behavior; the chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; metabolic mechanisms; nucleic acids; function and protein synthesis; and biochemical genetics; the regulation of biological processes must be taken in sequence. Prereq: Organic Chemistry and an introductory course in biology. 3 lectures and 1 discussion.

4119 Cellular and Comparative Biochemistry Laboratory (2) Basic biochemical procedures of general application in biochemistry and molecular biology. Prereq: 1 quarter of analytical chemistry. Prereq or coreq: 4110.

4210-20 Introduction to Physical Biochemistry (3, 3) 4210—Introduction to thermodynamics; phase stability and phase changes; chemical potential; osmotic pressure; activity and the Debye-Hückel model; electrochemistry; membrane permeability; 4220—Elements of statistical mechanics, diffusion, collision theory; chemical kinetics and transition state theory; higher order kinetics; the specialized kinetics of enzymatic processes; some biopolymer considerations. Prereq: Single Variable Calculus, Organic Chemistry, and an introductory course in biology.

4230 Introduction to Physical Biochemistry (3) Physical characterization of macromolecules; polyacrylamide gel electrophoresis, fluorescence, sedimentation and transport hydrodynamics, electrophoretic mobility, light scattering, and crystallography of proteins and nucleic acids. Prereq: Biochemistry 4220 or Chemistry 4340, or equivalent.

5000 Thesis

5010 Biochemical Techniques (2) Theory and laboratory practice in sedimentation, chromatographic and electrophoretic techniques in the isolation and characterization of macromolecules of importance in biochemistry and molecular biology. Prereq: 4119 or equivalent. Open to undergraduates with consent of the department.


5120 Membranes, Compartmentation, and the Regulation of Energy Metabolism (3) Examination of the metabolic pathways for electron transport, oxidative phosphorylation, and lipid synthesis, storage and degradation, and of the regulation of intracellular compartmentalization and the phenomenon of permeation which make possible the biological control of these pathways. Prereq: 4110-20.

5130 Protein Structure and Enzyme Function (3) Physicochemical properties of proteins; primary, secondary, tertiary and quaternary structure; denaturation, renaturation and other conformational change; structure-function correlations; coenzyme-specific models of catalysis; steady-state and transition-state kinetic analysis of allosteric enzymes. Prereq: 4110 and either 4220 or Chemistry 3430.

5220 Structures and Functions of the Nucleic Acids (3) Chemistry of the nucleic acids; hydrogen bonded and double-stranded structures; coiling, supercoiling, and other higher order structural considerations; the biosynthesis of DNA and RNAs; repair mechanisms; degrading mechanisms; mechanisms of genetic information storage and retrieval. Prereq: 4110-20 or equivalent.

5230 Protein Synthesis and Its Role in Metabolic Regulation (3) Structure of a peptide chain; ribosome structure and function; deciphering and genetic code; regulation of transcriptional and translational events (induction, repression, etc.) Prereq: 4110-20.

5300 Graduate Research Participation (3-9) May be repeated. Maximum 12 hrs.

5310-20-30 Experimental Techniques (2, 2, 3) A tutorial laboratory course in modern experimental methodology and instrumentation. Intended primarily for departmental majors.

5450 Special Topics (1-3) Registration only by prior arrangement with department. May be repeated.

5510 Properties of Biomolecules Related to Function (3) The structures, chemical and physical properties of biomolecules will be developed from the theoretical and experimental points of view to explain their actions and interactions. Prereq: 1 yr of Organic Chemistry; Analytical Chemistry recommended. Prereq or coreq: 4210, Chemistry 4910 or equivalent.

5520 Molecular and Cellular Basis of Metabolic Regulation (3) Regulation of metabolic pathways dependent on energy demands of the organism and on synthesis of macromolecule precursors. Prereq: 5510 or consent of department. Coreq: 4220 or Chemistry 4920 or equivalent.


6000 Doctoral Research and Dissertation

6010 Advanced Biochemistry Seminar (1) The topics to be covered will be posted in the spring quarter for the following year. Interested speakers of note will participate. The title of the topic covered will be printed on the student's record. May be repeated. Maximum 9 hrs.

6410-20-30 Current Topics in Biochemistry (2, 2, 3) Seminars and lectures dealing with current advances in the field of chemical biology. May be repeated with the consent of the department. S/NC only.

## Biology

### MAJOR

#### DEGREE

**Botany**

**MAJOR**

**DEGREES**

- M.S., Ph.D.

**Professors:**

**Assistant Professors:**
- C. Asmundsen, Ph.D. Colorado; S. L. Bell, Ph.D. Chicago; M. W. Birnar, Ph.D. Texas; J. D. Caporetti, Ph.D. Harvard; A. M. Evans, Ph.D. Michigan; A. S. Heilman, Ph.D. Ohio State; H. H. Shugart, Ph.D. Georgia.

**Associate Professors:**

**Requirements for admission:** In addition to the general Graduate School requirements (see page 11) the Botany Department also strongly recommends submitting aptitude and advanced scores from the Graduate Record Examinations, at
least three letters of recommendation from academic or professional persons, a short statement describing probable areas of interest in botany, and the following specific courses: (1) general botany or biology, 12 quarter hours; (2) advanced botany or closely allied biological sciences, 18 quarter hours; (3) physical sciences; general inorganic chemistry, 12 quarter hours, organic chemistry and physics highly recommended; (4) college mathematics, 9 quarter hours.

General degree requirements are given on page 19, and special departmental requirements include successful completion of:

THE MASTER'S PROGRAM

1. Satisfactory preparation of a written formulation and an oral defense to the student's committee of a research proposal suitable for a thesis problem. Must be completed before enrollment in Botany 5000.

2. Satisfactory performance on an examination in one modern foreign language or an A or B in French 3020 or German 3030 (can also be applied to the doctoral program).

3. Satisfactory completion of 2 credit hours at the 6000 level.


5. Presentation of a 30-minute departmental seminar.

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

THE DOCTORAL PROGRAM

1. Satisfactory presentation of a written formulation and oral defense to the student's committee of a research proposal suitable for a dissertation. Must be completed before enrollment in Botany 6000.

2. Satisfactory performance on a comprehensive preliminary examination; introduction to experimental phycology. Prereq: 3010 or consent of instructor.

3. Presentation of one or more cognate areas outside of the department totaling 9 graduate credit hours with at least a B average.

4. Satisfactory performance on an examination in one modern foreign language or an A or B in French 3030 or German 3030.

5. Satisfactory completion of 9 credit hours at the 6000 level (excluding dissertation).


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

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

*Note: Graduate School requirements are denoted by an asterisk. These requirements should be interpreted as minimal and candidates and specific stipulations or requirements such as additional foreign languages, additional oral preliminary examinations may be required by the individual student's faculty committee.

**Article 4** Plants in Evolution (4, 4) Monera to angiospermae; emphasis on evolutionary relationships, morphology and development. Prereq: 6 hrs in biological sciences.

**Article 3050** Field Botany (4) Study of plants in natural environments including plant identification, collection, preservation and basic ecological concepts. Prereq: 6 hrs in biological sciences.

3051-32 Field Botany (4), Emphasis on fall and winter flora, respectively. Prereq: 3050. Need not be taken in sequence.

**Article 3050** Socioeconomic Impact of Plants (3) Significance of plants in the origin and development of human cultures, evolution of cultivated plants, and the role of plants in present civilizations. Occasional field trips.

**Article 3070** Genetics and Society (3) An introduction to genetics, anthropological, and evolutionary with emphasis on genetic aspects of human society. (Same as Anthropology 3070.)

**Article 3090** Biology and Human Affairs (3) Basic biological principles involved in deterioration and preservation of an environment in which man and his cultures may survive.

3130 Introductory Plant Pathology (4) (Same as Agricultural Biology 3130.)

**Article 3210** Introductory Plant Physiology (4) Mineral nutrition, water relations, translocation, respiration, photosynthesis, growth phenomena. Prereq: General Chemistry, 3 hrs and 1 lab.

4300 Mechanisms of Plant Speciation (4) Processes of plant speciation emphasizing population genetics, isolation, drift, hybridization, variation in populations, establishment of population barriers and other aspects of plant speciation. Prereq: 3010-20 and General Genetics.

4120 Plant Anatomy (4) Comparative structure of vascular plants. 1 hr and 3 labs. Prereq: Fundamentals of Botany.

4240 Paleobotany (4) (Same as Geology 4240.)

4310 Plant Ecology (4) Interactions between individuals, species, communities and their environments. Circulation of energy and matter in ecosystems. Weekly field trips or laboratory periods, and at least two weekend field trips. Prereq: 3030 or equivalent.

5000 Thesis

5011 Mycology (4) An intensive survey of the fungi, including all major classes, utilizing lectures, laboratory and field information. Occasional field trips. Prereq: 3010-20 and 3 hrs and 1 lab.

5012 Morphology and Evolution of the Phycomycetes (4) Similar to 5000, but dealing with the Phycomycetes, fungi. Prereq: 5011 or consent of instructor.

5017 Field Mycology (4) An intensive summer course on the field characteristics and morphology of higher fungi. Frequent field trips. Prereq: Consent of instructor. May be repeated.

5021 Bryology (4) Taxonomy, phycology, ecology, distribution and application of the morphologic of bryophytes with an emphasis on field studies and current research. Prereq: 3020. 1 hr and 3 labs.

5022 Lichenology (4) Taxonomy, phycology, ecology, economics and symbiosis of lichens with an emphasis on field studies and current research. Prereq: 3010, 5011 or 5017, and 5061 recommended. 1 hr and 3 labs.

5031 Vascular Plant Taxonomy (4) Family characteristics of vascular plants, including principles of phylology and classification, based primarily on plants of the flora. Prereq: 3030 or equivalent. 2 hrs and 2 labs.

5061 Physiology (4) An intensive, comparative study of the major divisions of algae, both freshwater and marine, including taxonomical, ecological, morphological, developmental and phylogenetic aspects. Field and laboratory studies emphasizing identification and function; introduction to experimental physiology. Prereq: 3010 or consent of instructor. 2 hrs and 2 labs.

5065 Phytoplankton Ecology (4) The interaction between the environment and phytoplankton. Special emphasis on nutrient uptake, primary production, competition, ecological theory as applied to phytoplankton populations, and ecological and physiological adaptations by populations to the environment. Prereq: 3010 or consent of instructor.

5070 Principles of Biological Illustration (3) Principles and application of photography, including phycography and photomicrography, drafting, graphing, and other methods to the recording and presentation for research and publication of data in pictorial or graphic form. 1 hr and 2 labs.

5080 Petridiology (4) Evolutionary study of the lower vascular plants, including morphology, cytology, ecology, life cycles and classification. Biosystematic studies and recognition of local species. Prereq: 3030-30 or consent of instructor. 2 hrs and 2 labs or field trips.

5090 Morphology and Evolution of Basiomyces (4) Discussion of structure and function of somatic and sexual life cycles as they apply to evolution in the group. Examination of cultures and specimens in laboratory complements discussion material. Prereq: Botany 3010 or equivalent.

5120 Agrostology (4) Collection, identification, classification, and phylology of the tribes of grasses. Prereq: 3030 or consent of instructor. 2 hrs and 2 labs.

5150 Advanced Morphology of Flowering Plants (4) A consideration of vegetative and reproductive organs, reproductive morphology, phytology, floral development, pollination mechanisms, reproduction and its deviations, seed and fruit development. Prereq: 3030-30 or 4120; 3210 or consent of instructor.

5160 Biosystematics (4) A study of the major experimental methods being used today in cytology, microscopy, and their application to specific types of systematic problems. Cytotaxonomy, numerical taxonomy and chemotaxonomy will be emphasized. Prereq: Consent of Instructor.

5210 Advanced Plant Physiology I (3) Plant cell compounds and their metabolism including photosynthesis, respiration, and biosynthesis. Control mechanisms, water and solute movement into the cells and within the plant. Prereq: Botany 3010 or consent of instructor. 2 hrs and 2 labs.

5220 Advanced Plant Physiology II (3) Growth and differentiation of plants at the molecular, cellular, and organismic levels. Chemical regulation of development; macromolecular interpretations of differentiation; photoperiodism and endogenous rhythms; dormancy; germination; flowering and senescence. Prereq: 5210 or Biochemistry 4120 and a plant or cell physiology course.
1. Research and thesis to give 9 to 18 hours of graduate credit (5000).
2. Chemistry 4160-70, 5531, 5140-50, Polymer Engineering 4910.
3. Sufficient additional graduate course work in chemistry and/or related fields to make an overall total of 45 hours.
4. Participation in Chemistry Seminar (5911-21-31) and the Polymer Seminar Program during the entire period of graduate study.
5. A final oral examination.
6. The requirements for the M.S. degree in Chemistry with specialization in environment or energy consist of the satisfactory completion of:
   1. Research and a thesis on an environment- or energy-related problem to give 9 to 18 hours of graduate credit.
   2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
   3. Sufficient additional graduate course work in chemistry and/or related fields to give a total of 45 hours. For emphasis in environment, these additional courses must include Chemistry 5510-20-30 or 5520-30-35 or 5250-60-70-79, Ecology 5310, and Environmental Engineering 3000. For emphasis in energy, these additional courses must include Chemistry 5410, a chemistry sequence (Chemistry 5110-20-30-35 or 5250-60-69-69-79 or 5420-30 or 5710-20-50, 5810), Geology 5810, and Mechanical Engineering 4140. All course selections must be approved by the appropriate departmental committee.
   4. Participation in seminar (5911-21-31) during the entire period of graduate study. (No more than 3 credit hours of seminar may be applied to the above requirements.)
   5. A final oral examination.

MASTER OF ARTS IN COLLEGE TEACHING

The requirements for the MACT degree in Chemistry consist of the satisfactory completion of:

1. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
2. Research and a thesis to give nine hours of graduate credit (5000).
3. Sufficient additional graduate course work in chemistry and/or a related field to make an overall total of 60 hours. The additional hours must include two of the following sequences: 5110-20-29-30, 5250-59-69-69-70-79, 5420-30 or 5710-20-50.
4. Participation in seminar (5911-21-31) during the entire period of graduate study. No more than 3 credit hours of seminar may be applied to the above requirements.
5. A final oral examination.

THE DOCTORAL PROGRAM

The department offers specialization in nine areas for the Ph.D. degree: analytical chemistry, chemical physics, environmental chemistry, energy, inorganic chemistry, organic chemistry, physical chemistry, polymer science, and theoretical chemistry. For the Ph.D. degree in Chemistry with specialization in analytical, inorganic, organic, physical, or theoretical chemistry, the satisfactory completion of the following is required:

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and two of the following: 5511, 5521, 5531.
3. Participation in seminar (5911-21-31) and the Polymer Seminar Program during the entire period of graduate study.
4. Thirty hours of additional graduate course work, including at least 6 hours at the 6000 level and at least 12 hours from the Department of Chemistry offerings.
5. A comprehensive advanced examination in the field of specialization. Demonstration of a reading knowledge of one of the following languages: French, German, Russian, or an approved alternate.
6. A final oral examination.

THE DOCTORAL PROGRAM

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and one of the following: 5511, 5521, 5531.
3. An examination on the basic principles of mechanics, electricity, and magnetism.
5. The requirements listed in Items 3, 5, 6, and 7 above.
6. The program in chemical physics is conducted jointly with the Physics Department which offers a similar degree.
7. A final oral examination.

THE DOCTORAL PROGRAM

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and one of the following: 5511, 5521, 5531.
3. An examination on the basic principles of mechanics, electricity, and magnetism.
5. The requirements listed in Items 3, 5, 6, and 7 above.
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3. An examination on the basic principles of mechanics, electricity, and magnetism.
5. The requirements listed in Items 3, 5, 6, and 7 above.
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THE DOCTORAL PROGRAM

1. Research and a dissertation to give at least 36 hours of graduate credit (6000).
2. Chemistry 4160-70 and one of the following: 5511, 5521, 5531.
3. An examination on the basic principles of mechanics, electricity, and magnetism.
5. The requirements listed in Items 3, 5, 6, and 7 above.
6. The program in chemical physics is conducted jointly with the Physics Department which offers a similar degree.
7. A final oral examination.
mechanisms. Recommended for chemistry majors.

3810 Radioactivity and Its Applications (3) Radioactive materials in tracer and therapeutic applications. Radioactive decay, detection apparatus and techniques, tracer procedures and safety precautions in agriculture, biology, medicine, nutrition. Not for credit by chemistry or physics majors or minors. Prereq: 1 yr of general mathematics or equivalent, 1 yr of general chemistry, 2 hrs and 1 lab.


4191 Physical Chemistry Laboratory (1) Solutions, phase equilibria, reaction kinetics and spectroscopy. The corresponding course 4110 is coreq.

4160-70 Intermediate Physical Chemistry (3, 3) (Designed for entering graduate students who have had one year of physical chemistry.) 4160—Three laws of thermodynamics, phase equilibria and solutions, and chemical equilibrium. 4170—Gases and kinetic theory, chemical kinetics, molecular spectroscopy, and introduction to chemical statistics.

4210 Advanced Analytical Chemistry (3) Chemical separations including chromatography, ion exchange and solvent extraction; spectrophotometric techniques. Prereq: Analytical chemistry.

4219 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4210. Coreq: 4210.

4220 Advanced Analytical Chemistry (3) Electroanalytical methods of analyses (including voltammetry, coulometry, polarography, and voltammetric methods; mass spectrometry; x-ray absorption and fluorescence techniques. Prereq: Analytical chemistry. Recommended: 5420 or 4920.

4229 Advanced Analytical Chemistry Laboratory (1) Experiments on topics discussed in 4220. Coreq: 4220.

4420 Physical Inorganic Chemistry (3) The fundamental theoretical concepts leading to an understanding of inorganic chemistry; the quantum theory of the atom, principles of molecular structure, and elementary nuclear chemistry. Prereq: 3410-20-30, 4110.

4430 Intermediate Inorganic Chemistry (3) Detailed application of the theoretical concepts of the inorganic elements, their chemical states, and their reactions. Prereq: 4420.

4510 Organic Qualitative Analysis (3) Identification of pure organic compounds and mixtures. Prereq: 3211-21-31, 3219-29-39 or 3219, 3259-39. 3 labs. Not open to students who have completed 4610.

4580 Organic Reaction Mechanisms (3) Theory of bond formation and reaction mechanisms. Prereq: 1 yr of organic chemistry.

4610-20 Advanced Chemical Experimentation (2, 2) Laboratory course in application of modern experimental techniques to solution of chemical problems. Synthesis and characterization of organic and inorganic compounds with emphasis on independent study using advanced techniques. Prereq: 3251-39 or 3531-39, 3450-39, 4250. Not open to students who have completed 4510.

4640 Electronics for Chemists (4) Electronics in design and construction of chemical instrumentation. Prereq: 1 yr of physics.

4910-20-30 Biophysical Chemistry (3, 3, 3) Physicochemical principles with application to biological systems. Prereq: 4119. Not open to students having 3410-20-30, 4910—Gas laws; first, second and third laws of thermodynamics; equilibrium. 4920—Solution chemistry; electrochemistry; kinetics; nuclear chemistry. 4930—Elementary quantum chemistry; optical and magnetic spectroscopy; light scattering; macromolecular properties. Prereq: General chemistry, or equivalent; 1 yr of mathematics.

5000 Thesis

5110-20-30-35 Advanced Organic Chemistry (3, 3, 3) Special reading, consultation and laboratory. The three laws of thermodynamics, phase equilibria and solutions, and chemical equilibrium. 4170—Gases and kinetic theory, chemical kinetics, molecular spectroscopy, and introduction to chemical statistics.

5129 Advanced Organic Chemistry Laboratory (3) Synthesis of organic compounds illustrating modern techniques. Prereq: 1 yr of organic chemistry.

5140 Introductory Polymer Chemistry (3) Fundamental principles, stressing the role of chemistry in the interdisciplinary field of polymer science; relation of molecular structure to bulk properties of polymers. Prereq: 1 yr each undergraduate organic and physical chemistry.

5150 Kinetics of Polymerization (3) Kinetics of formation and molecular weight distributions of polymers, homogeneous and heterogeneous step growth and chain growth polymerizations. Prereq: 5140 and 4160-70 or equivalent.


5170 Physical Chemistry of Polymers (3) Rubber elasticity; solution properties of macromolecules; structural, configurational, and conformational analysis. Prereq: 5130.

5240 Electronics for Chemists (4) Includes the material of Chemistry 4640 plus a special project. Prereq: Consent of instructor.

5250-60-70 Advanced Analytical Chemistry (3, 3, 3) 5250—Absorption and emission spectroscopy, structure elucidation by IR, NMR, UV, and mass spectra; 5260—Chemical separation methods: solvent extraction, chromatography, electrophoresis; radiochemical methods; fluorescence; x-ray methods; 5270—Electroanalytical, magnetic and thermal analytical methods and computer analysis. Prereq: 1 yr of physical chemistry.

5259-69-79 Advanced Analytical Chemistry Laboratory (1, 1, 1) Experiments in the use of chemical separation methods and instrumental methods covered in the concurrent lecture course. Prereq: 1 yr of physical chemistry. Prereq or coreq: 5250 for 5259; 5260 for 5269; 5270 for 5279.

5280-90 Clinical Chemistry (3, 2) Introduction to clinical chemistry; clinical significance of physiologic parameters, electrolyte balance, metabolic dysfunctions, analytical methodology, data processing and problem areas. Prereq: Biochemistry 4110; 1 yr of instru-
topics of current significance. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6130 Natural Product Chemistry (3) The structural determination of naturally occurring substances of biological or environmental significance. The course content may vary with each offering and will reflect areas of current chemical interest. Prereq: Two of 5110-20-30-35.


6160 Orbital Symmetry Control (3) The application of Woodward-Hoffman rules and other theories to the mechanism and stereochemistry of organic or organometallic reactions. Prereq: Two of 5110-20-30-35.

6175 Organic Photochemistry (3) The physical and chemical effects of electron excitation of organic molecules. Experimental and theoretical techniques of photochemical importance. Inter- and intramolecular reactions of alkenes, ketones, dienes, dienones, aromatic compounds, and other photoactive species. Prereq: Two of 5110-20-30-35.

6190 Organometallic Chemistry (3) The structure, bonding, and synthesis of organometallic reagents. Subject matter varies among important current problems in organometallic synthesis. Prereq: Two of 5110-20-30-35.

6210 Advanced Analytical Spectroscopy (3) Newer methods of spectroscopic analysis, including: transform methods, lasers in spectroscopy, fiber optics, introductory nonlinear optics, and spectroscopic techniques for remote sensing. Prereq: 5220.

6211 Selected Topics in Analytical Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: environmental chemistry, spectroelectrochemistry, modern liquid chromatography, new electroanalytical methods, biochemical analysis, and microcomputer analysis. Applications to chemical instrumentation. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6311 Selected Topics in Polymer Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Two of 5140-50-60-70 or consent of Instructor. May be repeated.

6320 Natural Polymers (3) Structure, modification, and nonbiochemical utilization of natural polymers and polymers derived from naturally occurring monomers. Prereq: 5140 and two of 5110-20-30-35.

6411 Selected Topics in Physical and Theoretical Chemistry (3) Subject matter varies among important topics of current significance. Prereq: Any two of 5410-20-30-50, 5240-50. May be repeated.

6420 Nuclear Magnetic Resonance (3) Theory of nuclear magnetic resonance spectroscopy with emphasis on high-resolution methods. Applications to problems in molecular structure and behavior. Prereq: Any two of 5110-23-30-35.

6430 Photochemistry and Radiation Chemistry (3) Fundamental physical and chemical processes pursuant to the excitation of molecules by various means and subsequent processes and uses of laser sources; fluorescence and phosphorescence; radiationless transitions as studied by optracoustic spectroscopy; chemical reactivity of excited states; ion-molecule reactions and radical reactions; electron capture and electron-transfer processes. Prereq: 5430.

6450 Electrochemistry (3) Electrochemical double layer; electrode kinetics; transport properties of electrolytes; electroanalytical methods. Prereq: 5430 or 5270.

6475 Electronic Structure of Radicals (3) Applications of electron spin resonance to the study of molecular conformation, structure, and bonding in organic and inorganic radicals; comparison of experimental results with theoretical predictions based on the Walsh rules and on INDO molecular orbital calculations. Prereq: 5340-50 and 5820.

6480 Statistical Thermodynamics (3) Application of statistical mechanical methods to systems of chemical interest such as isolated effects on equilibrium and rate processes, phase equilibria, condensation phenomena. Prereq: 5410, 5450.

6485 Advanced Chemical Kinetics (3) Mechanism of elementary chemical reactions at the molecular level including topics such as dynamics of molecular collisions, potential-energy surfaces, cross-sections, "direct" vs. "complex" modes of reaction, photofragmentation, energy partitioning and transfer, chemiluminescence, and chemical lasers. Prereq: 5430.

6510 Thermodynamics of Solutions (3) The theory of regular solutions and of electrolyte solutions; measurement of activity coefficients and other thermodynamic properties; selected topics from the literature. Prereq: 5410.

6520 Magnetic Resonance (3) Principles of magnetic resonance spectroscopy underlying nuclear magnetic resonance and electron spin resonance. Chemical applications to solid and liquid systems. Prereq: 5340.

6711 Selected Topics in Inorganic Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: photoelectron spectroscopy, transuranium chemistry, organometallic compounds, inorganic solution kinetics and mechanisms, crystal chemistry, nonaqueous chemistry, chemistry of halogens and compounds. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.


6750 Molten Salt Chemistry (3) Structure, spectroscopic properties, solution thermodynamics, electrochemistry and phase equilibria of molten salts. Solutions of metals in molten salts. Prereq: 4110 and 5410 or equivalent.

6810 Vibrational Problems in Molecular Spectra (3) (Same as Physics 8610.)

6811 Selected Topics in Nuclear Chemistry (3) Subject matter varies among important topics of current significance. Recent topics: nuclear decay schemes, nuclear models, nuclear reaction theory, nuclear detection techniques, activation analyses; Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

6820 Molecular Vibration-Rotation Theory (3) (Same as Physics 8620.)
Computer Science

MAJOR

Computer Science

DEGREE

M.S.

Professors:

R. T. Gregory (Head), Ph.D., Illinois;
F. Donatelson,* Ph.D. Texas; R. J. Plemmons,
Ph.D. Auburn (Mathematics); G. R. Sherman,
Ph.D. Purdue (Director of Computing Center).

Associate Professors:

R. M. Aiken, Ph.D. Northwestern; T. Feagin,*
Ph.D. Texas (Aerospace Engineering);
R. C. Gonzalez, Ph.D. Florida (Electrical Engineering);
E. L. Hall, Ph.D. Missouri (Electrical Engineering);
C. E. Hughes, Ph.D. Pennsylvania State;
S. M. Selkow, Ph.D. Pennsylvania.

Assistant Professors:

A. M. Davis, Ph.D. Illinois; W. S. Havens,
Ph.D. British Columbia; C. P. Huang, Ph.D.
SUNY (Buffalo); S. R. Jordan, Ph.D. Wisconsin;
J. M. McShaff, Ph.D. Ohio State; C. P. Pfeiffer,
Ph.D. Pennsylvania State; D. W. Straight, Ph.D.
Texas; M. G. Thompson, Ph.D. Duke.

ENTRANCE REQUIREMENTS TO M.S. PROGRAM

Upon admission to the Graduate School, students who wish to enter the Master's degree program in Computer Science should have the following background:

1. Mathematical maturity at least equivalent to that of a student who has completed the calculus sequence through one year of Multivariable Calculus and Matrix Algebra.

2. Computer Science 3155 or an equivalent introductory numerical algorithms course.

3. A basic statistics and probability course such as Statistics 3450 (statistics for engineering) or Mathematics 3650 or 4650.

4. Computer Science 3715 or an equivalent Introductory course in discrete structures and logical foundations of computer science.

5. Computer Science 3510 and 3520 or equivalent courses in advanced FORTRAN programming, machine organization and assembler language programming.

THE MASTER'S PROGRAM

All students must receive departmental credit for or exhibit proficiency in the following courses:

1. Computer Science 4550 and 4510

2. Electrical Engineering 5615-25-35

3. One of the three courses Computer Science 4710, Computer Science 4035, or Computer Science 4225

The student may then select either Plan A or Plan B.

Plan A: Thesis Option

1. Complete 36 hours of courses at the 4000 level or above, including at least 27 hours at the 5000 level, exclusive of Electrical Engineering 5815-25-55.

2. Pass written and oral comprehensive examinations.

Under either plan, courses which are taken from a department other than computer science must have the approval of the Computer Science department.

Plan B: Non-Thesis Option

1. Complete 45 hours of courses at the 4000 level or above, including at least 27 hours at the 5000 level, exclusive of Electrical Engineering 5815-25-55.

3150 Introduction to Numerical Algorithms and Programming (3) Roots of equations, systems of linear equations, least-squares data fitting, numerical integration, numerical methods for ordinary differential equations. Introduction to programming in FORTRAN. 3150 and 3155 may not both be taken for credit. Prereq or coreq: Multivariable Calculus and Matrix Algebra. (Same as Mathematics 3150.)

3155 Introduction to Numerical Algorithms (3) Roots of equations, systems of linear equations, least-squares data fitting, numerical integration, numerical methods for ordinary differential equations. 3150 and 3155 may not both be taken for credit. Prereq: Introduction to Computer Science or consent of instructor. Prereq or coreq: Multivariable Calculus and Matrix Algebra. (Same as Mathematics 3155.)


3570 Programming Languages (4) Comparison and analysis of programming languages and their features. Languages to be discussed will include SNOBOL, LISP, APL, and PASCAL. Prereq: Structured Programming in PL/I.

3715 Discrete Structures (3) Introduction to discrete structures useful in computer science. Sets, set logic, relations, functions, proof techniques, graph theory, lattices, Boolean algebra. Prereq: Introduction to Computer Science and Multivariable Calculus and Matrix Algebra or equivalent. (Same as Mathematics 3715.)

4035-45 Introduction to Numerical Linear Algebra (3, 3) Floating-point numbers and arithmetic on modern digital computers; numerical algorithms for solving systems of linear equations; linear least-squares methods and eigenvalue computations. Prereq: 3150 or 3155. (Same as Mathematics 4035-45.)

4225-35 Introduction to Numerical Analysis (3, 3) (Same as Mathematics 4225-35.)

4310 Computation in Statistical Analysis (3) Use of digital computer in standard statistical analyses, such as frequency tabulations, percentiles, and regression, analyses of variance. (Not for credit for Computer Science majors.) Prereq: Probabilis and Statistics or equivalent. An elementary knowledge of a procedure-oriented language such as FORTRAN is also assumed.

4330 Independent Study in Computer Science (1-3) Special project in area of student's primary interest. To be directed by Computer Science faculty, perhaps jointly with student's faculty advisor. Prereq: Consent of instructor. May be repeated. Maximum 9 hrs.

4510 Data Structures and Non-numeric Programming (3) A study of data structures and algorithms for their manipulation. Arrays and orthogonal lists; stacks, queues, rings, doubly-linked lists, trees, dynamic storage allocation;

Cyclades Islands, Greek mainland, and Crete. Emphasis on palaces of Crete and Mycenaean Tiryns, and Pylos, their fall, the following Dark Age, and rebirth of Greek civilization. Illustrated lectures.

3320 Art and Archaeology of Arcas and Classical Greece (3) Survey of development of Greek sculpture, painting, and architecture from 650 B.C. to death of Alexander. Illustrated lectures.

3330 Art and Archaeology of Hellenistic Greece and Rome (3) Hellenistic Greek, Etruscan, and Roman sculpture, painting, and architecture with attention to city planning. Illustrated lectures.

3340 Cities of the Greek and Roman World (4) Archaeological survey of Greek and Roman cities from 3000 B.C. to 500 A.D. with emphasis on development of city planning and quality of life. Such cities as Mycenae, Athens, Priene, Alexandria, Rome, and Lepcis Magna will be studied.

3350 Shrines and Sanctuaries of the Greek and Roman World (4) Survey course with emphasis on archaeological remains such as Olympia, Epidauros, Paestum, Cumae, Paestum, and Baalbek.

4010 Greek Drama in English Translation (3) Survey of dramatic masterpieces of Greek.

4210 The Teaching of Latin (3) Carries no language credit. Purposes, techniques, materials, and evaluation; use of teaching materials in public schools; preparation of teaching plans and materials.

4220 Seminar in Classical Studies (3) Special problems in the literatures and the other arts of Greece and Rome. May be repeated with consent of department.

4230 Classical Mythology and Its Uses (3) An intensive review and survey of Greek and Roman mythology. Emphasis on the uses of classical mythology in literature, music, and the plastic arts, especially of modern times.

4510 Selected Readings in Latin Literature in Translation (3) Content varies; may be repeated with consent of department.

5620 Problems in Old World Archaeology (3) (Same as Anthropology 5620.)

Comparative Literature

H. C. Rutledge, Chairperson

4012-22-32 Special Topics in Comparative Literature (3, 3, 3) Content varies; may be repeated.

4050-60-70 Dante and Medieval Culture (3, 3, 3) Readings and lectures in English for students majoring or minoring in other departments. (Same as Italian 4050-60-70.)

5012 Comparative Theories of Literature (3) Croce, Richards, Frye, Welden, and others. Prereq: Completion of three literature courses in a foreign language above 3000, or the equivalent.

5022 Approaches in Comparative Literature (3) The French and American schools: "comparative literature" vs. "general literature"; Van Gogh, Diderot, Baudenapsgen, Welden. Prereq: 5012; completion of three literature courses in a foreign language above 3000, or the equivalent.

5032 Studies in Comparative Literature (3) Independent research problems. Prereq: 5012 and 5022.
4550 Computer Organization and Programming III (3) Computer organization and advanced programming. Machine language and design of computers, representation of information, microprogramming, software systems, input and output system, microprocessors. Prereq: 3520 or equivalent.

4610 Operating Systems—Concepts and Facilities (3) Detailed examination of a major operating system. Memory, processor, device, and memory management, multiprogramming, multilevel input-output, loaders and relocation, device characteristics, data set organizations, SPOOLing. Prereq: 4510 or equivalent.

4620 Operating Systems—Case Studies (3) Alternatives in operating system design, dynamic relocation, paging, segmentation, time sharing, time slicing, protection, concurrency, real-time systems. Examples from different operating systems analyzed as appropriate. Prereq: 4610 or equivalent or consent of instructor.

4680 Compiler Construction (3) Practical experience with the design of compilers, scanning, parsing, semantic processing, code generation, and error detection and correction. Term project will include a complete compiler for a small block-structured language. Prereq: 4510.


4730 Analysis of Non-numeric Algorithms (3) Study of efficient algorithms for searching (e.g., binary search, tree searches hash coding). Sorting algorithms (e.g., quick-sort, Shell's sort, quick-sort). Algorithms for other non-numeric applications, such as pattern matching, graph path detection, set operations. Precise notions of time and space complexity. Polynomial complete problems. Prereq: 4510.

4750 Interactive Computer Graphics (3) The course includes point plotting, vector generation, interactive graphical techniques, twodimensional transformation, and three-dimensional transformation, perspective depth, hidden line elimination, shading, shadowing, and hardware system design. Discussion of use of these techniques in design, problem solving, mapping, architecture, and many other areas. Introductory course in Computer Science, Electrical Engineering or Geography and a knowledge of computer graphics is a prerequisite of instructor. (Same as Geography 4750.)

4820 Introduction to Pattern Recognition (3) (Same as Electrical Engineering 4820.)

4830 Digital Image Processing (3) (Same as Electrical Engineering 4830.)

4850 Small Computer Systems (3) (Same as Electrical Engineering 4850.)

4910 Analysis and Management of Computer Installations (3) Analysis and design of computer systems. Implementation, justification, personnel in systems. Perspective on systems. Prereq: 3520 or equivalent.

4980-90 Special Topics in Computer Science (1-1, 1-1) Credit determined at registration. Prereq: Recommendation of computer science staff. May be repeated with consent of department. Maximum 9 hrs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for all non-thesis students not otherwise registered during any quarter when such a student uses university facilities and/or faculty assistance, but does not write a thesis. May not be used toward degree requirements. May be repeated. S/NC only.

5010 Computer-assisted Instruction (3) Study of the history and development of CAI systems. Emphasis on current use of CAI in the solution of major projects as well as investigating future role CAI will assume in education. Research projects involving development of CAI programs in languages to implement a CAI course. Prereq: 3510 or consent of instructor.

5050 Computer Modeling and Simulation of Physical Systems (3) Formulation of computer modeling and simulation. Inputs, driving functions, errors, outputs, interactive simulations as applied to various physical systems. Models to represent spatial relationships. Prereq: 3150 or 3155, and 3520 and Statistics 3450.

5210 Artificial Intelligence (3) Study of the simulation of intelligent processes by computer. Techniques of representation, search, and manipulation for various areas: problem solving, game playing, pattern perception, theorem proving, semantic information processing. Computer simulation of AI problems. Prereq: 4310 or consent of instructor. (Same as Electrical Engineering 5690.)

5250 Medical Computing (3) A study of the achievements and problems associated with the application of computer technology to the field of health care. Heuristic and software computing will be covered, including laboratory data systems, patient monitoring systems, diagnostic assistance, disease records, automated history taking, and hospital administration systems. Prereq: 4510.

5430 Theory of Compilers (3) Traces development of major components of a compiler using the constructs provided by formal language theory. Recognizers, symbol tables, semantic routines, allocation of storage, code optimization. Prereq: 4310.

5455 Finite Difference Methods for Partial Differential Equations (3) (Same as Mathematics 5455.)

5465 Mathematical Aspects of the Finite Element Method (3) (Same as Mathematics 5465.)

5565-67-75 Numerical Mathematics (3, 3, 3) (Same as Mathematics 5565-67-75.).


5730 Computability and Computational Complexity (3) Computability and decidability. Turing machines and the halting problem. Register machines. Recursive and recursively enumerable sets; partial and total recursive functions. Time and space bounded computations; P vs. NP problem. Prereq: 4710.

5750 Theory of Formal Languages (3) Phrase-structure languages, their generators and processors. Type 0, 1, 2, and 3 languages; operations on languages and grammars; deterministic context-free languages. Theory of translation. Prereq: 4710.

5810 Information Organization and Retrieval (3) A study of the organization, storage, searching, and special devices of development of IR systems from off-line to modern on-line operations. Information analysis and dictionary construction and operations. Search and matching procedures; retrieval process. Information dissemination systems. Data base retrieval systems. Prereq: 4510 or 4560.


5910-20-30 Special Topics in Computer Science (1-3, 1-3, 1-3) May be repeated. Maximum 9 hrs.

5940-50 Advanced Small Computer Systems (3, 4) (Same as Electrical Engineering 5940-50.)

5970 Independent Study in Computer Science (1-1, 1-1) May be repeated. Consent of instructor. Maximum 9 hrs.

Cultural Studies

Asian Studies

4010-20-30 Readings in Asian Literature (4, 4, 4) Prereq: Mastery of intermediate level of Japanese, Chinese, or Sanskrit and consent of instructor.

4012 Selected Topics in Asian Studies (4) Content varies. May be repeated. Maximum 12 hrs.

4531-32-33-34 Advanced Chinese (4, 4, 4, 4) Prereq: Intermediate level competence and consent of instructor. Must be taken in sequence.

Black Studies

3140-50-60 Directed Readings in Black Studies (1, 1, 1) Designed for students who are interested in doing intensive reading in some area of Black Studies which is defined by the student and the instructor. Prereq: Introduction to Black Studies.

4200 Senior Seminar on Pan-Africanism (4) Explores concepts and philosophers of Pan-Africanism and implications of this ideology for various societal institutions.

4300 Resource Materials in Black Studies (4) Explores basic sources such as bibliographies, indices, and listings of audiovisuals in Afro-American history, African history, and children's literature. Prereq: Introduction to Black Studies or consent of instructor.

4310 Research in Black Studies (4) Deals with Black experience and research process.

4500 Current Issues and Topics in Black Studies (3-4) Problems, topics and issues in the area of Black Studies. The course content and credit will be determined by the instructor. May be repeated. Consent required.

4630 Black Women in American Society (4) Historical and contemporary sociopolitical factors in American society as they relate to the Black woman. Afro-American History recommended. Prereq: Consent of Instructor.

4680 Afro-American Psychology (4) (Same as Psychology 4880.)

Cultural Studies

5101 Foreign Study (1-12) See page 148.

5102 Off-campus Study (1-12) See page 148.

5103 Independent Study (1-2) See page 148.
Linguistics

4000 Topics in Linguistics (3) Content varies. May be repeated. Maximum 9 hrs.

4020-30 Historical Linguistics, Neogrammarian School, and Growth of Structuralism (3, 3) 4020: Historical Linguistics is an advanced scientific approach to linguistics from Jacob Grimm and Franz Bopp through the nineteenth century. 4030: Traces the change in linguistic interest brought about by Saussure’s *Cours and the growing impact of anthropology and behavior on linguistic studies.

4471-81 English as a Second or Foreign Language (3, 3) (Same as English 4471-81.)

Economics
See College of Business Administration.

English

MAJOR DEGREES

English M.A., M.A.C.T., Ph.D.

Professors:

Associate Professors:

Assistant Professors:

Visiting Lecturers:
W. Dykeman, B.A. Northwestern; G. Griffiths, Ph.D. Vanderbilt.

Detailed information about the Master’s and Doctoral programs may be obtained by writing the Director of Graduate Studies in English, McClung Tower. For admission forms, write to the Graduate School.

THE MASTER’S PROGRAM

The departmental requirements for the M.A. degree in English include (1) a thesis and 36 quarter hours of courses in English or 45 quarter hours without a thesis, (2) evidence of proficiency in one foreign language, and (3) a final examination. The courses should include 12 hours at the 6000 level, 12 hours of additional courses at the 5000-6000 level, and 12 hours at any level for graduate credit, including the 3000-4000 level.

Students seeking the Master of Arts without a thesis may substitute 9 hours of 5000-6000-level courses for the thesis, making a total of 45 hours.

For the degree of Master of Arts in College Teaching (M.A.T.C.) the requirements include (1) 45 quarter hours of courses in English, (2) 6 hours in special courses designed for M.A.T.C. students, (3) a thesis or 9 additional quarter hours of 5000- or 6000-level courses in English, (4) evidence of proficiency in one foreign language, (5) a final examination, and (6) a program of supervised teaching approved by the department.

The language requirement may be fulfilled in one of the following ways:

a. The completion, before beginning graduate study, of a second or foreign language in college with a grade of C or better.

b. The completion of French 3020 or German 3020, at The University of Tennessee, with a grade of B or better.

c. The passing of the Ph.D. language examination as currently administered.

Registration in any course in the 5000 or 6000 series may be repeated with the permission of the department. That is, courses having the same number, but with differing subject matter, may be taken with each separate subject description.

THE DOCTORAL PROGRAM

The departmental requirement for the Ph.D. degree in English is completion of a minimum of three academic years of resident graduate study. This includes a balanced program of 24-semester courses (or their equivalent) in English: 12 courses at the 6000 level; 6 additional courses at the 5000-6000 level; and 6 courses for graduate credit at any level, including the 3000-4000 level. Three courses must be taken for graduate credit in a subject other than English. Upon recommendation of the department, doctoral candidates may include M.A. thesis credits as part of the required course hours. After the course work and the two language examinations are completed, the doctoral candidate will take four preliminary comprehensive examinations from six areas divided as the department directs. Successful completion of these examinations will be followed by the writing of the dissertation and an oral examination.

*1211 Written and Oral English for Foreign Students (6) Rapid review of English grammar structures and pronunciation with intensive oral, aural, and written drill. Required during the first quarter of graduate study. All foreign students must take this course with a grade of B or better.

*1211 Written and Oral English for Foreign Students (6) Emphasis on the more advanced structures of English grammar and on paragraph writing. Required during the first quarter of residence of foreign students who on the English Proficiency Examination demonstrate need for work in English structure, but not at the intensive level of English 1211. Required of all foreign students who complete 1211.

3070 Modern British Poetry (3) From House- man to Thomas and more recent poets.

3080 Modern American Poetry (3) From Robin- son to Crane and more recent poets.


3150 Melville (3)

3210-20 English Literature and Culture of the Nineteenth Century (3, 3) A survey of the literature dealing with leading movements in politics, science, religion, and the arts. 3210—1810 to 1835. 3220—1835 to 1900.

3411-12-20-30 Modern Drama (3, 3, 3) 3411—Continental to 1950. 3412—Continental since 1950. 3420—British, 3430—American. (Graduate credit normally limited to students in Speech and Theatre.)

3510 Sixteenth-century Prose and Poetry: More and Wyatt to Spenser (3)

3520-30 Elizabethan and Jacobean Drama (3, 3)

3610 Restoration and Eighteenth-century Po- etry (3) Emphasis upon Dryden and Pope.

3620 Restoration and Eighteenth-century Dra- ma (3) Dryden through Sheridan.

3630 Restoration and Eighteenth-century Prose (3) Defoe, Addison, Steele, Swift, and others.

3670 The Age of Johnson (3)

3710 Literature of the English Bible (3) Types of Old Testament literature, excluding Wisdom literature.


3940 The Novel of the Contemporary West- ern World (3) Proust, Joyce, Mann, and others.

4010-20 Shakespeare (3, 3) 4010—Early plays, c. 1580-1601, including Henry IV, Twelfth Night, and Hamlet. 4020—Later plays, 1601-1610, with emphasis upon tragedies and dramatic romances.

4050-60-70 American Novel (3, 3, 3) 4050—From earliest colonial novels through Brown, Cooper, and Kennedy, and major figures to 1875. 4060—Henry James and Mark Twain through 1910. 4070—Hemingway. 4080—Early to Modern times.

4140-50 Technical Writing (3, 3) 4140—For students planning careers in the physical, life and health sciences, engineering, agriculture, and others. The writing of proposals, labora- tory and progress reports, abstracts and jour- nal articles. 4150—Writing of scientific feature articles in which data are marshaled and analyzed for their human interest.

4210 Tennyson and His Contemporaries (3)

4220 Browning and Arnold (3)
4230 Hardy, Hopkins, and Housman (3) Includes other poets at the turn of the century.
4310-20-30-40 The British Novel (3, 3, 3, 3) 4310—Defoe to Jane Austen. 4320—Scott to Thackeray. 4330—George Eliot to Galsworthy. 4340—James Joyce to the present.
4430 Modern English Grammar (3) New approaches with emphasis on the generativetransformational approach.
4440 Language in Society (3) Methodology and significant discoveries of sociolinguistics in America.
4450 Dialectology (3) Theories and methodologies of dialect research, fieldwork and analysis. Prereq: Varieties of English or consent of instructor.
4460 Special Topics in English Linguistics (3) May be repeated with consent of department.
4471-81 English as a Second or Foreign Language (3, 3) 4471—Applied linguistics in teaching and learning of English as a second or foreign language. Phonological and grammatical knowledge of the English language. Analysis of differences (phonological, grammatical, and lexical) between English and another language. 4478 Materials and methods of language teaching, with emphasis on preparation of materials and structured teaching situations. Theories of teaching language competence and performance, with an experienced member of the staff. Prereq: 4471. (Same as Linguistics 4471-81.)
4510 Introduction to Literary Criticism (3)
4610-20-30 Black Literature (3, 3, 3) Trends and developments.
4651 Southern Literature from 1585 to 1860 (3) The beginning of writing in the South, especially in its relations to the formation of a regional or southern tradition in literature.
4652 Southern Literature from 1860 to 1970 (3) Humorists, local colorists, and realists of the later nineteenth century and of the New South; emphasis upon the southern flowering of 1920-1950; recent trends.
4680 Emerson and Thoreau (3) Selected writings of American Transcendentalism.
4690 American Humor through Mark Twain (3)
4721-31-41 Ballad and Folktale (3, 3, 3) 4721—Ballad and Folktale ; 4741—The folk narrative; popular ballads and their North American variants; 4731—Study of native American ballad and folktale; 4741—The folk narrative; functions, categories, and patterns of storytelling.
4850 Milton (3) Emphasis on major poems.
4860 Seventeenth-century Prose and Poetry: Bacon and Donne to Marvell (3)
4910 Chaucer—Early Poems and Troullis and Criseyde (3)
4920 Chaucer—The Canterbury Tales (3)
4950 Approaches to Literature (3) Basic knowledge and techniques necessary to understand and evaluate various kinds of imaginative literature.
5000 Thesis
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used for general electives. May be repeated. S/NC only.
5010 Foreign Study (1-12) See page 148.
5012 Off-campus Study (1-12) See page 148.
5013 Independent Study (1-12) See page 148.
5101-20-30 Tutorial in English (1, 1, 1) Observation of courses in freshman and sophomore English, grading of papers, supervised teaching, weekly conferences or seminars on the teaching of college English. Prereq: Consent of Instructor. Required of MACT candidates. S/NC only.
5150 Old English Prose (3)
5170 History of the English Language (3, 3) 5170—Phonetic transcription, Old English, development of inflection and syntax. 5180—Middle and Early Modern English, developments in pronunciation and vocabulary.
5210-20-30 Readings in American Literature from the Colonial Period to the Present (3, 3, 3)
5310 Rhetoric and Composition: Theory and Practice (3) Concentration on stylistics and types of expository writing.
5410-20-30 Readings in Middle English Literature (3, 3, 3)
5510-20 Readings in Literary Criticism from Plato and Aristotle to the Present Day (3, 3)
5560-20-30 Readings in English Literature of the Nineteenth Century (3, 3, 3)
5710-20-30 Readings in English Literature of the Eighteenth Century (3, 3, 3)
5810-20-30 Readings in English Literature of the Renaissance (3, 3, 3)
5860 Introduction to Literary Research (3) Critical examination of the aims of English studies, the profession of the English teacher, theory of literature, and methods of research, including collecting of information, evaluation of material, and transmitting of the results of scholarship.
5910-20-30 Readings in English and American Literature of the Twentieth Century (3, 3, 3)
6000 Doctoral Research and Dissertation
6110-20-30 Studies in Elizabethan Literature (3, 3, 3)
6150 Old English Poetry (3) Prereq: 5150.
6160 Beowulf (3) Prereq: 5150. 6150. 6170 Studies in Middle English (3)
6181-82-83 Studies in the English Language (3, 3, 3)
6210-20-30 Studies in American Literature (3, 3, 3)
6241-42 Studies in Colonial American Literature (3, 3, 3) From Thomas Harriot through Increase and Cotton Mather. 6242—From Jonathan Edwards to the adoption of the Constitution.
6270-80 Studies in American Fiction (3, 3)
6310-20-30 Studies in Victorian Literature (3, 3, 3)
6410-20-30 Studies in Chaucer (3, 3, 3)
6510-20-30 Studies in Spenser and Milton (3, 3, 3)
6610-20-30 Studies in English Romanticism (3, 3, 3)
6710-20-30 Studies in Eighteenth-century Literature (3, 3, 3)
6810-20-30 Studies in Drama and Theatre (3, 3, 3)
6910-20-30 Studies in Twentieth-century Literature (3, 3, 3)
French
See Romance Languages

Geography

MAJOR DEGREE

MAJOR

Geography

M.S., Ph.D.

Professors:
S. R. Jumper (Head), Ph.D. Tennessee; E. H. Hammond, Ph.D. California (Berkeley); R. G. Long, Ph.D. Northwestern; T. H. Schumdie, Ph.D. Wisconsin.

Associate Professors:
C. S. Alten, Ph.D. Georgia; T. L. Bell, Ph.D. Iowa; L. W. Brinton, Jr., Ph.D. Wisconsin; J. B. Rehder, Ph.D. Louisiana State.

Assistant Professors:
J. R. Carter, Ph.D. Georgia; W. N. Cherry, M.S. Tennessee; R. Alston, Ph.D. Northwestern.

THE MASTER'S PROGRAM

The department requires a minimum of 45 quarter hours beyond completion of a sound undergraduate major program. Of these, half must be in courses numbered above 5000, in addition to thesis, and must include Geography 5150-60 and (at each offering during residency) 5100. Thesis and comprehensive examination required.

THE DOCTORAL PROGRAM

The doctorate is a research degree and is open only to those persons who demonstrate proficiency in conducting independent research. Students must have achieved the equivalent of a comprehensive Master's program before they will be admitted to the doctoral program. All Ph.D. programs must include Geography 5170 and (at each offering during residency) 5100. Other course requirements will be determined by the student's committee in accordance with specific interests and needs. A normal program contains 75 hours in courses for graduate credit and includes a minimum of 15 hours in the 6000 series. A minimum of 15 hours of graduate credit must be earned in related fields outside the department. Registration in any course in the 6000 series may be repeated for credit with the permission of the department. Competence in one foreign language and pertinent quantitative techniques are required. The language will be French or German unless otherwise approved by the student's faculty committee. Written and oral qualifying examinations are required.


3430 Urban Geography (4) Concepts and theories concerning development and significance of systems of cities and internal morphology of cities.

3450 Rural Geography (4) Geographical appraisal of rural areas of the United States, including small towns and urban fringes. Problems and potentials of rural America.

3490 Geography of Resources (4) Study of factors related to variations in resource availability from time to time and from place to place, with particular emphasis upon energy and metallic resources.

3520 The Atmospheric System and Man (4) Overview of general circulation system leading to world pattern of climates. Role of climate in agriculture, architecture, human comfort and economic activity.

3530 The Land-Surface System and Man (4) Nature and regional variations in relationships
### THE DOCTORAL PROGRAM

Specific course program and thesis topic determined by candidate's faculty committee.

1. **Program to be determined by faculty committee.** Requirements include a **minimum of 45 hours** in courses for graduate credit, in addition to dissertation. These courses must include **at least 15 hours** in the 6000 series. Up to one-third of the required hours may be taken outside of the department. A **Master's degree** is recommended. Registration in any course in the 6000 series may be repeated for credit with the permission of the department.

2. **Preliminary examination** will be both written and oral.

3. Each Ph.D. student must satisfy a research tool requirement which will be determined by his/her faculty committee and which will consist of one of the following:

   - **A.** Demonstration by examination of a reading knowledge in one modern foreign language in which there is a significant body of geological literature.
   - **B.** Completion of course 3030 in an appropriate foreign language with a B or better.
   - **C.** Course (minimum of 6 hours) at 3000 level or higher taken for undergraduate credit and completed with a B average in appropriate mathematics, statistics, or computer science courses. The courses must be taken during a student's graduate program and must be approved by the student's entire committee.

   In no case will option C above be available unless the student has had reading training as a college undergraduate in an appropriate foreign language.

- **3160 Introduction to Earth Materials (4)** Introduction to the study of minerals and rocks. Laboratory includes both hand specimen and analytical methods of identification. Prereq: General Geology I. 2 hrs and 2 labs.

- **3180 Mineralogy (4)** Introduction to crystallography and the study of minerals. Laboratory includes hand specimen, chemical and x-ray methods of identification. Prereq: General Geology I. General Chemistry I or equivalent. 3 hrs and 1 lab.

- **3210-20 Invertebrate Paleontology (4)** Systematic review of important invertebrate fossil groups. 3210–Protista to Brachiopoda, including sponges, coelenterates and bryozans. 3220–Phoronida to Hemichordata, including annelids, molluscs, arthropods and echinoderms. May be taken separately or in any order. Prereq: Paleobiology, General Biology, consent of instructor. 3 hrs and 1 lab or field period.

- **3250 Micropaleontology (4)** Microscopic remains of animals and plants with special emphasis on microfossils in important groups. Prereq: 3210 or consent of instructor. 3 hrs and 1 lab.

- **3260 Paleobiology (4)** An introduction to the principles and materials of paleontology as applied to the interpretation of earth history. Prereq: General Geology II. 3 hrs and 1 lab or field period.

- **3270 Geological History of Land Organisms (4)** The geological history and development of the terrestrial biota and ecosystem with special emphasis on the fossil record of land plants and vertebrates. Prereq: General Biology or consent of instructor. 3 hrs and 1 lab or field period.

- **3310 Lithology (4)** Study of igneous and metamorphic processes and rocks. Laboratory includes hand specimen and microscopic study of important rock types. Prereq: 3180. 2 hrs and 2 labs.

- **3330 Geology of East Tennessee (4)** Lectures and field excursions. Prereq: 12 hrs of geology and consent of instructor.

- **3360 Stratigraphy-Sedimentation (4)** An introduction to stratigraphic principles and practices of sedimentary processes and the interpretation of depositional environments. Prereq: General Geology II and 3180. 3 hrs and 1 lab or field period.

- **3370 Structural Geology (4)** Introductory discussion of the origins and changes that have occurred in the earth's crust with emphasis on modern concepts of continental drift and plate tectonics. Prereq: General Geology II.

- **3410 Principles of Ground Water Geology (3)** Geophysical principles affecting the occurrence and behavior of water. 2 hrs and 1 lab. (Same as Water Resources Development 3410.)

- **3510 Introductory Environmental Geology (4)** Geologic problems involving environment and resources, and geologic parameters associated with their control and misuse. Prereq: General Geology II or consent of instructor. 2 hrs and 2 labs or field periods.

- **3610 Quaternary Geology for Engineers (3)** Erosional and depositional processes, landforms, ground water, 2 hrs and 1 lab or field period. Prereq: Introductory Geology for Engineers or equivalent.

- **3710 Origin and Evolution of the Continents and Ocean Basins (4)** An introductory study of the earth's crust with emphasis on modern concepts of continental drift and plate tectonics. Prereq: General Geology II.

- **4110 Principles of Economic Geology (4)** Formation of mineral deposits. Prereq: 3180, 3370, or equivalent.

- **4115 Elementary Applied Geophysics (4)** Basic principles of electrical, seismic, gravity and magnetic surveying. Prereq: General Geology II and Elements of Physics or Fundamentals of Physics: Waves and Optics. 3 hrs and 1 lab.

- **4130 Sedimentology (4)** Introduction to physical processes of sedimentation: transport of sediments and formation of sedimentary structures, rivers, waves, tides, and ocean circulation. Prereq: 3310. 3 hrs and 1 lab.

- **4230 Paleocology (4)** Principles of environmental analysis applied to fossil assemblages and associated lithologies. Prereq: 3260 or consent of instructor. 3 hrs and 1 lab.

- **4240 Paleobotany (4)** Survey of fossil record of plants with particular emphasis on comparative morphology and evolutionary trends in major plant groups and chronology of successional and geographic distribution of past floras on earth. Prereq: General Geology II or History of Life or permission of instructor. 3 hrs and 1 lab. (Same at Botany 4240.)

- **4310 Geologic Mapping (4)** Interpretation and methods. Prereq: 12 hrs of geology. 3 hrs and 1 lab or field period.

- **4370 Tectonic Styles (4)** Elements, habitats, and geologic control of basic styles of tectonic deformation are presented on maps, sections, aerial photographs and fabric diagrams. 3 lectures and 1 seminar or lab. Prereq: 10 credits of introductory instrucion.

- **4440 Field Geology (6)** Five-week field course, first term of summer quarter. Employs entire time of students. A report is required, to be submitted no later than end of fall quarter. Prereq: Three courses in geology and consent of instructor.

- **4460 Geologic Photography and Photogrammetry (4)** An introduction to the principles of terrestrial and aerial geologic photography, including photographic principles and practice, geometry of terrestrial and aerial photographs, and map interpretation. Prereq: 3370 or consent of instructor. 3 hrs and 1 lab.

- **4510 Principles of Geomorphology (4)** A study of the gradational processes acting at the earth's surface and the landforms produced. Prereq: General Geology II or consent of instructor. 3 hrs and 1 lab. (Same as Geography 4510.)

- **4550 Optical Mineralogy (4)** Identification of nonopaque substances by immersion methods, using petrographic microscope.

- **4610 Principles of Geochemistry (4)** Application of chemical principles to geologic problems. Emphasis on crystal chemistry and relation between basic atomic structure and distribution and behavior of elements in the earth's crust. Prereq: General Chemistry or equivalent. Recommended: 3310.

- **4650 Mineral Phase Equilibria (3)** Principles of phase chemistry and application of phase equilibria studies in rock-forming mineral systems as aid to understanding conditions of formation and modification of rocks. Prereq: 4610 or consent of instructor.

- **4810 Special Problems in Geology (1-4)** May be repeated. Maximum 4 hrs.

- **5000 Thesis**

- **5050 Geochmistry of Ore Mineral Deposits (3)** Study of ore deposits based on experimental, empirical, or theoretical considerations. Prereq: 4510 and 4511 or consent of instructor.

- **5069 Experimental Geochemistry Laboratory (1-3)** Independent lab study of a problem in geochemistry using techniques presented in 5060. Prereq: 5060 or consent of instructor.

- **5120 Geophysics—Gravity and Magnetic Methods (4)** Potential methods discussed in depth, introduction to geodesy and paleomagnetism. Prereq: 4115, Differential and Integral Calculus or consent of instructor. Advanced engineering mathematics desirable. 3 hrs and 1 lab.

- **5130 Geophysics—Seismic Exploration Methods (4)** Seismic reflection and refraction methods discussed in depth, introduction to seismology and seismology. Prereq: 4115 or consent of instructor. 3 hrs and 1 lab.

- **5210-20-30 Special Problems in Geology (1-4, 1-4, 1-4)**

- **5290 Quaternary Problems (4)** An interdisciplinary approach to the interpretation of physical and biological phenomena directly or indirectly influenced by Pleistocene glaciation. Prereq: Elements of Geology (quarters) or consent of instructor. (Same as Biology 5290 and Zoology 5290.)

- **5310 Advanced Stratigraphy and Sedimentation (4)** Integrated field-oriented study of sedi-
mentary rocks involving analysis of depositional environments, paleoenvironments, and paleogeographic interpretations of tectonic settings. Prereq: 3180 or equivalent, 4130, 5510.

5340 Seminar in Local Stratigraphy (1) Stratigraphy of the Knoxville area.

5350 Selected Topics in Geology (1) Presentation of graduate research, topics from current literature, and subjects of general interest. Registration required each quarter except summer for resident full-time graduate students. 2/NC only.

5370 Mesofabric Analysis (4) Introduction to techniques of gathering, processing, and interpreting tectonic mesofabric data. 3 lectures and 1 lab or field meeting. Prereq: 3370.

5460 Photogeologic interpretation (4) Advanced photogrammetric techniques used to obtain geological measurements from aerial photographs. Practice in photo interpretation of imagery covering selected geologic features. Prereq: 5450 or equivalent or consent of instructor.

5470 Plate Tectonics and Orogeny (4) Geology of plate slab motion used to disassemble models of geosynclines, fold belts, metamorphic and plutonic belts, with related sedimentary and volcanic rocks. 3 lectures and 1 seminar or lab. Prereq: 3370.

5520 Igneous Petrology (4) Description, classification, and origin of igneous rocks. Laboratories emphasize thin section study. Prereq: 3370 or equivalent, 4550. 3 lectures and 1 lab.

5530 Metamorphic Petrology (4) A study of the physical and chemical characteristics of the metamorphic environment; its gradational relationship to geologic processes. Prereq: General Chemistry 1 and Analytical Geometry and Calculus of a Single Variable, Elements in Physics. 5810 Geology of Fuels (4) Origin, occurrences, and uses of natural fuels. 5820-30 Mineral Deposits (4, 4) Distribution, origin and evolution of mineral deposits. May be taken separately in any order. Prereq: 4110 or consent of instructor. 3 hrs and 1 lab/field/seminar period.

5840 Ore Microscopy (4) Study of ore mineral assemblages by reflected light microscopy. Other techniques such as x-ray diffraction and electron microscopy may be used as and when necessary. Prereq: 4110, 4550, and consent of instructor. 2-4 hrs lab.

5850 Regional Studies in Economic Geology (3) Literature study and seminars on specific mining districts and deposits, followed by a trip between quarters to one of the same in the field. Prereq: 4110 and consent of instructor. 2 hrs plus field trip. May be repeated. Maximum 8 hrs.

5915 Regional Geomorphology (4) Study of selected geographically-related assemblages, which have common elements such as history or development, related processes which have produced genetically similar assemblages of landforms. May be repeated with consent of department. (Same as Geography 5915.)

6000 Doctoral Research and Dissertation

*6110 Seminar in Stratigraphic Geology (3)
*6210 Seminar in Paleontology (3)
*6310 Seminar in Structural Geology (3)
*6410 Seminar in Mineralogy (3)
*6510 Seminar in Petrology (3)
*6610 Seminar in Economic Geology (3)
*6710 Seminar in Geochemistry (3) Prereq: 4510 or consent of instructor.
*6810 Seminar in Geomorphology (3) Prereq: 4510 or consent of instructor.

Germanic and Slavic Languages

MAJORS

Emeritus Professor:
E. T. Hankamer, Ph.D. Bonn (Germany).

Professors:
H. Kretz (Head), Ph.D. Ohio State;
J. E. Fainen, Ph.D. Pennsylvania;
H. W. Fuller, Ph.D. Wisconsin;
R. L. Hiller, Ph.D. Cornell;
R. L. W. Nordeide, Ph.D. Ohio State;
J. C. Osborne, Ph.D. Northwestern.

Associate Professors:
N. A. Lauckner, Ph.D. Wisconsin;
D. E. Lee, Ph.D. Stanford;
M. P. Rice, Ph.D. Vanderbilt.

Assistant Professors:
J. L. Elliott, Ph.D. Michigan;
D. M. Fiere, Ph.D. Indiana;
G. Gutschke, Ph.D. Wisconsin;
C. J. Meiler, Ph.D. Chicago.

The Department of Germanic and Slavic Languages offers three advanced degrees. These are the Master of Arts (M.A.) in German, the Master of Arts in College Teaching (MACT) in German, and the Doctor of Philosophy (Ph.D.) in German Language and Literature.

THE MASTER'S PROGRAM

In addition to the general Graduate School requirements as stated on page 19, the department requires 36 quarter hours in approved courses, including at least 18 hours in courses numbered above 5000. In addition to course work, the student is required to write a thesis, for which he/she may get a maximum of 9 hours credit. The minimum quarter hour credit for the M.A. is 45 quarter hours.

MASTERS OF ARTS IN COLLEGE TEACHING PROGRAM

The MACT program is essentially an expanded M.A. program. The minimum requirement is 60 hours of graduate study, including 9 hours of thesis and a 3-quarter-hour seminar in college teaching. The aim of this program is to prepare highly qualified college teachers. Students receiving the MACT degree would be well prepared to go on to the Ph.D.

THE DOCTORAL PROGRAM

The student must fulfill the general requirements for the Ph.D. degree set by the Graduate School. The candidate for the Doctoral degree must complete a minimum of 81 quarter hours of course work beyond the Bachelor's degree in addition to 300 hours of doctoral research and dissertation. At least 45 quarter hours of the minimum must be taken in 5000 or 6000 courses. Of these 45 hours, a minimum of 18 hours must be chosen from the seminar (5200) and the literary or philological seminars (6210-20-30-40-50-60 and 6310-20-30). At least 9 hours must be taken in a cognate field. Students are encouraged to take additional work in allied fields. A minor in an allied field must consist of at least 18 hours of 5000 or 6000 courses. Students must satisfy the language requirement of the candidate's field of research. A preliminary comprehensive examination, both written and oral, on German language and literature and the minor field or fields, must be passed before the student may be admitted to candidacy. The student will be examined on an extensive reading list which covers the whole range of German literature, and will be expected to show familiarity with major works of world literature. The candidate will be required to defend the dissertation in an oral examination, which will cover also the general area of the dissertation. Central emphasis is put on the doctoral dissertation as a final test of the candidate's competence in his field of research.

The field of study is divided into (1) German literature and (2) German (or Germanic) philology or linguistics. A stu-
dent may concentrate on one or the other. Dissertation and seminar research topics will be chosen in accordance with the varying preferences and specific interests of the faculty. Detailed programs will be established in each case by the student’s faculty committee.

German

3010-30-30 Elements of German for Upper Division and Graduate Students (3, 3, 3) For graduate students preparing for language examinations. No graduate credit allowed.

3210-30-30 German Literature in English Translation (3, 3, 3) No foreign language credit.

3240 Old Norse Literature in English Translation (3-4) Prose readings of sagas of Norwegian kings, Icelandic family sagas, and Vinland sagas, narrating discovery of America around year 1000. Mythological and heroic poems of the Edda. No foreign language credit.

3250 Modern Scandinavian Literature in English Translation upon the development of the language. Phonological and morphological problems; intensive study of the prose and poetry of Old Saxon. Representative readings.


4210-20 History of the German Language (3, 3)

4610-20-30 German Civilization (3, 3, 3) Prereq: Intermediate German or equivalent.

4810-20-30 Advanced Conversation and Composition (3, 3, 3) Prereq: 3010-20-30 or equivalent or consent of department.

5000 Thesis

5101 Foreign Study (1-12) See page 148.

5102 Off-Campus Study (1-12) See page 148.

5103 Independent Study (1-12) See page 148.

5200 Proseminar (3) Bibliography; methods; illustrative problems; preparation of papers.

5210-20-30 College Teaching of German (1, 1, 1) Required of all M.A., MACT, or Ph.D. candidates, except those whose previous teaching experience warrants excuse from this requirement or who wish to pursue vocations other than teaching.

5410-20-30 Medieval German Language and Literature (3, 3, 3) 6410—Introduction to Middle High German; 5420-30—Readings in Medieval German Literature.

5500 Studies in German literature (3) Content varies. May be repeated. Maximum 9 hrs.

5510 German Humanism and the Reformation (3)

5520 German Baroque Literature (3)

5530 The Enlightenment and the Rococo (3)

5540 German Classicism (3)

5550 Goethe’s Faust (3)

5560 German Romanticism (3)

5570 German Realism and Naturalism (3)

5580 Modern German Literature (1899-1945) (3)

5590 Modern German Literature (1945-Present) (3)

5600 German Literary Theory and Criticism (3)


5740 The Russian Drama in English Translation (3-4) Selections from works of Gogol, Griboedov, Pushkin, Lermontov, Ostrovsky, Turgeney, Chekhov, and others.

3250 The Works of Ivan Turgenev and Anton Chekhov in English Translation (3-4)

3260 Russian Folklore in English Translation (3-4)

3270 Russian Philosophical and Theological Thought (4) (Same as Religious Studies 3270).

4010 Selected Topics in Russian and East European Studies (3) An interdisciplinary seminar on a selected topic using a comparative approach.

4110-20-30 Studies in Major Russian Writers (3, 3, 3) Content varies. Pushkin, Lermontov, Gogol, Turgenev, Tolstoy, Dostoevsky, Chekhov and others. Prereq: 9 hrs of 3000 courses (exclusive of 3010-20-30, Russian Literature in English Translation, Russian Scientific and Technical Literature) or equivalent. May be repeated.

4210-20-30 Studies in Russian Literary Periods (3, 3, 3) 4220—Russian Romanticism. 4230—Russian Realism, Russian Modernism. Prereq: 9 hours of 3000 courses (exclusive of 3010-30-30, Russian Literature in English Translation, Russian Scientific and Technical Literature) or equivalent. May be repeated.

4250 Introduction to Descriptive Linguistics (3) (Same as French 4250).
3. Language Requirements: Candidates shall be required to possess a reading knowledge of one language and such additional language or languages as may be determined by the student's graduate committee. Under normal circumstances students specializing in European history will need two languages. The committee may also specify other research tools, such as statistics, which it regards as essential for the student's preparation.

The foreign language requirements may be satisfied in one of two ways:

(a) By examination. When the student is ready to take a language examination he/she should consult with an advisor. The appropriate forms and the time of the examination may be obtained from the Graduate School.

(b) By course work. Upon consultation with the advisor, a student may elect to complete an appropriate 3010-20-30 sequence in a language department (or an Intermediate language sequence in which no 3010-20-30 sequence is available). Satisfactory completion requires that a student must have at least a B in the final quarter.

4. Preliminary Examinations and Committee: Incoming students will be advised by the department head. The preliminary examinations must be taken after all course work is completed, language requirements fulfilled, and at least nine months before the degree is expected. These exams should normally be taken before beginning the ninth quarter of work toward the doctorate. The candidate must present four fields, distributed as follows: one major field; two minor fields; and one major field which may be either in history or outside the department. In any case, the student is required to have 9 hours of graduate work outside the History Department. Three of the four areas listed below must be represented by a major or a minor field, or both.

I. Ancient and Medieval
   (1) Ancient Near East
   (2) Greece
   (3) Rome
   (4) Early Middle Ages, 375-1122
   (5) Late Middle Ages, 1095-1450

II. Early Modern
   (1) Renaissance and Reformation
   (2) Europe, 1559-1815
   (3) American History to 1815
   (4) Latin America, 1492-1825

III. Modern
   (1) Europe, 1815-1914
   (2) European World Since 1914
   (3) United States, 1815-present
   (4) Latin America, 1789-present
   (5) Asia, 1641-present
   (6) Middle East, 1798-present

IV. National, Sectional and Topical
   (1) England, 1485-1763
   (2) Great Britain, 1760-present
   (3) France, 1500-1815
   (4) France, 1789-present
   (5) Germany, 1555-1806
   (6) Germany, 1806-present

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(7) Russia, 1600-1800
(8) Russia, 1800-present
(9) Colonialism and Imperialism
(10) Diplomatic History of the United States
(11) Social and Cultural History of the United States
(12) The Russian Revolution
(13) Frontier and Westward Movement
(14) Afro-American

Preliminary examinations will be both written and oral.

5. Dissertation and Final Examination: Original research forms the basis for the dissertation. After the dissertation has been completed, a final oral examination will be given on the dissertation in its historical context.

3061-71 History of Western Religious Thought and Institutions (4, 4) (Same as Religious Studies 3061-71)

3140-50-60 History of England (3, 3, 3) 3140—Henry VIII through the Revolution of 1688, 1690 —1689 through the Reform Bill of 1832, 3160—1832 to the present.

3311-21 History of Tennessee (3, 3) 3311—Eighteenth Century to Civil War Era. 3321—1865 to present.

3411-12-13 Renaissance and Reformation (3, 3, 3) 3411—The Renaissance. 3412—The Reformation. 3413—The Catholic Reformation and the Wars of Religion. (Same as Religious Studies 3411-12-13)


3445-46 History of France (4, 4) 3445—France to 1875. 3446—France since 1875.

3470-89-90 History of Russia (3, 3, 3) 3470—To 1891. 3480—Nineteenth Century. 3490—Twentieth Century.

3510-20 The American Colonies and the American Revolution (3, 3) 3510—Settlements to 1754, 3520—1754-1789.


3710-20-30 History of Germany (3, 3, 3) 3710—The First Reich to 1713, 3720—Habsburg and Hohenzollern and the Formation of the Second Reich, 1713-1860. 3730—From a Unified to a Divided Germany, 1890 to present.

3751-52 Ancient Near Eastern Civilization (3, 3) 3751—Early and Middle Bronze Ages. 3752—Late Bronze and Iron Ages.

3760-70 The Ancient World (3, 3) 3760—Greece. 3770—Rome.

3780-90 History of the Middle East (3, 3) 3780—Rise and spread of Islamic Civilization to the 16th Century. 3790—The impact of the West on the Middle East from the Sixteenth century to World War I.

3790 Contemporary Middle East (4) Background of current problems in the area, from World War I to present.
wars, and relationship between American so-

4360 The United States in World War II (4)

t between Western Culture and women's protest

4280 Women in European History (4) Com-
tivism, 1870-present.

4250-60-70 European Intellectual and Cultural
tury. 4130-Nineteenth century to present.
discovery and exploration to nineteenth cen-

4120-30 History of Colonialism and Im-

4015 Studies in History (3-4) Variable content
non course affording opportunity to offer subject

4140-45-46 Modern World History (4-4)

tory (2) European history to 1914.

4030-35-36 History of Russia (3-3)

4000 Introduction to Historical Methods (3)

4850 History of the Caribbean (3) The Carib-
bean region from discovery and colonization to

4870-80-90 China (3, 3, 3) 4870—Cultural his-
tory of China. 4880—History of modern China.

4910-20-30 History of the South (3, 3, 3)

4510-20 Tudor-Stuart England (3, 3) 4510—

4500 History of Medieval England (3)

4510-19-1848) (3)

4570 Twentieth-century Britain (3)

4580 Revolution & Reform: Ireland in the

19th and 20th centuries.

4050-60-70 American Intellectual and Cultural

tury. 4130-Nineteenth century to present.

4240-50-60 Social and Cultural History of the

United States (3, 3, 3) 4640—Colonial Society

and Early Nation to 1825. 4650—1825 c. 1860.

4670 American Urban History (4)

4710-20-30 Medieval History, 500-1000 (3, 3, 3)

4740 The City in Europe, c. 1200-1900 (3)

4720-962 to Renaissance of twelfth century.

4730-Renaissance of twelfth century.

4710-20-30 Medieval History, 500-1000 (3, 3, 3)

4740 The City in Europe, c. 1200-1900 (3)

4720-962 to Renaissance of twelfth century.

4730-Renaissance of twelfth century.

4710-20-30 Medieval History, 500-1000 (3, 3, 3)

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4710-20-30 Medieval History, 500-1000 (3, 3, 3)

4740 The City in Europe, c. 1200-1900 (3)

4720-962 to Renaissance of twelfth century.

4730-Renaissance of twelfth century.

4710-20-30 Medieval History, 500-1000 (3, 3, 3)

4740 The City in Europe, c. 1200-1900 (3)

4720-962 to Renaissance of twelfth century.

4730-Renaissance of twelfth century.
Mathematics

MAJOR

DEGREES

Mathematics

M.A., M.S., M.M., Ph.D.

Professors:

L. K. Barrett (Head), Ph.D. Pennsylvania; G. E. Albert (Emeritus), Ph.D. Wisconsin; J. S. Bradley, Ph.D. Iowa; J. H. Carruth, Ph.D. Louisiana State; R. E. Clines, Ph.D. Purdue; A. J. Daverman, Ph.D. Wisconsin; D. J. Deesert, Ph.D. Maryland; E. D. Eaves (Emeritus), Ph.D. Texas; H. Frankena, Ph.D. Illinois; D. A. Gardiner, Ph.D. North Carolina State; R. T. Gregory, Ph.D. Illinois; T. G. Halaim, Ph.D. Missouri; D. B. Hinton, Ph.D. Tennessee; A. S. Householder (Emeritus), Ph.D. Chicago; L. H. Husch, Ph.D. Florida State; R. M. McConnell, Ph.D. Duke; H. T. Mathews, Ph.D. Tulane; D. D. Miller, Ph.D. Michigan; R. J. Piemonts, Ph.D. Auburn; C. K. Reddy, Ph.D. Indian Institute of Technology (India); F. W. Stallmann, Ph.D. Gissener (Germany).

Associate Professors:

J. S. Bradley, Ph.D. Kentucky; D. E. Dobbs, Ph.D. Cornell; M. D. Gunzburg, Ph.D. New York; G. S. Jordan, Ph.D. Wisconsin; K. K. Kimbile, Ph.D. State; G. A. Kissien, Ph.D. Nebraska; Y. Kuo, Ph.D. Cincinnati; H. L. Lee (Emeritus), Ph.D. Duke, R. S. Rajput, Ph.D. Illinois; P. W. Schafer, Ph.D. Maryland; J. Smith, Ph.D. California (Berkeley); K. Soni, Ph.D. Orland State; L. H. Turner, Ph.D. Purdue; W. R. Wade, Ph.D. California (Riverside); C. G. Wagner, Ph.D. Duke.

Assistant Professors:


Math 3050, 3060, 3090, 3100, 3110, 3120, 3130, 3230, 3240, 3910, 3150-20-30, 3720, and 3910 are intended primarily for students preparing to teach in elementary or secondary schools. Any 3000 or 4000 course in the department whose course number ends in "0" may be offered as an honors version. In this case, the last digit will appear as an "8" and the title will be preceded by the word "Honors" both in the timetable and on the student's transcript. Honors courses are listed in the Graduate Catalog and are acceptable for graduate credit. Such courses may be offered upon the initiative of interested faculty, students, or the department head (though in all cases subject to the approval of the department head).

MASTER OF MATHEMATICS PROGRAM

The Master of Mathematics degree is intended primarily for teachers of high school mathematics.

Before admission to this program, the applicant must have either (a) certification in teaching secondary mathematics in at least one of the states of the United States, or (b) three years of successful elementary or secondary school teaching experience.

Evidence of the requirement being met must be supplied by the student.

Applicants for admission to this program must take the Graduate Record Examination (applicants who have had at least one year of college mathematics including analytic geometry. The following requirements must be met:

1. Completing 45 hours of course work, of which at least 9 must be at the 5000 level. The course work must include:
   a. 36 hours of mathematics courses numbered 3050 or above,
   b. 9 hours of additional work from mathematics courses numbered 3050 or above or from courses in other departments selected in consultation with the advisor.

2. Passing a comprehensive examination upon completion of all course work.

THE MASTER'S PROGRAMS

The Master of Arts degree and the Master of Science degree are designed to prepare students for industrial employment and for teaching at the high school and junior college levels.

The department offers two options for these degrees. The first option requires a thesis for which 9 credit hours may be earned along with 36 additional hours of work in acceptable courses numbered above 4000. Of the additional hours, 9 may be in an area outside the department and 18 must be in courses in mathematics numbered above 5000.

After two quarters of graduate study, a student whose supervisory committee gives its approval may choose the non-thesis option, for which 45 hours of work in courses numbered above 4000 are required. Of these, 27 hours (at least 24 of which are in mathematics) must be in courses numbered above 5000. Of the 45 hours, 15 in courses approved by the supervisory committee may be taken in fields other than mathematics. For this option it is also required that a written comprehensive examination be passed, and that credit be received for a 3-hour seminar or reading course (5990-5995) in which a term paper or project is required.

A student offering mathematics as a minor for the Master's degree is required to obtain at least 9 hours of resident graduate credit in courses numbered above 4000 and approved by both the major department and the Department of Mathematics.

THE DOCTORAL PROGRAM

For the Ph.D. in Mathematics the student must meet the following departmental requirements:

1. Pass written examinations covering four of the following subjects to the extent indicated by the accompanying course numbers and such other topics as the graduate faculty may prescribe:
   a. Algebra 5510-20-30
   b. Functions of a Complex Variable 5110-20-30
   c. Functions of a Real Variable 5210-20-30
   d. Topology 5910-20-30

Latin

See Classics

* Space Institute, Tullahoma.
b. Linear Analysis 5240-50-60 Mathematical Statistics 5750-60-70 Numerical Mathematics 5865-65-75 Partial Differential Equations 5450-60-70 The student must pass at least two examinations from Group a.; anyone passing two examinations from Group b. will be required to take an approved one-year graduate course (numbered 5000 or above), in which mathematics is extensively used, outside of the Mathematics Department, and not cross-listed as course.

2. Pass an intensive examination in the student's area of specialization.

3. Demonstrate a reading knowledge of two of the following languages: French, German, Russian or an approved alternative. At least one language requirement must be met before taking a written exam in the student's third year and the second language requirement must also be satisfied by the exam in the student's area of specialization.

4. Complete an approved one-year 6000-level course in mathematics outside the area of specialization.

5. Complete a dissertation consisting of original and significant research.

6. Pass a final oral examination.

Study in a cognate field is not required by the Mathematics Department. Registration in any course in the 6000 series may be repeated for credit with the permission of the department.

*3050 Elementary Probability and Statistical Analysis (3) Combinatorial problems; sample spaces, sets, and events; statistical independence; axiomatic probability theory; random variables and their distributions; simple random processes. Prereq: Introductory Calculus, General Mathematics or equivalent.

*3060 Elementary Statistical Analysis (3) Elementary probability distributions used in statistical analysis; normal and normal and their properties; sampling theory; confidence intervals and statistical tests of hypotheses; least squares and linear regression. Prereq: 3050 or consent of instructor.

3090 Polynomials and Rings (3) Elementary introduction to modern abstract algebra. Axiomatic approach is used to study divisibility and factorization in rings of integers and of polynomials with coefficients from various fields. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

*3100 Logic and Sets (3) Elements of mathematical logic; truth sets and open sentences; diagrams for truth sets; elementary algebra of sets with operations of union and intersection. Prereq: 1 yr of college mathematics. Primarily for students in the College of Education.

*3110 The Real Number System (3) Laws of arithmetic; rational and irrational numbers; fields. Prereq: 1 yr of college mathematics. Primarily for students in the College of Education.

3150 Introduction to Numerical Algorithms and Computing (3) (Same as Computer Science 3150.)

3155 Introduction to Numerical Algorithms (3) (Same as Computer Science 3150.)

3220 History of Mathematics (3) Survey of development of various branches of mathematics, from ancient to modern times. Prereq: Single Variable Calculus or Calculus or equivalent.

3310 Advanced Euclidean Geometry (3) Triangles and circles containing modern concepts. Prereq: 1 yr of college math.

3320 Non-Euclidean Geometry (3) Foundations of geometry. Elliptic and hyperbolic plane geometry. Prereq: 1 yr of college mathematics.

3330 Transformational Geometry (3) Fundamental transformations of plane and space, symmetries of a polygon; inversions. Prereq: 1 yr of college mathematics.

3510 Intermediate Analysis (3) Primarily for students in secondary mathematics education. Course covers elementary calculus from an advanced viewpoint with emphasis on proofs of basic theorems. Topics covered include limits of sequences and functions, continuous functions, derivatives, definite integral, and fundamental theorem of integral calculus. Prereq: Calculus of Algebraic Functions, Linear Algebra and Calculus or Single Variable Calculus.

3715 Discrete Structures (3) (Same as Computer Science 3715.)


3780-90 Introduction to Combinatorial Theory (3, 3) Introduction to arrangements and selection within discrete systems. Enumeration by recurrence relations and generating functions, graph theory, finite geometries and their applications. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

3810 How to Prove It (3) Course is designed to improve understanding of nature and methods of mathematical proof by means of practice and presentation. Emphasis on development of Variable content but will include certain standard topics such as elementary set theory, relations, functions, real numbers, and basic mathematical induction. Coreq: Multivariable Calculus and Matrix Algebra or Calculus.

4035-45 Introduction to Numerical Linear Algebra (3, 3) (Same as Computer Science 4035-45.)

4050 Matrix Algebra and Applications (3) Matrices, elementary operations, systems of linear equations, determinants, eigenvalues and eigenvectors. Prereq: Multivariable Calculus and Matrix Algebra or Calculus or consent of instructor.

4060-70 Matrix Algebra and Applications (3, 3) Eigenvalues and eigenvectors, singular values and singular vectors, unitary and similarity transformations, quadratic forms, vector and matrix norms, Jordan canonical form, and related topics. Prereq: Multivariable Calculus and Matrix Algebra or 4050.

4120 Linear Algebra (3) Abstract vector spaces, linear transformations, determinants, systems of linear equations and determinants, inner products, and diagonalization of symmetric matrices. Prereq: Multivariable Calculus and Matrix Algebra or Calculus.

4150-60 Abstract Algebra (3, 3) Equivalence relations and partitions, properties of integers, elementary theory of groups, polynomial rings, integral domains, division rings, unique factorization domains, fields. Must be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra or 4050.

4225-35 Introduction to Numerical Analysis (3, 3) Interpolation and approximation, numerical differentiation and integration, roots of equations, systems of linear and nonlinear equations. Prereq: Combinatorial Theory 3155. (Same as Computer Science 4225-35.)

4230 Intermediate Numerical Methods (3) Numerical methods in differential and algebraic equations, linear computations and other topics in scientific computing and applications to problems in application of computers. Must be taken in sequence. Prereq: 3150 or 3155.

4250 Elementary Complex Variables (3) Complex numbers. Cauchy-Riemann equations, elementary functions and Cauchy's integral formula, Taylor and Laurent series, residues and their applications. Prereq: Multivariable Calculus and Matrix Algebra or 4050, Calculus of Algebraic Functions and Matrix Algebra or 4050.

4450 Infinite Series and Functions of Several Variables (3) General theory, power series and Taylor's formula, uniform convergence. Partial differentiation and maxima and minima for functions of several variables. LaGrange multipliers. Prereq: Multivariable Calculus and Matrix Algebra.

4550 Partial Differential Equations (3) Fourier series; Fourier integrals; orthogonal functions; the vibrating string; solution by separation of variables, implicit function theory. Multiple integrals, infinite series, sequences and series of functions, uniform convergence. Taylor series. Should be taken in sequence. Prereq: Multivariable Calculus and Matrix Algebra.

4560 Calculus of Finite Differences (3) Theory of differences and functional equations, generating functions, interpolation, the vibrating string, solution by series, heat equations. Prereq: 3150 or 3155. (Same as Computer Science 4560.)


4630-70 Numerical Mathematics (3, 3, 3) Linear algebra and second-order differential equations. Power series solutions and Legendre polynomials. Regular singular points, Frobenius method, and Bessel equations. Systems of linear differential equations and the matrix exponential. 4620—Numerical methods for ordinary differential equations including the Runge-Kutta, Euler, and Taylor methods; A-stability, and two point boundary value problems. 4630—Special topics which may include existence and uniqueness, oscillation theory, Laplace transform, matrix stability, singular perturbations, and asymptotic solutions. Prereq: 4610: Multivariable Calculus and Matrix Algebra or 4560; 4620: 4600 or Multivariable Calculus and Matrix Algebra or 3150 or 3155; 4650: 4610 or consent of instructor.

4640 Calculus of Finite Differences (3) Real difference equations in several variables and their applications. Prereq: Multivariable Calculus and Matrix Algebra or Calculus.

4650-70-75 Introduction to Mathematical Statistics (3, 3, 3) Introduction to probability; discrete and continuous distributions; correlation, regression, and statistical independence; foundations of sampling theory; significance tests.
4710 Vector Analysis (3) Fundamental operations, basis vectors, dot and cross products, dimensions, vector differentiation, curl of vector fields, line and surface integrals, divergence theorem of Gauss, and Stokes's theorem. Prereq: Multivariable Calculus and Matrix Algebra.

4750-50-70 Introductory Probability Theory (3, 3, 3) 4750—Elementary combinatorial analysis, probabilities in discrete sample spaces, conditional probability and stochastic independence, binomial, Poisson, hypergeometric and normal distributions. 4760—Expectation, conditional expectation, and the characteristic function of random variables, infinite sequences of random variables, the weak and strong laws of large numbers, and the central limit theorem. 4770—Markov chains: limiting probabilities; steady-state and stationary distributions; Stochastic processes: Poisson, birth and death processes; Kolmogorov equations. Prereq: Multivariable Calculus and Matrix Algebra.

4810 Elementary Number Theory (3) Divisibility; congruences; theorems of Fermat and Wilson, primitive roots; indices; quadratic reciprocity. Prereq: Multivariable Calculus and Matrix Algebra or consent of instructor.

4900 Readings in Mathematics (1-3) Open to superior students with permission of department head. In conjunction with faculty guidance. May be repeated. Maximum 9 hrs.

4990 Studies in Mathematics (1-4) Credit determined at registration. May be repeated. Must be taken in conjunction with Recommendation of Mathematics Department faculty member and consent of department.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities or/and is present on campus before degree is completed. May not be used toward degree requirements. May be repeated. S/NC only.

5011 Elementary Functions from an Advanced Standpoint for Teachers (3-4) The order and completeness axioms of the real numbers; limits of sequences, derivatives of functions; definitions and derivatives of the exponential, logarithmic and trigonometric functions; infinite series; convergence; Taylor's and MacLaurin's series; applications to construction of logarithmic and trigonometric tables. Prereq: Intermediate Analysis or 3110 or consent of instructor.

5012 Differential Geometry for Teachers (3-4) Advanced techniques applied to graphing functions. Curves, surfaces, parametrizations, singular points, tangent lines and tangent planes, osculating planes, are length of curves in the plane and curves on a surface, curvatures, torsion, Frenet formulas. Prereq: 3511, or 1 yr of calculus, or consent of instructor.

5013 Geometry for Teachers (3-4) Primarily for high school teachers of geometry. Historical and modern presentations of topics encountered in a high school geometry class: axioms, theorems and proofs, metric, models, betweenness, congruence of segments and triangles; parallel postulates; similarity; area; ruler and compass constructions; Klein's Erlangen Program. Prereq: Consent of instructor.

5014 Analysis for Teachers (3-4) A study of functions of several variables, vectors, limits and continuity, partial derivatives, directional derivatives and gradient, implicit function theorem, maxima and minima, transformations. Prereq: Intermediate Analysis or consent of instructor.

5015 Probability and Statistical Inference for Teachers (3-4) Probability distributions including the binomial, hypergeometric, Poisson; moment generating functions; expectation of continuous random variables; moment generating functions of the uniform and normal distributions; Sampling including the Chi-square, F, and t distributions; interval estimation of means and variances; simple hypothesis testing. Prereq: 1 yr of calculus and 3050 or consent of instructor.

5050-50-70 Mathematical Logic (3, 3, 3) Truth functions; the syntax and semantics of some propositional theory; Gentzen's sequence-calculus and systems of natural deduction; algebraic logic; the syntax and semantics of first order theories; elementary model and recursion theory; consistency, completeness, decidability.

5110-20-30 Theory of Functions of a Complex Variable (3, 3, 3) Complex numbers; infinite series; analytic functions; conformal mappings; analytic continuation; special functions; Riemann surfaces. Prereq: 4510-20 for 5110; 4530 for 5120. Must be taken in sequence.

5150 Foundations of Analysis (3) Development of the real number system from Peano axioms. Prereq: 4510-20.

5160 Foundations of Analysis (3) Propositional functions and classes; Boolean algebra, Cardinal and ordinal arithmetic. Prereq: 4510-20.


5210-20-30 Theory of Functions of a Real Variable (3, 3, 3) Sets and real valued functions in Euclidean spaces; abstraction of these concepts, Lebesgue measure and integration; abstract measure and integration, Classical function spaces, such as Lp spaces. Generalized Fourier series theory. Special topics. Prereq: 4510-20-30. Must be taken in sequence.


5310-20-30 Introduction to Higher Geometry (3, 3, 3) Projective spaces and coordinates; transformations; conics and quadrics. Elliptic and hyperbolic geometry from the viewpoint of projective geometry. Prereq: 4150-60. Must be taken in sequence.

5340-50-60 The Numerical Treatment of Algebraic and Transcendental Equations (3, 3, 3) The mathematical principles underlying such methods as those of Gauss, Newton, Bernoulli, Graefe, and others for obtaining numerical solutions; theorems of Budan and Fourier, Sturm, Runge and Hurwitz, and others for localizing roots.


5450-60-70 Introduction to Partial Differential Equations (3, 3, 3) Linear second-order differential equations in two variables; properties of elliptic, hyperbolic and parabolic equations, separation of variables, and Fourier series, nonhomogeneous problems, problems in higher dimensions, multiple Fourier series, Fourier and Laplace transforms. Prereq: 4510-20-30 and 4610 or consent of instructor.

5455 Finite Difference Methods for Partial Differential Equations (3) Finite difference techniques for the solution of parabolic, elliptic, and hyperbolic equations. Computer implementation, stability, consistency and convergence; nonlinear problems; curved boundaries; solution of linear systems. Prereq: 3150 or 3156 and 4550. (Same as Computer Science 5465.)

5463 Mathematical Aspects of the Finite Element Method (3) A survey of the Ritz-Galerkin methods for the solution of ordinary and partial differential equations. Local bases, approximation theory, rates of convergence, eigenvalue and initial value problems; singularities, hybrid elements. Prereq: 3150 or 3156 and 4550. (Same as Computer Science 5465.)

5480-90 Mathematical Programming (3, 3) Optimization of functions of several variables subject to constraints. Prereq: 3150, 4610 and 4550.

5510-20-30 Introduction to Higher Algebra (3, 3, 3) Survey of algebraic systems: groups, rings, integral domains, fields. Must be taken in sequence.

5540 Galois Theory (3) Fields and their extensions, separable and normal extensions, algebraic closure, groups of automorphisms, fundamental theorem of Galois theory, applications of equations, by radicals. Prereq or coreq: 5520.

5560-79-80 Theory of Matrices in Numerical Analysis (3, 3, 3) Fundamental matrix identities and inequalities: Factorization theorems, generalized reciprocals. Hadamard inequalities, Lanczos reductions. 5570—Vector and matrix norms, convergence, domains of inclusion and exclusion of roots of matrices; the field of values; minimax and maximin theorems for Hermitian matrices; Kantorovic inequalities. 5580—Computational methods for inverting matrices, direct and by successive approximation; methods of reduction to normal form; successive approximations to the roots of matrices; measures of error. Prereq: Consent of instructor.


5610-20-30 Mathematical Methods in Physics (3, 3) (Same as Physics 5610-20-30.)

5640 Numerical Methods in Physics (3) (Same as Physics 5540.)

5655-65-75 Numerical Mathematics (3, 3, 3) The numerical solution of large systems of linear algebraic equations, systems of nonlinear equations and the algebraic eigenvalue-
eigenvector problem. Prereq: 4235 or 4236.

5710-20-30 Tensor Analysis (3, 3, 3) The absolute differential calculus in three-dimensional Euclidean space; differential geometry of curves and surfaces; applications to physics; extending to n-dimensional space. Prerequisite: 129 in mathematics or physics. Must be taken in sequence.

5750-60-70 Advanced Mathematical Statistics (3, 3, 3) Distribution functions and mathematical expectation; sampling theory, regression; tests of general theory of statistical inference, topics from sequential analysis. Prereq: 4510-20-30. Must be taken in sequence.

5810-20-30 Number Theory (3, 3, 3) Arithmetic functions, distribution of primes, Diophantine equations, approximation theory, Shubirelin density and Mann's theorem, quadratic forms, Dirichlet's theorem, prime number theorem. Prereq or coreq: 5510 for 5810; 5520 for 5820.

5910-20-30 Modern Topology (3, 3, 3) Topological spaces; matrization, homomorphism invariants of point sets; structure of Peano continua. Mapping; homotopy. Introduction to combinatorial topology.

5990 Graduation Reading in Mathematics (1-3) Open to graduating students with permission of the department head. Independent study with faculty guidance. May be repeated. Maximum 9 hrs.

5991 Seminar Analysis (1-3)
5992 Seminar Topology (1-3)
5993 Seminar Algebra (1-3)
5994 Seminar Foundations (1-3)
5995 Seminar Applied Mathematics (1-3)

6000 Doctoral Research and Dissertation

6210-20-30 Linear Analysis (3, 3, 3) Algebraic and topological properties of linear spaces, emphasis on normed spaces; linear functionals and dual spaces; linear transformations; special topics (spectral theory, ergodic theory, semigroups of transformations); applications to problems in analysis. Prereq: 4160 and 5210-20-30. Must be taken in sequence.


6510-20-30 Modern Algebra (3, 3, 3) Intensive study of some major branch of algebraic theory. Subject matter may vary according to interests and preparation of students. Prereq: 5510-20-30.

6540-60-80 Theory of Semigroups (3, 3, 3) Congruences and homomorphisms; ideal theory; representations, decompositions, and extensions; free, regular, inverse, simple, and completely simple semigroups. Prereq: 5520.

6570 Theory of Groups (3) Structure of groups, free groups, nilpotence and solvability, extensions and products, permutation groups, abelian groups. Prereq: 5520.

6610-20-30 Advanced Ordinary Differential Equations (3, 3, 3) Theory of ordinary differential equations from an advanced viewpoint. Topics from the current literature. Subject matter varies according to interests and preparation of students. Prereq or coreq: Intro-duction to Differential Equations or 5110-20-30 or 5210-20-30 or consent of instructor.


6810-20-30 Topological Algebra (3, 3, 3) Topology chosen from topological semigroups, topological groups, Lie groups; transformation groups; topological lattices; relations in topological spaces; topological rings, fields, algebras. Prereq or coreq: 5110-20-30.

6910-20-30 Modern Topology (3, 3, 3) This course provides technical background to read and contribute to current literature in topology. Topics vary from year to year.

6940-60-80 Introduction to Algebraic Topology (3, 3, 3) Introduction to homology, cohomology, and homotopy theories. Typical topics discussed will be homology and cohomology groups, the Eilenberg-Steenrod axioms, cup and cap products, duality theorems, homotopy equivalence, higher homotopy groups, fiber spaces, spectral sequences. Prereq: 4160 and 5920.

6991 Seminar Analysis (1-3)
6992 Seminar Topology (1-3)
6993 Seminar Algebra (1-3)
6994 Seminar Foundations (1-3)
6995 Seminar Applied Mathematics (1-3)

Registration for seminars may be repeated with consent of department.

Microbiology

MAJOR

DEGREES

Microbiology

M.S., Ph.D.

Professors:

A. Brown (Head), Ph.D. Chicago; R. W. Beck, Ph.D. Wisconsin; J. O. Mundt, Ph.D. Michigan State; J. M. Woodward, Ph.D. Kansas; C. J. Wust, Ph.D. Indiana.

Associate Professors:

J. M. Becker, Ph.D. Cincinnati; T. C. Montie, Ph.D. Maryland; W. S. Riggsby, Ph.D. Yale; B. T. Rouse, Ph.D. Guelph (Canada).

Assistant Professors:

D. A. Barnis, Ph.D. Cornell; D. A. Brian, Ph.D., D.V.M. Michigan State; R. V. Miller, Ph.D. Illinois; G. S. Sayler, Ph.D. Idaho.

Lecturers:


Students planning to major in Microbiology are expected to present, as undergraduate prerequisites, a minimum of one year of biology, one year of mathematics including calculus, two years of chemistry and one year of physics.

The student's dissertation committee determines whether a foreign language is required for the Doctorate degree.

3810 Food Bacteriology (4) Methods for examination, cultivation and identification of bacteria associated with food fermentation and food spoilage. Prereq: General Microbiology and Elements of Organic Chemistry or Chemistry 3211.

3820 Yeast and Molds (4) Morphology, taxonomy, and physiology of yeasts, actinomycetes, and fungi of industrial importance. Prereq: General Microbiology and Elements of Organic Chemistry or Chemistry 3211 or consent of instructor.

4110 Physiology of Bacteria (2) Modern concepts of bacterial physiology and metabolism including cell structure and function. Prereq: Introduction to Microbiology I: Physiology, Genetics and Ecology and 12 hrs of organic chemistry.

4119 Bacterial Physiology Laboratory (2) Prereq: Introduction to Microbiology Laboratory I: Coreq: 4110.

4130 Taxonomy of Bacteria (3) Bacterial classification. Prereq: Introduction to Microbiology I: Physiology, Genetics, and Ecology and laboratory.

4140 Molecular Genetics of Prokaryotes (2) Transmission and expression of genetic information at the molecular level. Emphasis on bacterial and viral systems, but unique features of eukaryotic genetic systems. Prereq: Introduction to Microbiology I: Physiology, Genetics and Ecology; 1 yr of Organic Chemistry; General Ecology or consent of instructor.

4150 Microbial Ecology (3) Application of ecological principles to the study of microbial communities. Emphasis on the functional role of microorganisms in natural environments. Prereq: Introduction to Microbiology I: Physiology, Genetics, and Ecology; 1 yr of Organic Chemistry; General Ecology or consent of instructor.

4270 Advanced Immunology (2) Chemistry of antigens and antibodies, theories of antibody formation, cell cooperation in immune mechanisms, transplantation, abnormalities of the immune system, and autoimmune diseases. Prereq: Introduction to Microbiology II: Immunology or consent of instructor. (Same as Zoology 4270.)

4279 Advanced Immunology Laboratory (3) Laboratory exercises designed to accompany 4270. Prereq or coreq: 4270.

4320 Pathogenic Bacteriology (2) Disease producing microorganisms including bacteria, rickettsias, and viruses. Prereq: Introduction to Microbiology II: Pathogenic Microbiology.

4329 Pathogenic Bacteriology Laboratory (2) Techniques for isolation, cultivation, and identification of pathogenic bacteria. Prereq: Introduction to Microbiology Laboratory II: Coreq: 4320.

4330 Medical Mycology (2) Disease-causing fungi; cytology; physiology, pathogenesis and immunity; emphasis on methodology of isolation and identification. Prereq: Introduction to Microbiology III: Pathogenic Microbiology and 3920.

4339 Medical Mycology Laboratory (2) Prereq: Introduction to Microbiology Laboratory I: Coreq: 4330.

4420 Molecular Virology (2) Molecular aspects of the replication, assembly and expression of viruses; with emphasis on bacteriophage. Prereq: Introduction to Microbiology I: Physiology, Genetics, and Ecology.

4430 Medical Virology (3) General Virology with emphasis on medical aspects. Prereq: Introduction to Microbiology III: Pathogenic Microbiology.

4439 Medical Virology Laboratory (2) Laboratory procedures for isolation, handling and culturing of animal viruses. Prereq: Introduction to Microbiology Laboratory III: Coreq: 4430.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such
5450 Seminar in Filmamentous Fungi (1) Readings and discussions based on the current literature. May be repeated. S/NC only.

5510-20-30 Research Problems (3, 3, 3)

5720 Microbiological Physiology (3) Lectures and seminars dealing with current advances in microbiology including growth and cell structure. Prereq: 4111; Biochemistry 4110-20.

5730 Pathogenesis of Infectious Disease (3) Host response to infection. Derangement of homeostasis produced by microbial invasion, toxins, endotoxins and other factors related to virulence. Alteration of genetic and hormonal control resulting from progressive infection. Prereq: 3071.

5750 The Oncogenic Viruses (3) Lectures and special laboratory exercises dealing with known tumor-inducing viruses. Prereq: 4521 or consent of instructor. 2 hrs and 1 lab.

5760 The Bacterial Viruses (3) Lectures and discussions dealing with bacterial viruses with emphasis on the biological and chemical consequences of bacteriophage infection. Text will be supplemented by readings from the literature. Prereq: 4521; Biochemistry 4110-20.

5819 Molecular Genetics Laboratory (3) Principles and methods of research in molecular genetics. Fundamental genetic concepts (mutation, complementation, recombination) at the molecular level. Emphasis on studies of the lac operon of Escherichia coli. Prereq: 4811 and Biochemistry 4110-20 or consent of instructor.

5820 Microbiology of Foods (3) Lectures and seminars dealing with current advances and selected topics in food microbiology with emphasis on analytical methods, safety and preservation. Prereq: 3810; Biochemistry 4110-20. Recommended: Food Technology 4920.

5829 Experimental Microbial Ecology (3) Survey of techniques for the assessment of microbial forms, functions, activities, and interactions in a variety of habitats. Prereq: 3009; Coreq: 4950 or consent of instructor. 1 hr and 2 labs.

5830 Seminar in Microbial Pathogenesis (1) Readings and discussions based on the current literature. May be repeated. S/NC only.

5832 Seminar in History of Microbiology (1) Students concerned with microbiologists and their achievements from Pasteur to the present. S/NC only.

5910-20-30 General Seminar (1, 1, 1) Reviews of current literature. May be repeated with consent of department. S/NC only.

5940 Seminar in Microbial Genetics (1) Readings and discussions of current literature. May be repeated with consent of department. S/NC only.

5970 Seminar in Virology (1) Readings and discussions of current literature. May be repeated with consent of department. S/NC only.

6000 Doctoral Research and Dissertation

6140 Concepts of Immunity (3) Discussions, readings, and laboratory in the most recent advances of resistance to infectious disease. 3-3 hr labs.

6720 Advanced Topics in Microbial Physiology (3) Prereq: 5630 or 5720. May be repeated with consent of department.

6730 Advanced Topics in Microbial Pathogenesis (3) Prereq: 5730. May be repeated with consent of department.

6740 Advanced Topics in Virology (3) Prereq: 4521. May be repeated with consent of department.

6760 Advanced Topics in Microbial Genetics (3) Prereq: 5940. May be repeated with consent of department.

6810-20-30 Problem Seminar (1, 1, 1) Research problems and methods, critical analysis of experimental data and validity of conclusions. May be repeated with consent of department. S/NC only.

THE MASTER OF MUSIC PROGRAM

Voice: 45 hours distributed as follows:
(a) 12 hours in applied music, (b) 9 hours in music history/literature or music theory, (c) 6 hours in vocal pedagogy, and (d) 3 hours in recital or lecture-recital, (e) 3 hours in ensemble, and (f) 12 hours in elective (excluding applied music and ensemble).

Piano: 45 hours distributed as follows:
(a) 12 hours in applied music, (b) 9 hours in piano literature and/or pedagogy, (c) 3 hours in music research, (d) 6 hours in music theory, (e) 3 hours in ensemble or accompanying, (f) 6 hours in music history/literature, (g) 3 hours in recital, and (h) 3 hours in music electives.

Organ: 45 hours distributed as follows:
(a) 12 hours in applied music, (b) 6 hours in organ literature and/or pedagogy, (c) 3 hours in music research, (d) 9 hours in music theory, (e) 3 hours in ensemble or accompanying, (f) 6 hours in music history/literature, and (g) 3 hours in recital.

Music

MAJOR

DEGREES

Music

M.A., M.M.

Professors:

Associate Professors:

Assist Professors:

The Department of Music offers the degrees of Master of Music with concentrations in performance, composition, theory, choral conducting. Suzuki string tech-
hours in music theory, (d) 6 hours in music history/literature, (e) 9 hours in thesis, and (f) 3 hours in electives.

**Music Theory:** 45 hours distributed as follows: (a) 18 hours in music theory, (b) 3 hours in musical performance, (c) 6 hours in music history/literature, (d) 9 hours in thesis, and (e) 9 hours in electives.

**Choral Conducting:** 45 hours distributed as follows: (a) 6 hours in conducting, (b) 6 hours in choral literature/techniques, (c) 3 hours in music research, (d) 9 hours in theory, (e) 6 hours in ensemble, (f) 3 hours in church, (g) 6 hours in chamber music, and (h) 12 hours in electives.

**Suzuki String Techniques:** 45 hours distributed as follows: (a) 21 hours in applied music, (b) 6 hours in Suzuki literature/techniques, (c) 3 hours in music research, (d) 3 hours in music theory, (e) 3 hours in recital, (f) 6 hours in ensemble, and (g) 12 hours in electives.

**Musicology:** 45 hours distributed as follows: (a) 21 hours in music history/literature, (b) 3 hours in music research, (c) 6 hours in theory, (d) 9 hours in thesis, and (e) 6 hours in electives.

A reading knowledge of French or German must be demonstrated by candidates for the Master of Arts degree.

Specific course requirements will be prescribed by the department for all degree programs and elective courses must have the approval of the student's advisor.

**3041 Keyboard Harmony (3) Melody harmonization, figured bass realization, and improvisation. Prereq: Harmony I, sight singing and ear training, and keyboard proficiency at the 2000 level.**

**3051 Organ Improvisation (3) Prereq: organ proficiency at the 2000 level.**

**3114-24 Choral Arranging (3, 3) Analysis of scores and writing of arrangements for choirs. 3114—male and female chorus; 3124—mixed chorus. Prereq: Instrumentation or consent of instructor.**

**3122 Orchestration (3) Advanced techniques in instrumental writing with emphasis on scoring for the concert orchestra. Prereq: Choral conducting or consent of instructor.**

**3230 The Symphony (3) Survey of symphonic literature from predecessors of classical symphony to present.**

**3240 The Concerto (3) Survey of symphonic literature from predecessors of classical symphony to present.**

**3260 Chamber Music (3) Survey of chamber music from 1700 to present.**

**3271-81 History of Opera (3, 3) Dramatic, vocal and orchestral elements in opera of Italian, French, and German schools. 3271—1600-1800; 3281—1800 to present.**

**3340 Oratorio (3) Choral works other than those appropriate for use in church.**

**4001 Organ Design (3) Historical, tonal and mechanical principles of organ design.**

**4041 Styles in Opera Acting (3) Study and practice of styles in opera acting based on historical and national characteristics. Prereq: Fundamentals of Opera Acting or consent of instructor.**

**4045 Projects in Opera Theatre (1-3) May be repeated. Prereq: Consent of instructor.**

**4050 Advanced Instrumental Conducting (3) Development of knowledge and skills in instrumental conducting; study of various periods and composers and relationship of different styles to the conductor's art; musical analysis and practice in conducting. Prereq: Instrumental Conducting or equivalent.**

**4060 Advanced Choral Conducting (3) Development of knowledge and skills in choral conducting; study of various periods and composers and relationship of different styles to the conductor's art; musical analysis and practice in conducting. Prereq: Choral Conducting or equivalent.**

**4111-21-31-41 Analysis of Music Literature (3, 3, 3) Detailed examination of musical compositions by historical period with emphasis on harmony, form and structure. Traditional and contemporary analytical techniques, 411I—1600-1750, 4121—1750-1825, 4131—1825-1890, 4141—1890 to present. Prereq: Analysis II.**

**4112 Twentieth-century Compositional Techniques (3) Styles and compositional devices from Debussy to present. Analysis of scores; idiomatic writing. Prereq: Harmony II or equivalent.**

**4113 Pedagogy of Music Theory (3) Techniques, methods and materials involved in college-level theory programs. Prereq: Consent of instructor.**

**4114 Stage Band Arranging (3) Study of scoring and arranging for the stage band. Prereq: Instrumentation and consent of instructor.**

**4115 Variation (3) Study and application of variation procedures. Prereq: Analysis II or equivalent.**

**4116 Set Structure in Musical Composition (3) Theory of sets and its application to analysis of music. Prereq: Consent of instructor.**

**4124 Band Arranging (3) Study and application of techniques employed in scoring for the marching and concert bands. Prereq: Instrumentation or equivalent.**

**4124 Band Transcription (3) Technique and application of transcription keyboard and orchestra music for concert band; editing and rescoring. Prereq: Instrumentation or equivalent.**

**4210 Music in the Romantic Period (3) Survey of music from Beethoven through post-Romantic instrumental and vocal styles.**

**4230 Contemporary Music: 1945 to Present (3) Survey of music and avant-garde music in Europe and America since World War II.**

**4241 American Music (3) American music from colonial times to present. Emphasis on twentieth century. Includes both folk and cultivated traditions.**

**4260 Introduction to Ethnomusicology (3) Basic attitudes and techniques of ethnomusicology. Survey of music cultures of the Pacific, Near East, Asia and Africa.**

**4280 The Mass to 1600 (3) Brief consideration of development and development of liturgy of the Mass. Early polyphonic settings of portions of the Mass through thirteenth century. Earliest settings of the Ordinary, Development of settings of the Ordinary from late Middle Ages through Renaissance. Special consideration of settings of the Requiem.**

**4290 Gregorian Chant (3) Chants of Latin rite. Masses and Offertories are used as functional music counterparts as well as style interpretations and historical performances.**

**4310 History of Art Song (3) Survey of music from fourteenth century to present.**

**4315 Wind Chamber Music (3) Study of wind chamber music from eighteenth through twentieth century. Emphasis placed on style interpretation, rehearsal techniques, programming and musical significance, both historical and theoretical.**

**4340-50 Works of Bach (3, 3) Detailed examination of sonatas, chamber, keyboard, and orchestral works: cantatas, motets, passions and oratorios. 4340—Instrumental works; 4350—vocal works.**

**5000 Thesis**

**5001 Choral Conducting Document (3) Analytical—critical, historical—technical essay on choral music.**

**5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.**

**5010 Organ Literature Seminar (3) Topics vary. Prereq: Organ Literature.**

**5012-22-32 Pedagogy of Voice (2, 2, 2) 5012—Survey of voice production processes in singing including: voice classification, quality, diction, registration, breath support, and coordination. 5022—Examination of teaching materials, preparation of programs for various vocal categories and levels of study. Observation of studio teachings. 5030—Analysis of the vocal problems of a selected group of students. Supervised teaching. Prereq: Principles of vocal pedagogy or consent of instructor.**

**5020 Piano Literature Seminar (3) Topics vary. Prereq: Advanced Piano Literature.**

**5025* Choral Literature Seminar (3) Topics vary.**

**5040 Vocal Literature Seminar (3) Topics vary.**

**5050 Graduate Recital (3)**

**5051 Opera Performance (3)**

**5052 Vocal Chamber Music Performance (3)**

**5053 Choral Conducting Performance (3)**

**5054 Lecture-Recital (3)**

**5060 Seminar in Choral Performance (3) The study of rehearsal and performance problems and techniques as allied to score reading and preparation. Particular attention will be afforded to individual problems. Prereq: 4060 or equivalent.**

**5070 Opera Production (1-3) Prereq: Consent of instructor.**

**5090 Special Topics in Performance (1-3) Prereq: Consent of department head.**

**5100 Independent Study in Music Theory (1-3) Prereq: Consent of department head.**

**5111 Advanced Harmony (3) An analytic survey of harmonic trends in compositions from 1700 to present. Exercises employing and illustrating these techniques. Prereq: Consent of instructor.**

**5112 Proseminar in Music Theory (1) Discussion, analysis, research, writing in theoretical topics. Prereq: Consent of Instructor.**

**5114 History of Music Theory (3) A survey of the work and contributions of theorists from ancient Greece to present. Emphasis on 1600 to present. Prereq: Consent of Instructor.**
5115 Theory of Computers and Music Research (3) Theory of computer applications in music, emphasizing techniques of analysis and indexing. Prereq: Consent of instructor.

5116 Musical Styles (3) The elements of design and their role in the definition of musical styles. Exercises in aural and visual identification. Prereq: Consent of instructor.


5121 Analytical Techniques (3) A survey of analytical techniques with emphasis on contemporary approaches. Tonal and neotonal music. Prereq: Consent of instructor.

5125 Practicum in Computers and Music Research (3) Programming languages, design, and implementation of projects in musical analysis, composition and indexing. Prereq: 5115 or consent of instructor.

5150 Seminar in Music Theory (3) Topics vary. Prereq: Consent of Instructor.

5200 Independent Study in Music History and Literature (1-3) Prereq: Consent of department head.

5210 Introduction to Music Research (3)

5220 Proseminar (3) Research techniques in music emphasizing bibliography, writing of research papers and presentation of oral reports. Prereq: Consent of instructor.

5270 Seminar in Musicology (3) Topics vary. Prereq: Consent of Instructor.

5315 Band Literature (3) A study of band literature and the origins of the band emphasizing its important, expanded cultivation during the past century in the United States and Europe.

5350 Music in the Middle Ages (3) Emphasis on early Christian chant, medieval secular song, early theory, and the development of polyphony and musical notation.

5352 Music in the Renaissance (3) Survey of music from 1400 to 1600. Mass, motet, chanson, madrigal, and other vocal and instrumental forms and genre.

5353 Music in the Baroque Period (3) Music from 1600 to 1750; rise of opera and oratorio, church and secular cantata, instrumental forms, performance practice.

5355 Music in the Classic Period (3) Pre-classical music (Rococo) and music of Haydn, Mozart and early Beethoven. Includes background of other cultural and artistic activities.

5400 Musical Aesthetics (3) An examination of the nature of music and the musical experience, sense perception and the emotions, values in music, and the role of the artist in society. The aesthetic viewpoint of individuals and historical eras will be explored through selected writings.

*5500 Flute (1-4)
*5505 Oboe (1-4)
*5510 Bassoon (1-4)
*5515 Clarinet (1-4)
*5520 Saxophone (1-4)
*5525 Horn (1-4)
*5530 Trumpet (1-4)
*5535 Trombone (1-4)
*5540 Baritone (1-4)
*5545 Tuba (1-4)
*5550 Percussion (1-4)

*5560 Violin (1-4)
*5565 Viola (1-4)
*5570 Cello (1-4)
*5575 String Bass (1-4)
*5580 Piano (1-4)
*5585 Harpsichord (1-4)
*5590 Organ (1-4)
*5595 Guitar (1-4)

5597 Composition with Electronic Media (1-3) May be repeated. Maximum 9 hrs. Prereq: 3199 and consent of instructor.

5600 Small Ensemble (1)

*5602 Brass Choir (1)

*5604 Jazz Ensemble (1)

*5606 Trombone Choir (1)

*5607 Tuba Ensemble (1)

*5610 Percussion Ensemble (1)

*5612 Baroque Ensemble (1)

*5620 UT Singers (1)

*5630 Chamber Singers (1)

*5632 Collegium (1)

*5634 Saxophone Choir (1)

*5640 Opera Theatre (1)

*5642 Opera Workshop (1)

*5650 Concert Band (1)

*5652 Campus Band (1)

*5654 Varsity Band (1)

*5656 Laboratory Band (1)

*5657 Marching Band (1)

*5670 Symphony Orchestra (1)

*5680 Concert Choir (1)

*5682 University Chorus (1)

*5694 Campus Chorus (1)

*5686 Men's Glee Club (1)

*5687 Women's Chorale (1)

*5699 Accompanying (1)

* May be repeated.
** May be repeated. Maximum 6 hrs.

Philosophy

MAJOR

DEGREES

Philosophy

M.A., Ph.D.

Professors:

J. W. Davis (Head), Ph.D. Emory;
R. B. Edwards, Ph.D. Emory; R. D. Herrmann,
Ph.D. Mainz (Germany); M. H. Moore (Emeritus),
Ph.D. Chicago; D. Van de Vate, Jr., Ph.D. Yale.

Associate Professors:

R. E. Aquila, Ph.D. Northwestern; L. B. Cabik,
Ph.D. Nebraska; G. C. Graber, Ph.D. Michigan.

Assistant Professors:

J. O. Bennett, Ph.D. Tulane; G. G. Brankort,
Ph.D. Michigan; S. H. Cofer, Ph.D. Northwestern;
K. A. Emmett, Ph.D. Ohio State;
H. P. Hamlin, Ph.D. Georgia; R. Jones, Ph.D.
Chicago; B. C. Latta, Ph.D. Yale; S. Reaven,
Ph.D. California (Berkeley).

THE MASTER'S PROGRAM

See general requirements on page 19. Courses below 4000 may not be taken for graduate credit by philosophy majors except with special permission.

THE DOCTORAL PROGRAM

Specific requirements for doctoral students in Philosophy include a minimum of three academic years of graduate study involving at least 72 quarter hours credit in course work (normally 24 quarter courses or their equivalent, exclusive of credit for the thesis and dissertation) of which not less than 45 shall be in courses numbered over 5000, and of which at least 9 shall be in a subject other than philosophy. The specific number and distribution of courses will be determined by the student's faculty committee.

Two foreign languages, normally French and German, are required. As an alternative to the two-language requirement, candidates for the Ph.D. may elect to demonstrate a substantially more advanced proficiency in reading knowledge of one language. Requirements for this option may be obtained in the department office.

Registration in any course in the 5000 or 6000 series (except 5050 and 5910-20-30) may be repeated for credit with the consent of the department.

That is courses having the same number, but with different subject matter, may be taken with each separate subject description.

MEDICAL ETHICS

The department has an M.A. and Ph.D. program of graduate study with a concentration in medical ethics. Details concerning the program can be obtained from the department.

RELIGIOUS STUDIES

The department has an M.A. program of graduate study with a concentration in philosophy of religion and other religious studies. Details concerning the program can be obtained either from the Departments of Philosophy or Religious Studies.

3111 Ancient Western Philosophy

3121 Medieval Philosophy

3131 Seventeenth- and Eighteenth-century Philosophy

3141 Nineteenth- and Early Twentieth-century Philosophy

3151 Contemporary Philosophy (4)

3270 Russian Philosophical and Theological Thought (4) (Same as Religious Studies 3270.)

3311-12 American Philosophy (4, 4) 3311—Colonial to late nineteenth century. 3312—Late nineteenth century to present.

3315 American Ideals (4) Ideological variants in the American scene.

3320 Philosophy of Law (4) Nature, sources, function of law.

3330 Philosophy of History (4) Speculative and critical aspects of the philosophy of history.
3410 Philosophical Ideas in Literature (4) Philosophic assumptions and implications in major literary works.
3420 Philosophy of Literature (4) Study of the nature of faulty and epistemic principles of literary arts.
3430 Concepts of Woman (4) Examination of some of the theoretical foundations of feminism and antifeminism.
3440 Social Ethics (4) Ethical theory as related to politics, economics, law, religion and the family.
3510 Existentialism (4)
3550 Marxism as Philosophy (4)
3650 Philosophy and Religion in India (4) (Same as Religious Studies 3650.)
3660 Buddhist Philosophy and Religion (4) (Same as Religious Studies 3660.)
3690 Philosophy of Religion (4) Analysis of basic issues of religion. (Same as Religious Studies 3690.)
3720 Science, Technology, and the Modern World: A Philosophical Approach (4)
3740-50 Conceptual History of Science (4, 4) 3740-The Scientific Revolution: Historical evolution of thought in astronomy, mechanics and philosophy of nature up to Newton, 3750-The Development and Decline of Newtonian Science: historical evolution of thought on the nature of matter and light, and on that of life. Prereq: 8 hrs of physical science or consent of instructor.
3770 Introduction to Philosophy of Science (4) Standard topics in philosophy of science; scientific method, nature of laws and theories, problems of induction, explanation, measurement. No background in logic presupposed.
3810 Introductory Symbolic Logic (4) Techniques for formal analysis of deductive reasoning (propositional logic and quantification theory).
3910 Contemporary Aesthetics (4) Philosophical discussion of contemporary art.
4000 Special Topics (4) A student-initiated course to be offered at the convenience of the department. Subject matter to be determined by mutual consent of students and instructor with approval of department. Prerequisites to be determined by department.
4111-21 Modern Religious Philosophies (4, 4) (Same as Religious Studies 4111-21.)
4310 Intermediate Ethics (4) Topics in metaethics or ethics. Prereq: Elementary Ethics.
4370-71 Theoretical Issues in Medical Ethics (4, 4) Prereq: for 4370: Elementary Ethics or Religious and Philosophical Issues of Medical Ethics or consent of instructor. Prereq for 4371: 4370 or consent of instructor. (Same as Religious Studies 4370-71.)
4410 Plato (4) Prereq: 8 hrs of philosophy or consent of instructor.
4420 Aristotle (4) Prereq: 8 hrs of philosophy or consent of instructor.
4450 Continental Rationalism (4) Prereq: 8 hrs of philosophy or consent of instructor.
4460 British Empiricism (4) Prereq: 8 hrs of philosophy or consent of instructor.
4470 Kant (4) Prereq: 8 hrs of philosophy or consent of instructor.
4480 Advanced Topics in Existentialism and Phenomenology (4) Prereq: 8 hrs of philosophy or consent of instructor.
4490 Process Philosophy (4) Prereq: 8 hrs of philosophy or consent of instructor.
4511 Advanced Topics in Logic (4) Prereq: Consent of instructor. May be repeated.
4610 Philosophical Analysis (4) Prereq: 8 hrs of philosophy or consent of instructor.
4620 Philosophy of Mind (4) Problems of mind and body in relation to consciousness and personal identity. Prereq: 8 hours of philosophy or consent of instructor.
4630 Philosophy of Language (4) Prereq: 8 hrs of philosophy or consent of instructor.
4710 Philosophy of Natural Science (4) Consideration of standard topics pertinent to natural science including reduction of theories and teleological explanation. Familiarity with symbolic logic is recommended. Prereq: 3770 or 2 yrs of natural science.
4720 Philosophy of Social Science (4) Examination of methods of inquiry and modes of explanation in social sciences. Prereq: 3770 or 2 yrs of social science.
4810 Metaphysics (4) Prereq: 8 hrs of philosophy or consent of instructor.
5000 Thesis
5050 Symbolic Logic (4)
5089 Philosophy of Logic (4) Nature of logic; epistemological, metaphysical and axiological assumptions and implications in various theories of logic. Prereq: 4510 or its equivalent.
5110-20-30-40-50-60 Studies in the History of European Philosophy (4, 4, 4, 4) Intensive critical work on a major philosopher or a school. 5110—Greek; 5120—Hellenistic or Medieval; 5130—Modern, before Kant; 5140—Kant; 5150—Nineteenth Century; 5160—Twentieth Century.
5250 Studies in the History of American Philosophy (4) Intensive, critical work on a major philosopher or a school.
5370 Topics in Medical Ethics (4) Prereq: 4370/71 or permission of the Medical Ethics Committee.
5410 Philosophy of History (4) Theories of history and historical processes.
5430 Philosophy and Literature (4) Mutual influence of philosophy and literature, the possibility of philosophy of literature, the philosophy of criticism.
5440 The Problem of the Self (4) Current studies in sociology, social psychology, and philosophy are used to amend and elucidate traditional philosophical treatments of the problem of the self.
5450 Philosophy of Mind (4) An examination of the relation of the mental to the physical and of the role of words in discourse for mental activities such as thinking and feeling.
5520-60 Philosophy of Science (4, 4) The nature of the subject matter and method of the sciences. 5530—Natural sciences. 5550—Social sciences.
5610 Recent Developments in Philosophy of Religion (4)
5710 Studies in Metaphysics (4) Metaphysics of a philosopher or systematic philosophical tradition.
5810 Social and Political Philosophy (4)
5910-20-30 Research (4, 4, 4) Independent study under the direction of a member of the department.
5950 Clinical Practicum in Medical Ethics (4-12) Prereq: Permission of the Medical Ethics Committee. Open only to students concentrating in medical ethics. S/N or NG only.
6000 Doctoral Research and Dissertation
6110-20-30 Seminars in the History of European Philosophy (4, 4, 4)
6150-60 Seminars in the History of American Philosophy (4, 4)
6250 Seminar in the Philosophy of Religion (4)
6310 Seminar in Axiology (4)
6370 Advanced Topics in Medical Ethics (4) Prereq: 5370 or permission of the Medical Ethics Committee.
6510 Seminar in Epistemology (4)
6550 Seminar in Philosophy of Science (4)
6950 Advanced Residence in Medical Ethics (4-12) Prereq: Permission of the Medical Ethics Committee. Open only to students concentrating in medical ethics. S/N or NG only.

Physics and Astronomy

MAJOR DEGREES

Physics M.S., M.A.T., Ph.D.

Professors:

Associate Professors:

Assistant Professors:
M. F. Fair, Ph.D. Tennessee; M. S. Michigan; R. H. Kohl, Ph.D. Ohio State; R. S. Thoe, Ph.D. Connecticut.
Lecturer: R. L. Becker, Ph.D., Yale.

A student who enrolls in the Graduate School with the intention of attaining an advanced degree shall, in general, have completed an undergraduate major in physics or its equivalent. Physics 3210-20-30, 3710-20-30 or 4110-20-30, 4210-20, 4230 or 4240 constitute the minimum course prerequisite to graduate study.

A student who intends to present Physics as a graduate minor shall, in general, have completed an undergraduate minor in physics or its equivalent. Physics 3210-20, 4210-20 constitute the minimum course work prerequisite to graduate study.

Graduate programs leading to the Master of Science and Doctor of Philosophy are offered in a number of specialized fields including chemical physics, elementary particle physics, atomic and low temperature physics, health physics, molecular spectroscopy, nuclear physics, plasma physics, solid state physics, theoretical physics, and acoustics.

Departmental graduate programs providing special opportunities for academic and research work in areas pertinent to atmospheric and space flight are available at the Space Institute, Tullahoma.

All first-year graduate students are required to take a comprehensive examination in undergraduate physics during the fall quarter registration period.

THE MASTER'S PROGRAM

The Physics Department has two Master's degree programs—thesis and non-thesis.

The thesis program is primarily designed for students intending to go into industrial or governmental laboratories as physicists. The course requirements include 36 quarter hours in such courses as Physics 4510-20-30, 4610-20-30, 5110-20-30, 5210-20-30, 5310-20-30, 5610-20-30 and appropriate courses in related fields. Each candidate must present an acceptable thesis, equivalent to 9 hours of credit, and pass an oral examination on course material and thesis.

The non-thesis program is primarily designed for students intending to teach in colleges or universities on the elementary or intermediate level, or for students specifically intending to work toward a Ph.D. Students seeking an M.S. in Physics by this method must apply to the department's graduate committee for permission to enroll under this program. The requirements for the M.S. under this method are the satisfactory completion of 48 hours of course work composed of 36 hours of Physics courses, supplemented by a minor in mathematics, comprising above 6000 (preferred of advanced laboratory nature). In addition, the candidate must pass a comprehensive examination administered by the committee.

The Physics Department is also participating in the program which leads to the Master of Arts in College Teaching degree, in addition to the requirements for either of the Master's programs described above, the MACT degree in Physics requires 15 more hours of credit, making a total of 60 quarter hours. Nine of these hours are specified as follows: 3 hours in a seminar course dealing with general problems of college teaching; 3 hours in a seminar course dealing with special problems in the teaching of physics; and 3 hours in a course dealing with the history and philosophy of physics. The other 6 hours of course work may be elected from any of the physics courses numbered above 5000. During the two-year program leading to the MACT degree, the candidate will be continually engaged in supervised teaching activities.

THE DOCTORAL PROGRAM

All students are expected to take Physics 5210-20-30, 5310-20-30, 5410-20-30, 5510-20-30, 5610-20-30, 6110-20-30 and 6310. Physics 6210-20-30 are normally required of students specializing in theoretical physics. Physics 65010-10 of students in plasma physics, Physics 6610-20-30 of students in health physics, Physics 6710-20-30 of students in solid state physics, and Physics 6810-20 of students specializing in molecular spectroscopy. (The Master's degree is not required.)

A reading knowledge of one foreign language in which there exists a significant body of literature is required.

German or French 3030 with a grade of A or B may be substituted for the corresponding language examination.

The thesis topic will be chosen with reference to one of the fields in which research facilities can be made available either at the University laboratory or at the Oak Ridge National Laboratory, Oak Ridge, Tennessee.

A program leading to the Ph.D. in chemical physics is conducted jointly with the Chemistry Department, which offers a similar degree. Physics departmental requirements for the degree in chemical physics include the successful completion of: Physics 4510, 4610-20-30, 5210-20-30, 5310-20-30, 5410-20-30, 5510-20-30, 5610-20-30, 6110-20-30, and either 6310 or 5720; Chemistry 4160-70, 5430, and any two quarters from 5340-50, 5460, 5860, 6730 or 6810-20.

Astronomy


Physics


3230 Heat and Thermodynamics (3) Concepts of temperature and heat; the laws of thermodynamics; applications of laws to simple physical and chemical problems. Prereq: College physics and calculus; 3210-20 or consent of instructor.


3510-20-30 Physical Measurements (3, 3, 3) Laboratory measurement of some physical quantities. Theory supplied where necessary. Prereq: College physics and calculus; 3610 for 3520 and 3530. 3 labs.

3610-20 Electronics (3, 3) Electronic components and circuits of interest to physicists. Prereq: College physics and calculus. 3610 for 3520, 3 labs.

3630 Nuclear Electronics Laboratory (3) Elementary circuits of interest in nuclear instrumentation are designed and built, and their characteristics are tested as a function of various parameters. Prereq: 3610-20.

3840-50-60 Health Physics Practicum (3, 3, 3) Instrumentation; legal aspects and practice of applied health physics; problem solving; record keeping and report writing. For students in the health physics cooperative program.


4140 Elementary Nuclear Physics (3) General properties of nuclei, two-nucleon systems, nuclear forces, nuclear reactions, nuclear disintegrations and beta-decay, nuclear spin and magnetism. Prereq: 3730 or 4120.

4160 Physical Acoustics (4) Considerations fundamental to detailed investigation of any branch of acoustics; propagation of acoustic waves in the infrasonic, the audible, the ultrasonic, and the hypersonic ranges of frequencies. 3 hrs and 1 lab. Prereq: 3210-20, 3230.

4210-20-50 Electricity and Magnetism (3, 3, 3) Intermediate level electrostatics; steady and alternating currents; laws of electromagnetism; Maxwell's equations; radiation of electromagnetic waves; reflection and refraction of electromagnetic waves; electromagnetic fields of moving charges. Must be taken in sequence. Prereq: Fundamentals of Physics: Waves and Optics; and Multivariable Calculus and Linear Algebra.

4230-40 Modern Optics (4, 4) 4230—Geometrical optics: Reflection and transmission of light at a diatomic interface. Theory of Fresnel's law of interference, formation of images, properties of lenses, and mirrors; thin lenses, lens systems, ray tracing; polarization; imagery; laser light. 4240—Physical optics; Mathematics of wave motion, interference of waves, interference of light. Fourier optics, holography. Prereq: 4210 or consent of instructor. 3 hrs and 3 labs.


5440 Experimental Methods of Infrared and Raman Spectroscopy (3, 3, 3) Fourier transformation methods; infrared and Raman spectra; band theory, semiconductors and semiconductors and photoelectricity, conduction of electricity and units, point kernel and extended sources, stopping power, range-energy relations, counting statistics of nuclear reactions. Experiments illustrate recent techniques for investigating the nucleus and nuclear radiation. 1 hr lecture, 6 hrs lab. Prereq: Fundamentals of Electricity, Waves and Optics, Modern Physics.

4580 Principles of Nondestructive Testing (3) The detection and characterization of discontinuities in materials by nondestructive physical measurements. Ultrasonic, electromagnetic, holographic, and penetrating radiation techniques are discussed. Prereq: 1 yr of fundamentals of Physics: Electricity, Waves and Optics, Modern Physics, or consent of instructor.


4710-20-30 Introduction to Health Physics (3, 3, 3) Radioactivity, interaction of electromagnetic radiation with matter, radiation quantities and units, point kernel and extended sources, x-rays and gamma rays, neutron activation interaction of charged particles with matter, stopping power, range-energy relations, count statistics, shielding, dosimetry, waste disposal, criticality prevention, radiation biology, statistics of counting, nuclear properties. Experiments illustrate recent techniques for investigating the nucleus and nuclear radiation. Prereq: 3210-20 or equivalent, advanced calculus.


5610-20-30 Mathematical Methods in Physics (3, 3, 3) Vector and tensor analysis; linear algebra, matrices, vector spaces; Fourier series and integrals; spherical harmonics; Bessel functions; linear second-order partial differential equations and their associated boundary value problems. Variational calculus; Green's functions; integral transform methods. Special attention is devoted throughout course to problems arising in physics. Prereq: Advanced calculus and differential equations. (Same as Math 5610-20-30.)

5640 Numerical Methods in Physics (3) Numerical methods available for solution of physical problems, pointed toward use of automatic computing devices, without much concern for error. Prereq: 5610-20-30, or consent of instructor. (Same as Mathematics 5640.)

5720 Physics of Polyatomic Molecules (3) Introduction to the electronic structure of molecules and the physical processes of luminescence of these molecules: theoretical and experimental aspects of intermolecular and intramolecular electron excitation energy transfer and charge transfer; application of excitation energy transfer and charge transfer in such fields as organic molecular reactivity and organic scintillation. Prereq: 5210-20 or consent of instructor.

5910-30 Special Problems (3, 3, 3) Special assignment of student or experimental work on problems not covered in other courses.

5911-31 Special Problems in the Teaching of Physics (1, 1) Design of physics experiments and demonstrations, construction and analysis of physics tests and examinations, techniques in presentation of physics topics, and related problems. Prereq: Consent of instructor. Required of MACT candidates.


May be repeated with consent of department. Maximum 2 hrs.

6000 Doctoral Research and Dissertation

6110-20-30 Quantum Mechanics (3, 3, 3) Fundamental principles of quantum mechanics and principal approximation methods. Applications to atomic, molecular and nuclear physics. Prereq or coreq: 5110-20-30 or 5410-20-30. Whichever of the latter series is not used as a prerequisite is to be considered corequisite.

6210-20-30 Nuclear Structure (3, 3, 3) General properties of the nucleus; two-body scattering problems; saturation and symmetry properties of nuclear forces; theory of light nucleus; nuclear spectroscopy; special nuclear models; theory of nuclear reactions; theory of beta-decay. Prereq: 6110-20-30.


6320 Special Relativity (3) Lorentz transformation; Einstein postulates; relativistic ten-dimensional space-time model; kinetic theory; (c) statistical mechanics, including theory of nonequilibrium processes. Prereq: 5310-20-30, 5410-20-30, 6310.

6330 General Relativity (3) Tensor calculus; general theory of relativity; gravitational field equations. Prereq: 5410-20-30, 6310.

6420 Advanced Topics in Classical Theory (3) Courses will be given to meet special needs of students. Possible fields are: (a) advanced dynamics and hydrodynamics; (b) electromagnetic theory; (c) statistical mechanics, including theory of nonequilibrium processes. Prereq: 5210-20-30, 5410-20-30, 5510-20-30. May be repeated with consent of department.

6430 Advanced Topics in Quantum Theory (3) Courses will be given to meet special needs of students. Possible topics are: angular-momentum theory, beta-ray theory, theory of atomic spectra, molecular structure and valence theory, theory of radiation, electric and magnetic susceptibilities, high energy processes, scattering and collision processes, theory of fields. Prereq: 6110-20-30. May be repeated with consent of department.

6500-10 Electrical Conduction in Gases and Plasma Physics (3, 3) Electrical conduction in gases at high and low pressures. Characteristics of spark, arc and glow discharges. Collision theory and plasma physics; plasma oscillation; magnetohydrodynamics; instabilities. Topics of current interest in astrophysics, geophysics and thermonuclear research. Prereq: 3710-20-30 and either 5410-20-30 or Electrical Engineering 5310-20-30. (Same as Electrical Engineering 6500-10.)

6510 Interaction of Radiation with Gases (3) Interaction of electromagnetic radiation with atoms and molecules; oscillator strength, intensity of electromagnetic radiation with atoms; ionization; transmutation and light emission. Electron interaction, transport and transport of charged particles in an electromagnetic field. Prereq or coreq: 5410-20-30.

6520 Interaction of Electrons with Solids (3) Collisions with free electrons; stopping power; electron slowing down; specific energy loss; bremsstrahlung; gamma ray production; electron diffusion; plasmon effects in irradiated solids; light emission from irradiated solids; techniques in electron spectroscopy; applications to dosimetry. Prereq or coreq: 6110-20-30.

6530 Interaction of Radiation with Matter (3) Topics in atomic collision theory. Photon-storm

6710-20-30 Advanced Solid State Physics (3, 3, 3) Lattice dynamics; phonons; Brillouin zone; heat capacity. Energy bands structure of solids; cohesive energy; work function. Crystal oscillator strengths; effective mass approximation. Die-, para-, and ferromagnetism; neutron diffraction. The Fermi surface. Superconductivity. Phonon and electron scattering from phonons, electrons, and defects. Excitations; polaron; surface states. Superconductivity; and other defects. Prereq: 4830, 5210-20. Prereq or coreq: 4830 or 5240 or 5250; 6110 for 6710, 6120 for 6720.

6810 Vibrational Problems in Molecular Spectra (3) Normal coordinates and potential functions; group theoretical methods and selection rules in gases and condensed phases. Lasers and spectroscopy and nonlinear electro-optical phenomena. Prereq: 5340-50 and 5420 or equivalent. (Same as Chemistry 6810)

6820 Molecular Vibration-Rotation Theory (3) Molecules as vibrating and rotating systems possessing specific symmetry properties; quantum mechanics of symmetric and asymmetric molecular vibrators including vibration-rotation interaction theory; intensities and energy levels of molecules; method of analysis used in high resolution molecular spectroscopy. (Same as Chemistry 6820).

Political Science

MAJOR

Political Science M.A., Ph.D.

Public Administration M.P.A.

Professors: T. D. Ungs (Head), Ph.D., Iowa; R. S. Avery Ph.D., Northwestern; D. H. Carlisle, Ph.D., North Carolina; L. S. Greena (Emeritus), Ph.D., Wisconsin; V. R. Lear. Ph.D., Chicago; D. D. Mimm, Ph.D., Vanderbilt; H. Flass, Ph.D., Utah; N. M. Brown, Ph.D., Syracuse; O. H. Stephens, Ph.D., Johns Hopkins; D. M. Wellborn, Ph.D., Texas.

Associate Professors: R. E. Cunningham, Ph.D., Indianas; J. Dodd, Ph.D., Tulane; A. Eilcott, Ph.D., Columbia; G. Ehrick, Ph.D., Dartmouth; R. H. Hopkins, Ph.D., Syracuse; S. Osokoff (on leave), Ph.D, Columbia; R. L. Peterson, Ph.D., Yale; T. Mich, Ph.D., Simons; Ph.D., Johns Hopkins; T. A. Smith, Ph.D., Ohio State.

Assistant Professors: M. Boughton, M.A., Tulane; W. Koeher, Ph.D., Cornell; W. Lyons, Ph.D., Oklahoma; C. Mauney, Ph.D., Tennessee; G. J. Rathjen, Ph.D., Michigan State; R. E. Robson, Ph.D., Maryland.

Registration in any courses in the 5000-6000 series may be repeated for credit with consent of the department.

THE BUREAU OF PUBLIC ADMINISTRATION

The University maintains in the College of Liberal Arts a Bureau of Public Administration for the purpose of promoting sound governmental administration through research, publication, and consultation. The staff is as follows: Professor UNGS (director); Professor Lyons (acting associate director), Robson (assistant director); Research Associates Brown, Durant, Kennedy, Thomas.

THE MASTER'S PROGRAM

See general requirements on page 19.

MASTER'S IN PUBLIC ADMINISTRATION

Specific requirements for graduation include:
1. The completion of 45 quarter hours of approved graduate courses including 9 hours of thesis work. In lieu of thesis, candidates may complete a total of 45 quarter hours of course work.
2. At least fifty percent of the credit hours including thesis must be in approved courses numbered 5000 and above.
3. Demonstration of command of the material covered in course work in an oral comprehensive examination. A non-thesis student must have a written examination which may be followed by an oral.
4. Inquiries concerning all programs should be directed to the Department of Public Science, Knoxville, Tennessee 37916.

THE DOCTORAL PROGRAM

Specific requirements for the degree of Doctor of Philosophy in Public Science include:
1. A minimum of 117 quarter hours, following the Bachelor's degree, is required. At least 93 hours shall be in political science. At least 72 hours in political science with at least 45 graduate level hours of course work in political science will be considered for the degree of Doctor of Philosophy in Public Science.
2. At least 45 of these graduate level hours shall be at the 6000 level. This figure includes 36 hours of credit for the dissertation.
3. Each Ph.D. candidate must pass an examination in one foreign language. Students specializing in some areas may be required to demonstrate knowledge of a second language or appropriate research tools for or both.
4. Admission to candidacy shall be based on written and oral preliminary examinations which must be passed not later than three quarters before the date on which the degree is granted.
5. The candidate must successfully complete a final oral examination on the doctoral dissertation.
6. Successful completion of the degree also depends on course performance and other evidence of professional interest and conduct.


3555 Minority Group Politics in the United States (3) Content varies from quarter to quarter. May be repeated with consent of department. Maximum 8 hrs.

3555 Introduction to Public Administrative Organization and Management (4) Organization and decision-making theory, line and staff services, politics of organization, leadership, personnel and fiscal management, administrative responsibility, United States Government and Politics desirable as preceding course. (Same as Water Resource Development 3566).

3566 Public Administration and the Policy-Making Process (4) Public bureaucracies and the policy-making process, their political environments, administrative problems associated with policy making, United States Government and Politics desirable as preceding course.

3605 Political Change in Developing Areas (4) Characteristics and problems of political changes with primary focus on developing areas.

3815-16 Dynamics of Black African Politics (4, 4)

3921-22 Politics of Asian States (4, 4)

3925-26 Latin American Government and Politics (4, 4)

3931-32 Government and Politics of the Soviet Union (4, 4)

3935-36 Political Systems in Western Democracies (4, 4) Political culture, patterns, and institutions of Western democratic systems.

3841 Government and Politics of Middle East and North Africa (4)

3710 State Politics (4) Focus on formal and informal setting of state government; governors, courts, legislatures, and state administrators. Attention will be paid to state government's role in formulating, enacting, and implementing state policy.

3720 State Government and Policy Making (4) Nature and functions of the institutions of state government; governors, courts, legislatures, and state administrators. Attention will be paid to state government's role in formulating, enacting, and implementing state policy.

3750 The Urban Pollity (4) Analysis of political institutions and processes in metropolitan areas.

3760 Urban Policy Process (4) Analysis of urban problems and policies in metropolitan areas.

3796 Contemporary Problems of Soviet Foreign Policy (4)

3801 Studies in Ancient Political Thought (4) Classical Greek and Roman political thought.

3802 Studies in Medieval Political Thought (4) From Augustine to Luther; Emphasis on problems and theories of religion and politics.

3803 Studies in Early Modern Political Thought (4) Machiavelli through the Enlightenment.

3804 Studies in Nineteenth- and Twentieth-century Political Thought (4) Political theories of industrial and technological societies; nine- teenth and twentieth century.

3880 American Political Thought (4) Examination of role of selected political ideas, doctrines, and themes in America, emphasizing their development and relationships to diverse political interests.

4410 Law and the Administrative Process (4) Powers of, procedures of, controls over administrators.

4535-36 Political Attitudes, Opinions and Communication (4, 4)

4540-50 Presidency, Congress and Public Policy (4, 4) The Presidency and Congress within framework of policy-making process.

4545-46 The Judicial Process (4, 4) The study of courts as components of political systems, and public policy formulation through judicial
decision making. United States Government and Politics desirable as preceding course.

4575 Special Topics in United States Government and Politics (4) May be repeated with consent of department. Maximum 8 hrs.

4610 Budgetary Process (4) Fiscal planning, budget and expenditure processes in government, their policy and administrative implications.

4620 Public Personnel Administration (3) Development of the merit system in government, career systems, public personnel management functions, organization for personnel management.

4630 Problems in Public Management (3) Selected problems. Emphasis on internal and external communication and information systems in government and public access to information.

4655-66 Policy Making in Democracies (4, 4)

4675 Special Topics in Comparative Government (4, 4)


4711 International Law (4)

4727 Politics of Inter-American Relations (4) Analysis of selected theoretical and policy issues concerning international relations in the Americas with emphasis upon imperialism, intervention, and the Cuban Revolution, nationalism, foreign assistance, trade and economic integration.

4740-50-60 Politics and Elections (3, 3, 3) 4740—Structure and function of party systems; nominations and campaigns. 4760—Voting behavior of the electorate.

4815 Contemporary Soviet Marxism-Leninism (4)

4831-32-33 The Systematic Study of Politics (4, 4, 4)

4875 Special Topics in Political Thought (4) May be repeated with consent of department. Maximum 8 hrs.

4940 Politics and the Environment (4) Examination of formulaion and implementation of public policies relating to physical environment with emphasis upon water and air pollution control.

4975 Proseminar in Political Science (4) Selected research for seniors; primarily for majors. May be repeated with consent of department. Maximum 8 hrs.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5101 Foreign Study (1-12) See page 148.

5102 Off-campus Study (1-12) See page 148.

5103 Independent Study (1-12) See page 148.

5110-20 Seminar in Political Theory (3, 3) Selected problems in political philosophy. Topics to be selected by the instructor.

5120 Seminar in African Politics (3) African political thinkers, schools, historical interpretations.

5130-40 Seminar in Latin American Government (3, 3, 3)

5150 Internship in Political Science (3-9) Open to students participating in approved internships. May be repeated with consent of instructor. Maximum 9 hrs.

5160-70-80 Seminar in World Politics (3, 3, 3) Research in world problems and organization.

5170-80 Seminar in Public Policy (3, 3) Role of administrators in policy analysis and decision making with special attention to historical and current issues.
Psychology

MAJOR

DEGREES

Psychology

M.A., M.A.ED., PH.D.

Professors:

W. H. Calhoun (Head), Ph.D. California (Berkeley); G. M. Burghardt, Ph.D. Chicago; J. F. Byrne, Ph.D., Ph.D. Tennessee; H. H. Fine, Ph.D. Syracuse; L. Hendler, Ph.D. Michigan; J. L. Nabors, Ph.D. Chicago; K. R. Newton, Ph.D. Tennessee; R. R. Pollio, Ph.D. Michigan; N. L. Rasch, Ph.D. Pittsburgh; R. S. Shrader, Ph.D. Tennessee; F. Samejima, Ph.D. California; W. S. Verplanck, Ph.D. Brown; R. Dir. Washington, Ph.D. Syracuse.

Associate Professors:

H. S. Bacon, Ph.D. Tennessee; C. P. Cohen, Ph.D. Kansas; L. F. Droppleman, Ph.D. Michigan; H. R. Friedman, Ph.D. Tennessee; S. J. Handel, Ph.D. Johns Hopkins; M. G. Johnson, Ph.D. Johns Hopkins; A. McIntyre, Ph.D. Yale; J. C. Malon, Ph.D. Duke; W. G. Morgan, Ph.D. Tennessee; W. M. Simmons, M.S.S.W. Tennessee; S. D. Sudstrom, Ph.D. Utah; C. A. Travis, Ph.D. California (Davis).

Assistant Professors:


The Psychology Department emphasizes doctoral degree programs with specializations in clinical, school/community, industrial-organizational and general psychology. Some students complete a Master's degree as part of their doctoral program. For detailed information on graduate programs and admissions requirements, write: Graduate Secretary, Department of Psychology, University of Tennessee, Knoxville, Tennessee 37916.

THE PSYCHOLOGICAL CLINIC

The Psychological Clinic supports graduate training in clinical psychology. Psychological diagnosis and psychotherapy are offered on an outpatient basis, with medical consultants, to the general public as well as to University students, on referral by a physician.

4107 Experience in Individualized Instruction (1-6) Supervised participation as a tutor in individualized instruction. Prereq: Consent of instructor. May be repeated. Maximum 12 hrs.

4120 Topics in Social Psychology (4) Intensive study of current research topics. Prereq: 3120 or Sociology 3130 (Same as Sociology 4120)


4239 Laboratory in Sensory Processes and Perception (2) Prereq or coreq: 4230. 2 periods.

4460 Organizational-Industrial Psychology (3)

4510 Personality Theories (4) Prereq: Abnormal Psychology or consent of instructor.

4520 Personality and Social Systems (4) Prereq: Abnormal Psychology.

4610 Group Processes (3) Study and experience of theory and techniques of group processing and facilitation. Those participating in 4610 are expected to continue into 4620 and 4630. Prereq: Human Relations and consent of instructor.

4620-20 Seminar in Group Processes (3, 3) Didactic and laboratory experience for those qualified for further training as group facilitators. Prereq: Consent of instructor.

4640 Psychological Tests and Measures (4) Theory and construction of individual and group measures; survey of various methods of assessment of intelligence, personality, special abilities, and educational achievement. Prereq: Psychological Statistics.

4650 Symbolic Processes (4) The logic of signs and symbols; directed and associative thinking; memory, problem solving, and concept formation; the nature, use and development of language. Prereq: Learning and Thinking or consent of instructor.

4670 The Psychology of Language (4) Theories and descriptions of phonology, syntax, and semantics as applied to psychology and related disciplines. Recommended: 4580 or Linguistic Foundations of Language.

4710 Physiological Psychology (4) Nervous system and physiological correlates of behavior. Prereq: 1 yr of biology or zoology and Biological Foundations of Behavior.

4719 Physiological Psychology Laboratory (4) Coreq: 4710.

4720 Comparative Animal Behavior (4) Methods and principles. (Same as Zoology 4720)

4729 Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq: 4720. (Same as Zoology 4729).

4750 Evolution and Ontogeny of Social Behavior (4) Genetic, evolutionary, ecological, and developmental processes as they apply to social organization and dynamics of vertebrates. Prereq: Consent of instructor.

4830 History and Systems of Psychology (4) Prereq: 9 hrs of upper division psychology.

4850 Learning Theories (4) Historical and theoretical development of learning models. Prereq: Learning and Thinking.

4860 Programmed Learning (3) Same as Curriculum and Instruction 4860.

4870 Contemporary Research in Behavior of Women (4) Study of interaction of cultural and biological factors in determining the behavior of women, with emphasis on psychological mechanisms involved.

4880 Afro-American Psychology (4) Review and analysis of psychological literature on Afro-Americans. Prereq: Consent of instructor. (Same as Cultural Studies 4880).

4900 Aspects of Urban Environment (4) Interdisciplinary course on urban problems. Prereq: Consent of instructor. (Same as Architecture 4900, Real Estate 4900) S/NC only.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5017 Colloquium in Experimental Psychology (1) Coreq: 5019. S/NC only.

5019-29-39 Laboratory Techniques in Experimental Psychology (3) Prereq: consent of all first-year students in experimental, physiological, and comparative psychology. Coreq: 5017. S/NC only.

5070 Seminar in College Teaching (2) Concepts, methods, and materials in the introduction of psychology at the college level. Emphasis upon research. Required of all Ph.D. candidates. S/NC only.

5079 Practicum in College Teaching (2) Supervised participation in College Teaching. S/NC only.

5080 Current Topics in Applied Psychology (3)

5100 Development Psychology (3) Prereq: Child Psychology or Child-Adult Psychology. (Same as Educational Psychology 5100).

5105 Developmental Assessment (3) Survey of techniques for assessing development in infants and children. Does not include practicum. Prereq: 5160 or equivalent and consent of instructor.

5110 Clinical Aspects of Human Sexuality (3) Nature of sexuality: societal perspectives, personal identity, application, intimacy and isolation including psychosocial and psychosexual identity and models for decisions. Intended for graduate students in clinical psychology, social work, and community and mental health professionals. Prereq: Consent of instructor.

5111-12-13 Seminar in Current Issues in School Psychology (1, 1, 1) Historical, ethical, and professional issues facing impinging on school psychological practice.

5140-50-60 Psychoeducational Assessment (3, 3) Naturalistic, psychometric, and sociometric assessment methods in school learning environments. Must be taken in sequence. Coreq: 5479-89-99. Prereq: Admission to School Psychology program or consent of instructor. (Same as Educational Psychology 5140-50-60).


5170-80-90 Proseminar in Organizational Psychology (3, 3, 3) Introduction to the basic concepts and ideas required for graduate study in organizational psychology. Must be taken in sequence during the student's first year. Prereq: Consent of instructor. (Same as Industrial Management 5170-80-90).

5200 Topics in Developmental Psychology (3) Prereq: 5100 or equivalent and consent of instructor. May be repeated. Maximum 6 hrs.

5210 Readings in Psychology (1) S/NC only.

5220 Readings in Psychology (2) S/NC only.

5230 Readings in Psychology (3) S/NC only.

5240 Readings in Psychology (4) S/NC only.

5250 Readings in Psychology (5) S/NC only.

5260 Special Problems in Psychology (1) S/NC only.

5270 Special Problems in Psychology (2) S/NC only.

5280 Special Problems in Psychology (3) S/NC only.

5290 Special Problems in Psychology (4) S/NC only.

5300 Special Problems in Psychology (5) S/NC only.

5319 Field Work in School Psychology: Level 1 (2) Supervised on-the-job training in school psychology. Limited to students fully admitted to the doctoral program in school psychology who are assigned to program approved field
settings. May be repeated. Maximum 6 hrs. Prereq: 5140-50-60 or equivalent; S/NC only. (Same as Educational Psychology 5319.)

5340 Group Dynamics (3) (Same as Educational Psychology 5340.)

*5350-60-70 Seminar in Psychology (3, 3, 3)

5400 Psychophysics and Scaling Methods (3) Prereq: One course in statistics.

5420-30-40 Advanced Psychological Statistics (3, 3, 3) Must be taken in sequence.

5445 Advanced Correlational Methods (3) Bivariate, tetrachoric, and polychoric correlation; partial and multiple correlation and regression; stepwise regression and cross-validation; simple discriminant analysis; rank correlation methods. Prereq: 5430.

5450 Human Problems in Administration (3) (Same as Industrial Management 5250.)

5460 Personnel Research Seminar (3) (Same as Industrial Management 5260.)

5500 Fundamentals of Psychometrics (4) Basic ideas and orientation in psychometrics. All the graduate students who plan to take one or more courses in psychometrics are required to take the course. Prereq or Coreq: 4640.

5510 Instrumentation for Psychological Research (3)

5520 Theory of Mental Measurement (3) Reliability, validity, scaling and equating, norms, combining tests into batteries. Prereq: Descriptive Statistics, Interpretation of Statistical Reports, 4540 and 5500.

5530 Issues in Applied Psychological Measurement (3) Applications of measurement in community and organizational research. Prereq: Statistics 5050-60-70 or equivalent and consent of instructor.

5550 Advanced Social Psychology (3) Interaction between individual and group. Theories of group behavior. Prereq: Social Psychology. May be used for credit in sociology.

5560-70 Seminar in Social Psychology (3, 3) Prereq or Coreq: 5550. May be repeated. Maximum 9 hrs.

5580 Theories of Personality (3)

5581-82-83 Clinical Psychology I: Human Development and Personality (2, 2, 2) First quarter core of the doctoral program in clinical psychology. Students take the 3-2 hr courses concurrently, each covering the content area from one to three major contemporary points of view.

5589 Psychological Techniques Laboratory (2) Basic techniques of psychological appraisal. Restricted to doctoral students in clinical psychology.

5590 Psychodynamics (3) A research-and-theory-oriented course focusing upon the origins of behavior.

5591-92-93 Clinical Psychology I: Patterns of Adaptation (2, 2, 2) Second quarter core of the doctoral program in clinical psychology. Students take the 3-2 hr courses concurrently, each covering the content area from one of the three major contemporary points of view.

5601-92-93 Clinical Psychology I: Behavioral Deviance and Psychopathology (2, 2, 2) Third quarter core of the doctoral program in clinical psychology. Clinical students take the 3-2 hr courses concurrently, each covering the content area from one of the three major contemporary points of view.

5610-20 Psychology of Learning (3, 3) Prereq: 3510 or Educational Psychology 3730.

5650 Ethics and Professional Practices (1) A review and discussion of problems arising in the practice of clinical psychology. Offered in alternate years. Prereq: M.A. in psychology or equivalent.

5670 Forensic Psychology (2) The psychologist's role in relation to the law, including questions concerning licensure requirements, legal restrictions, and testimony as an expert witness. Offered in alternate years. Prereq: M.A. in psychology or equivalent.

5680 Neural Basis of Behavior (3) Neuroanatomy; the basis and symptomatology of neurological syndromes encountered in clinical psychology. Prereq: M.A. in psychology or equivalent.

5690 Psychopharmacology (3) A review and evaluation of pharmacology as it relates to psychology. Prereq: Consent of instructor. Offered in alternate years.

5713 Learning Modules for Techniques in Professional Psychology (1-4) A set of learning packages, each of which develops a skill in assessment, technology, child psychology, or methodology. Prereq: Consent of instructor. May be repeated. S/NC only.

5750 Ethological Psychology (3) Evolutionary and physiological basis of comparative psychology and implications for human behavior. Prereq: Introductory Biology and graduate standing.

5760 General Vertebrate Neuroanatomy (3) Lecture and laboratory dealing with structure and function of the central and peripheral nervous system. Prereq: 4710, 4719 or consent of instructor. (Same as Zoology 5760.)

5769 Advanced Techniques in Physiological Psychology (3) Animal and human laboratory procedures central to research in physiological psychology. Prereq: 4710, 4719 and consent of instructor. May be repeated with consent of instructor.

5780 Seminar in Psycholinguistic Concepts in Speech Pathology (3) (Same as Speech Pathology 5790.)

5810 Techniques of Psychological Examination (3) Development and administration of basic and extended techniques. Intended primarily for students in fields related to psychology using assessment procedures. Prereq or Coreq: 4640 or equivalent and consent of instructor.

5819 Practicum in Techniques of Psychological Examination (2) Coreq: 5810.

5840 Student Appraisal (3) (Same as Educational Psychology 5840.)


5859-69-79 Practicum in Psychological Appraisals (2, 2, 3) Ordinarily to be taken concurrently with 5650-60-70.

5890 Counseling Theories and Techniques (3) (Same as Educational Psychology 5890.)

5950-60-70 Consultation in Human Development Settings (3, 3, 3) Study of issues, models, and evaluation of the process of consultation in settings where human developmental needs and crises are managed by persons who seek aid from psychologists. Must be taken in sequence. (Offered in Educational Psychology 5950-60-70.)

Advanced Psychometrics (3, 3) Construction and standardization of psychological tests, questionnaires, and rating scales, theory of errors or measurements; item analysis, scaling, equating, and norms development. Prereq: 4650, 5440, and 5500. May be repeated. Maximum 9 hrs.

Field Placement in Clinical Psychology Levels 1, 2, 3, 4, (1-4, 1-4, 1-4, 1-4) Supervised clinical experience. Required of and limited to students fully admitted to the Ph.D. program in Clinical Psychology. May be repeated. Maximum 8 hrs per course. S/N/NC only.

Seminar in Psychometrics (3) Seminar for advanced graduate students in psychometrics or quantitative psychology, to deal with advanced theories, methodologies, and their applications. Prereq: 4640, 5500 or equivalent, and consent of instructor. May be repeated. Maximum 9 hrs.

Seminar in Advanced Social Psychology (3) Prereq: Consent of instructor.

Seminar in Mental Health Administration (3) Theory and problems in the organization and management of mental health administration.

Systems Approaches in Psychology (3, 3) Systems and organization development approaches in schools and other human services settings. Prereq: Consent of instructor. (Same as Educational Psychology 6650-60-70.)

Practicum in School Psychology III (2, 2, 2) Third year School Psychology Program practicum core sequence. S/N/NC only. (Same as Educational Psychology 6659-69-79.)

Seminar in Physiological Psychology (3)

Seminar in Comparative and Ethological Psychology (3)

Methods of Ethological and Naturalistic Research (3) Current laboratory and field techniques. Prereq: 4729, 5750, 6720, or consent of instructor.


Advanced Psycholinguistics (3) Language from psychological and associated points of view; methodological and theoretical problems. Prereq: Consent of instructor.


Adult Psychotherapy (3) Prereq: 5580-90-600. Prereq or coreq: 6580-60.

Field Work in Industrial and Organizational Psychology (1-15) (Same as Industrial Management 6900.)

*Note: Psychology 5210-5300, 5580-60-70, 5819, 6310-400, 6419-20-39, 6710-20-30, 6750, 6840, 6870, and/or 6900 may be repeated for credit with the approval of the department.

Religious Studies

Professors: F. S. Lusby (Head), B.D. Colgate Rochester; D. L. Dungan, Th.D. Harvard; R. V. Norman, Jr., Ph.D. Yale.

Associate Professors: B. L. Daniels, Ph.D. Duke; W. L. Humphreys, Ph.D. Union; D. E. Linge, Ph.D. Vanderbilt; C. H. Reynolds, Ph.D. Harvard.

Assistant Professors: J. Kim, Ph.D. Chicago; R. Lee, Ph.D. Harvard.


An M.A. in Philosophy with a concentration in religious studies is available for graduate work in these related fields. (Details of this program are available in the office of either department.) Graduate courses in religious studies further provide opportunity for students in a variety of disciplines to pursue work in religious studies as a graduate concentration.

History of Western Religious Thought and Institutions (3) First century to the thirteenth century. 3051-13 (Same as History 3081-71.)

Early Greek Mythology (3) (Same as Classics 3210.)

Greek Mythology in the Classical Period (3) (Same as Classics 3220.)

Roman Mythology (3) (Same as Classics 3230.)

Russian Philosophical and Theological Thought (4) A survey of the development of philosophical and theological thought in Russia from the Middle Ages to the Revolution. Special emphasis on the expression of this thought in Russian literature and literary criticism.努. May be repeated. (Same as Philosophy 3270 and Russian 3270.)

Renaissance and Reformation (3, 3) (Same as History 3411-12-13.)

Religion of Primitive Peoples (3) (Same as Anthropology 3440.)

Philosophy and Religion in India (4) (Same as Philosophy 3450.)

Buddhist Philosophy and Religion (4) (Same as Philosophy 3460.)

Philosophy of Religion (4) (Same as Philosophy 3490.)

Modern Religious Philosophies (4, 4) Examination of the religious implications of major thinkers and movements. 4111-Nicolas of Cusa to Hume, 4121-Kant and the nineteenth century. Prereq: 9 hrs of philosophy other than logic. (Same as Philosophy 4111-21.)

Topics in Ancient Israelite and Ancient Near Eastern Religions (4) Prereq: Ancient Israel's Historical and Religious Traditions, The Rise of Judaism, or consent of instructor. May be repeated. Maximum 8 hrs.

Jesus and Paul Compared (4) Jesus' teaching and activity in the context of first-century Palestinian Judaism; analysis of what the Apostle Paul made of the tradition of and about Jesus. Recommended prereq: Introduction to Religions of the World or Introduction to Ancient Near Eastern Religions and images of Jesus.

Theoretical Issues in Medical Ethics (4, 4) (Same as Philosophy 4370-71.)

American Religious Thought (4) Selected figures, movements and problems in American religious thought from colonial period to present.

Topics in American Religion (4) Prereq: one of the following: Religion in America, 4410; or consent of instructor. May be repeated. Maximum 8 hrs.

Social and Religious Change (4) (Same as Sociology 4540.)

Topics in Western Religious Thought and Institutions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: History of Western Religious Thought and Institutions. May be repeated. Maximum 12 hrs.

Topics in Early Christianity and Hellenistic Religions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: Introduction to Ancient Near Eastern Religions or permission of instructor. May be repeated. Maximum 12 hrs.

Topics in Eastern Religions (4) Selected figures, issues and institutions. Seniors and graduate students only, except by permission of department. Prereq: 3560-50. May be repeated. Maximum 12 hrs.


Sociology of Religion (4) (Same as Sociology 4940.)

Theory of Religion (4) Elements for construction of a theory of religion drawing on resources from fields of psychohistory, social anthropology, theology and comparative religion.

Tradition, Change and Modernity in Asia (4) Comparative study of processes of religious and social change in historical context in Asian societies. Comparative focus of course will vary each year (e.g., China and Japan, India and South Asia.) May be repeated. Maximum 8 hrs. (Same as Sociology 4960.)

Foreign Study (1-12) See page 148.

Off-Campus Study (1-12) See page 148.

Independent Study (1-12) See page 148.

Topics in Religion and Society (4, 4)

Topics in the History of Religion (4, 4)

Topics in Religious Thought (4, 4)

Romance Languages

MAJORS

French

Spanish

M.A., Ph.D.

French

Spanish

M.A., Ph.D.

DEGREES

M.A.

M.A.

MACT

M.A.

M.A.

M.A.

M.A.

M.A.

Associate Professors:

W. F. Byess (Emeritus), Ph.D. Pennsylvania;

R. M. DeRuyck, Ph.D. Illinois; C. E. Elliott, A.M. Illinois;

W. H. Heliman, Jr., Ph.D. North Carolina;

B. Irving, Ph.D. Princeton; D. E. Lawd, Ph.D. Minnesota;

T. B. Irving, Ph.D. Princeton; D. E. Lawd, Ph.D. Minnesota;


Assistant Professors:

J. C. Campion, Ph.D. Yale; M. Handlerman,

Ph.D. Florida; K. B. Levy, Ph.D. Kentucky;

C. Pinsky, Ph.D. California (Berkeley).

The Department of Romance Languages offers three advanced degrees: the Master of Arts in College Teaching (MACT) in the Romance Languages only; the Master of Arts (M.A.) in French and Spanish; and the Doctor of Philosophy (Ph.D.) in Spanish.
College of Liberal Arts  141

THE MASTER OF ARTS IN COLLEGE TEACHING PROGRAM

This program requires a minimum of 60 hours of graduate work. Students must participate in the graduate seminar in college teaching during their first year of residence (3 hours credit). They must also complete 6 credits in supervised instructional experience. French or Spanish must be selected as the major subject, and at least 36 hours of graduate work including 9 hours of thesis and 9 hours of linguistics and philology, and 3 hours of problems in language teaching, must be completed. In addition, civilization courses are strongly recommended. Spanish or French must be selected as the minor subject, in which at least 18 hours of graduate work must be completed.

THE MASTER OF ARTS PROGRAM

The student may select either Plan A or Plan B.

Plan A
1. Completion of a minimum of 36 quarter hours of which 24 must be taken in courses numbered above 5000, including 5011 (French or Spanish, as appropriate).
3. A written examination covering the course work and selected items from a master reading list.
4. A final oral examination covering the thesis.

Plan B
1. Completion of 45 quarter credits of which 33 must be in courses beyond 5000, including 5011 (French or Spanish, as appropriate).
2. Three term papers that have been accepted as satisfactory by the Advisory Committee.
3. A written examination covering the course work and selected items from a master reading list.

THE DOCTORAL PROGRAM

Residence and Course Work:
Completion of at least three consecutive quarters of full-time residence, a minimum of 81 credit hours in course work beyond the Bachelor's degree or its equivalent, and a dissertation (36 credit hours).

No less than 54 quarter hours should be taken in courses pertaining to the student's major field; of these a minimum of 18 hours are to be taken in courses above 6000, a maximum of 12 hours may be taken in courses of the 4000 level and the rest in courses above 5000. All students must complete the series in methods of research (5151-61-71) for a total of 3 credits. The minor shall consist of at least 18 hours of which at least 12 hours must be numbered above 5000 and the rest above 4000, and should represent a meaningful complement to the student's area of concentration. In addition 9 hours of courses above 4000 in a related discipline are required. In special cases the latter requirement may be waived in favor of additional course work in the major field.

Language Requirements:
Students are expected to demonstrate written and oral fluency in Spanish as well as knowledge of two other foreign languages. One of these must be French; the second one should be chosen from such languages as German, Italian, Portuguese, Arabic or Hindustani in accordance with the student's field of concentration. Proficiency in Latin shall be required of all students specializing in an area related to philology or the medieval period.

Examinations:
A preliminary comprehensive examination, both written and oral, covering the major and minor fields must be passed before a student can become an official candidate for the degree. This preliminary examination is to be held at the time deemed most appropriate by the student's major advisor and committee. The candidate is expected to defend the dissertation in a final oral examination.

For additional information on the program, consult pages 22-23.

Arabic
3510-20 Intermediate Modern Standard (4, 4)
3610 Islamic Literature in English Translation (4) Survey from origins to modern period of major Islamic literatures, especially Arabic, Persian, and Turkish. Readings include The Arabian Nights, The Rubaiyat of Omar Khayyam and Gibran's The Prophet.
5070 Spanish Arabo-Islamic Literature and Culture (3, 3, 3) (Same as Spanish 5070-80-90).
5101 Foreign Study (1-12) See page 148.
5102 Off-campus Study (1-12) See page 148.
5103 Independent Study (1-12) See page 148.

French
3610-20-30 Elements of French for Upper Division and Graduate Students (3, 3, 3) Elements of language, elementary and advanced readings. Open to graduate students preparing for language examinations, and upper division students desiring reading knowledge of the language. Undergraduate credit only. No credit for those having had Elementary French. No auditors.
4010 Masterpieces of French Literature in English Translation (3) No foreign language credit.
4020 Masterpieces of French Drama in English Translation (3) No foreign language credit.
4110-20-30 French Literature of the Seventeenth Century (3, 3, 3) Prereq: Intermediate French (third quarter) or equivalent.
4150 Theatrical French (1-3) Performance in one or more French plays. May be repeated with consent of department. Prereq: 1 year of Intermediate French or equivalent and consent of instructor.
4160-70-80 Advanced Conversation (2, 2, 2) Intensive training in paired and spontaneous conversations. Subjects range from travel and current events to literature and aspects of national culture. Prereq: Completion of 9 hrs of courses on 3000 level.
4210-20-30 Phonetics and Advanced Grammar (3, 3, 3) Prereq: Intermediate French (third quarter) or equivalent.
4250 Introduction to Descriptive Linguistics (3) Phonetics and phonemics, morphology and syntax, Types of languages, linguistic groups, dialects and dialect geography. The application of descriptive linguistics—field linguistics, dialect study; its practical use in learning languages and in language teaching. An introduction to transformational grammar. Prereq: 9 hrs of upper division English, or 9 hrs of upper division courses in a modern or ancient language (exclusive of German and French 3019-20-30, courses in literature in translation, and general courses in Latin and Greek requiring no knowledge of these languages), or consent of the instructor (Same as German and Spanish 4250).
4260 Introduction to Historical and Comparative Linguistics (3) (Same as German 4260).
4270 Introduction to Romance Linguistics (3) A study of the development of Classical Latin through Vulgar into the major Romance languages. (Same as Spanish 4270).
4310-20-30 French Literature of the Eighteenth Century (3, 3, 3) Prereq: Intermediate French (3rd quarter) or equivalent.
4410-20-30 French Civilization (3, 3, 3) Prereq: Intermediate French (third quarter) or equivalent.
4510-20-30 French Literature of the Nineteenth Century (3, 3, 3) Prereq: Intermediate French (third quarter) or equivalent.
4640-50-60 French Literature of the Twentieth Century (3, 3, 3) Prereq: Intermediate French (third quarter) or equivalent.
5000 Thesis
5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student not otherwise registered during any quarter when such a 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.
5011 Techniques in Literary Analysis (3) Required for either Plan A or Plan B of the M.A. Intermediate French or equivalent.
5101 Foreign Study (1-12) See page 148.
5102 Off-campus Study (1-12) See page 148.
5103 Independent Study (1-12) See page 148.
5110-20-30 French Directed Readings (3, 3, 3) (Same as Spanish 5110-20-30).
5111-20-30 Third Year (3, 3, 3) Prereq: Intermediate French or German.
5120-30-40 French Civilization beyond Intermediate (3, 3, 3) Prereq: Intermediate French (third quarter) or equivalent.
5121 College Teaching of Romance Languages (3) Seminars, demonstrations and practical applications of techniques and procedures for teaching and evaluating basic language skills, cultural aspects, and beginning literature. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships except those whose previous training or experience warrants their being excused by the department.
5151-61-71 Bibliography and Methods of Research (1, 1, 1) as Italian and Spanish 5151-61-71.) S/NC only.
5210-20-30 French Literature of the Sixteenth Century (3, 3, 3)
5310-20-30 French Directed Readings (3, 3, 3)
5350-60-70 The Philosophes (3, 3, 3) Textual analysis of the works of Voltaire, Diderot, Rousseau, and eighteenth-century writers.
5410-20-30 The French Novel (3, 3, 3)
5450-60 Epic Poetry of the Nineteenth Century (3, 3, 3) 5450-German and English influences on French Romanticism and the gen-
eralion of the poets of "le mal du siècle," 5460—Victor Hugo; the Parnassians.

5470 Baudelaire and the Symbolists (3) A study of Les Fleurs du mal and Petits poèmes en prose with especial emphasis upon the theories of color and "correspondances" and their influence on the Symbolist school.

5510-20-30 The French Drama (3, 3, 3)

5510-20-30 Trends in Contemporary French Literature (3, 3, 3)

5560-60 Advanced Syntax and Stylistics (3, 3) Readings and written imitations of modern literary styles in the form of compositions, sketches and original stories.

5670 Problems in Romance Linguistics (3) Topics vary. May be repeated with permission of the department. Prereq: 4270 or its equivalent. (Same as Spanish 5670.)

5710-20-30 Seminar in French Literature (3, 3, 3) Topics vary. May be repeated with consent of department.

5910 Literary Criticism: The Foundations of Romance Criticism (3) (Same as Spanish 5910.)

Italian

3210-20-30 Civilization and Culture (3, 3, 3) Prereq: Intermediate Italian (third quarter) or equivalent.

3310-20-30 Italian Literature in English Translation (3-4, 3, 3, 3) 3310—The Sicilian School, the Florentine School, Dante, Петрарка, Boccaccio, Machiavelli, Ariosto, Tasso. 3320—From the Baroque through nineteenth century, commedia dell'arte, Vico, Leopardi. 3330—Twentieth century, Carducci, Pirandello, Quasimodo, D'Annunzio, Croce, Moravia. No foreign language credit. No change in credit hours after add deadline. Option of 4 hrs credit must present appropriate amount of extra work above that required for 3 hrs.

3510-20 Aspects of Italian Literature (4, 4) Prereq: Intermediate Italian or equivalent. Recommended for literature majors.

4010-20 Italian Drama in English Translation (3-3, 3-4, 3-3) 4010—La commedia dell'arte and major works of Machiavelli, Metastasio, Alfieri, Goldoni. 4020—Twentieth-century theatre: operatic drama, the Grottesco, Pirandello, De Filippo, Pratella. First. No foreign language credit. No change in credit hours after add deadline. Option of 4 hrs credit must present an appropriate amount of extra work above that required for 3 hrs.

4050-60-70 Dante and Medieval Culture (3, 3, 3) Readings and lectures in English for students majoring or minoring in other departments. (Same as Comparative Literature 4050-60-70.)

4160-70-80 Advanced Conversation (2, 2, 2) Intensive training in prepared and spontaneous conversations. Subjects range from travel and current events to literature and aspects of national culture. Prereq: Completion of 6 hrs of courses on 3000 level.

4220 Petrarch (3) Prereq: 3520 or equivalent.

4230 Boccaccio (3) Prereq: 3520 or equivalent.

4330 History of the Italian Language (3) Prereq: 3520 or equivalent.

4410-20-30 The Literature of the Rinascimento (3, 3, 3) From Pulci to Tasso, the Quattrocento, and the Cinquecento. Prereq: 3520 or equivalent.

4530 The Modern Novel (3) Prereq: 3520 or equivalent.

4540 The Modern Theatre (3) Prereq: 3520 or equivalent.

4610 Contemporary Theatre (3) Prereq: 3520 or equivalent.

4620 Contemporary Poetry (3) Prereq: 3520 or equivalent.

4630 Contemporary Prose (3) Prereq: 3520 or equivalent.

5011 Techniques in Literary Analysis (2) An intensive course in explication de texte.

5101 Foreign Study (1-12) See page 148.

5102 Off-campus Study (1-12) See page 148.

5103 Independent Study (1-12) See page 148.

5151-61-71, Bibliography and Methods of Research (1, 1, 1) (Same as French and Spanish 5151-61-71.) S/NC only.

5610-20-30 Readings in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of department.

5710-20-30 Seminar in Italian Literature (3, 3, 3) Topics vary and may be repeated with consent of department.

Portuguese

3510-20 Aspects of Portuguese Literature (4, 4) Prereq: Intermediate Portuguese or equivalent. Recommended for literature majors.

4310-20-30 Directed Readings in Brazilian and Portuguese Literature (3, 3, 3) May be repeated with consent of instructor.

5101 Foreign Study (1-12) See page 148.

5102 Off-campus Study (1-12) See page 148.

5103 Independent Study (1-12) See page 148.

Spanish

4030 Masterpieces of Spanish Literature in English Translation (3) No foreign language credit.

4040 Masterpieces of Spanish Drama in Translation (3) No foreign language credit.

4050-60-70 Hispano-Arabic Literature and Culture (3, 3, 3) 4050—General culture history, philosophy in Arab Spain. 5060—Development of the traditional marketplace story, episodic prose narrative, into the modern novel of character after the invention of print. 5090—Mutual influence of traditional Arabic poetry and the popular and native Spanish choral lyric; development of the classical muwashshah, the colloquial zahif, and the later villancico. Readings in Arabic and Spanish. (Same as Arabic 5070-80-90.)

5101 Foreign Study (1-12) See page 148.

5102 Off-campus Study (1-12) See page 148.

5103 Independent Study (1-12) See page 148.

5110-20-30 Old Spanish (3, 3, 3, 3) Medieval Spanish language and literature.

5121 College Teaching of Romance Languages (3) Seminars, demonstrations, and practical applications of techniques and procedures for teaching and evaluating basic language skills, cultural aspects, and beginning literature. Required of all M.A. and Ph.D. students holding Graduate Teaching Assistantships except those whose previous training or experience warrants their being excused by the department.

5151-61-71 Bibliography and Methods of Research (1, 1, 1) (Same as French and Italian 5151-61-71.) S/NC only.

5211 Don Quixote (3, 3) Must be taken in sequence.

5212-22-32 Goldene Age Prose (3, 3, 3) 5212—La Celestina; critical study of Fernando de Rojas' life and work. The Celestinesque genre; Feliciano de Silva's Segunda Celestina. 5222—Spanish philosophical thought; mystical prose; satirical works. 5232—Spanish and the Spanish picaresque genre.

531 The Exemplary Novels, Persiles y Sigismunda (3)

5250-60 The Generation of '98 (3, 3) 5250—Ansel Gavinet, Giner de los Ríos, Baroja, Unamuno, Unamuno, Benavente, Azorín, Pérez de Ayala.

5270 The Contemporary Novel (3) The Civil War and post-Civil War period.

5310-20-30 Directed Readings (3, 3, 3)

5311-21-31 Special Topics in Spanish or Spanish American Literature (3, 3, 3) May be repeated.
### Sociology

**MAJOR DEGREES**

<table>
<thead>
<tr>
<th>Sociology</th>
<th>M.A., M.A.T., Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professors:</strong></td>
<td></td>
</tr>
<tr>
<td>D. Beal (Head), Ph.D. North Carolina</td>
<td>J. A. Black, Ph.D. Iowa; D. J. Champion, Ph.D. Purdue; W. E. Cole (Emeritus), Ph.D. Cornell; L. E. Dotson, Ph.D. Vanderbilt; L. Ebersole, Ph.D. Pennsylvania; S. Wallace, Ph.D. Minnesota.</td>
</tr>
<tr>
<td><strong>Associate Professors:</strong></td>
<td>D. M. Botz, Ph.D. Michigan State; D. Clelland, Ph.D. Michigan State; D. Hastings, Ph.D. Massachusetts; T. C. Hood, Ph.D. Duke; R. Perrin, Ph.D. British Columbia; N. Shover, Ph.d. Illinois.</td>
</tr>
<tr>
<td><strong>Assistant Professors:</strong></td>
<td>S. Kurth, Ph.D. Illinois; S. Norlant, Ph.D. Iowa; T. Weirath, Ph.D. Wisconsin.</td>
</tr>
</tbody>
</table>

For a full statement of departmental requirements, students are referred to the Departmental Graduate Manual. All registration for 3000- and 4000-level courses requires the consent of the Instructor.

**THE MASTER'S PROGRAM**

The department offers both a thesis and non-thesis option for a Master's degree. For information concerning the Master's degree with thesis, see the General Requirements on page 19. Those interested in the non-thesis option should obtain details from the department.

**THE DOCTORAL PROGRAM**

General requirements for the degree of Doctor of Philosophy are described on page 22. Additional specific requirements for the degree of Doctor of Philosophy in Sociology include:

1. A minimum of 108 credit hours following the Bachelor's degree, exclusive of credits for the Master's thesis, is required. Of this number, 36 hours shall be allocated to doctoral research and dissertation. A maximum of 12 hours credit outside the major may be taken in related fields, with the approval of the student's committee. Exclusive of doctoral research and dissertation at least one-half of all credits shall be in courses numbered 5000 or 6000.
2. A written preliminary examination covering sociological theory, research methodology, and two other areas in sociology must be passed prior to admission to candidacy. This examination must be passed not later than one academic year before the date on which the degree is granted.
3. No later than one month before granting of the degree, the candidate will be required to pass an oral examination on the doctoral dissertation. At the oral examination the candidate will be expected to show a thorough knowledge of sociological theory and methodology related to the research.

**Sociology and Law (4)** A general treatment of the social origins and consequences of law and the legal process. Particular emphasis is placed on problems of law and social change, and on the structure and functioning of legal sanctions. Some attention is paid to paid and law-like phenomena in formal organizations and primitive societies.

**Population Problems (4)** Demographic factors and social structure; trends in fertility, mortality, population growth, migration, distribution, and composition; population policy.

**Topics in Social Psychology (4)** As Psychology 4120.

**Sociology of Punishment and Corrections (4)** Traces development of correctional movement, develops a critical sociological perspective on contemporary correctional programs, and provides overview of evaluative research in corrections.

**Criminology (4)**

**Urban Ecology (4)** Examination of public, private, corporate, and individual space. Classical school of ecology, its neoclassical reviewers, social area analysis, and cognitive symbolic ecology emphasized.

**Community Organization (4)** Structure; function; linkages; change and development; important community studies are reviewed and discussed. Emphasis on sociological analysis, not on the implementation of change.

**Social and Religious Change (4)** As Religious Studies 4540.

**Formal Organization (4)** Analysis of the bureaucratization process, division of labor, delegation of authority, channelled communication under a system of rationality.

**American Minority Groups (4)** Minority groups and social structure in American society; analysis of intergroup relations with attention given to non-past and present relationships of selected groups to broader society.

**Social Movements (4)** Development, organization, and function of social movements; attention is given to the ideology, leadership and organization of political, religious and other types of social movements.

**Sociology of Religion (4)** Interrelationship of society, culture, and religion. (Same as Religious Studies 4940.)

**Tradition, Change and Modernity in Asia (4)** (Same as Religious Studies 4960.)

**Thesis (1)**

**Non-Thesis Graduation Completion (3-15)** Required for the non-thesis student not otherwise registered during any quarter when such a 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.

**Methodological Issues in Social Research (3)**

**Seminar in Political Sociology (3)** The political system from the societal, organizational, and group perspectives.

**Special Social Investigation (3, 7)** Directed readings and/or research projects.

**Seminar in Collective Behavior and Social Movements (3)**

**Social Theory (3, 3)**

**Social Control (3)**

**Seminar in Sociology of Medicine (3)**

**Theory and Research in Human Migration (3)**

**Selected Topics in Migration Research (3)**

**Methods in Sociological Research (3)** A consideration of major methodological issues in sociology; scaling techniques; reliability, validity, sampling, and qualitative methodology.

**General Statistics (3, 3)** General survey of parametric and nonparametric procedures in analysis of sociological data; assumptions underlying procedures; advantages, disadvantages, and special applications. Must be taken in sequence.
Theatre

3121-22 Advanced Acting (4, 4) Historical styles of acting. 3121—Renaissance, 3122—seventeenth and eighteenth centuries.

3151-52 Major Productions (1-4, 1-4)

3153 Outdoor Repertory Production (4)

3221-22 Introduction to Scene Design (4, 4) Descriptive drawing as an approach to three-dimensional design; theatrical graphic standards; problems in stage design with reference to lighting; movement, scale and style. Prereq: Stagecraft or consent of instructor.

3252-53-54 History of the Theatre (4, 4, 4) Drama in perspective with particular emphasis on theatre architecture, scene design and acting styles. 3252—Antiquity to the Renaissance. 3253—The European Theatre, 1650-1850. 3254—Modern Theatre.

3262-63 History of American Theatre (4, 4) Development of theatre as social institution in American life. 3262—from its beginnings to 1900. 3263—from 1900 to present.

3271-72 Introduction to Lighting Design (4, 4) Mechanical and electrical aspects of stage lighting; elementary theory; problems in basic lighting practice. Prereq: Stagecraft and consent of instructor. Must be taken in sequence.

3451-52 Play Directing (4, 4) Must be taken in sequence. Prereq: Acting.

5431-43-44 Special Problems in Acting (4, 4) Advanced exercises in voice and movement; preparation of major role, with particular emphasis on relationship of character to stage; the application of costume and setting to the interpretation of character. Prereq: Basic stage costume or consent of instructor.

5439-40-41 Advanced Creative Writing (4, 4) Character development, plot structure, scene writing and directing. Prereq: 3151-52. Available for credit only to theatre majors Prereq: Consent of instructor.

5912 Play Production in Secondary Schools (4) Principles and methods for directing high school productions. (Same as Curriculum and Instruction 5912.)

5950-50-70 Studies in Dramatic Theory and Criticism (3, 3, 3)
Advanced Biology); and (7) a grade point average of 3.0 out of a possible 4.0. Otherwise superior students, deficient in one or more of the above requirements, may be admitted at the discretion of the Graduate Affairs Committee.

A course in biostatistics is required of all candidates for an advanced degree in Zoology.

All aspirants for advanced degrees in Zoology must exhibit competency in four (M.S.) or five (Ph.D.) of six areas of zoology as determined by a comprehensive examination. Students must take this examination during the fall quarter of the first year and may repeat the examination the following fall quarter if unsatisfactory scores are received. Competency must be exhibited within this two-year period for a student to continue in the program.

Preparation for thesis or dissertation: During the first year a written examination and a special research problem in each of two faculty members' laboratories will determine the student's preparation for thesis or dissertation study.

THE DOCTORAL PROGRAM

Special requirements in Zoology are as follows: (1) course requirements shall be determined by the candidate's faculty committee; (2) the preliminary examination will be an oral and written examination in zoology and in allied fields in which the candidate has had training; (3) the candidate for the Ph.D. degree must possess a reading knowledge of at least one foreign language in which there exists a sizeable amount of literature relevant to the major field of study. The student has the option of demonstrating a reading knowledge of this foreign language by (a) passing the official reading examination given by the language department or (b) earning at least a B in 3030 language courses. This requirement for the first language must be fulfilled before the student can take the preliminary examination.

The student's faculty committee may require of the student a level of training or proficiency in a second foreign language but may not require that the student take the official language examination in the second language.

3040 Natural History of the Vertebrates (5) Behavior, life history, physiology, and classification. 3 hrs and 2 labs or field periods.

3050 Comparative Vertebrate Embryology (5) Developmental morphology of selected vertebrates. 2 hrs and 3 labs.

3060 Comparative Vertebrate Anatomy (4) Anatomy of organ systems. Dogfish shark and cat used in laboratory. 2 hrs and 2 labs.

3071 Immunology (3) (Same as Microbiology 3071.)


3110 General Entomology (5) Introduction to insects: basic structure, development, behavior; classification of insect orders and representative families; interpretation and use of keys. Prereq: General Physiology or consent of instructor. 3 hrs and 2 labs.

3150 Invertebrate Zoology (5) Biology of invertebrates (except insects) with emphasis on ecology and behavior. Prereq: General Ecology. 3 hrs and 2 labs.

3220 Physiology of Reproduction (3) (Same as Animal Science 3220.)

3320 Histology (4) Study of animal tissues. Prereq: Cell Biology. 2 hrs and 2 labs.

3410 Bioethics (3) Relationship between biological discoveries and human values. Open discussion of selected dilemmas arising from new knowledge about medicine, behavior, resources, and technology.

4007, 4010-4017 Minicourse in Zoology (2 hrs each) Selected advanced topics in zoology, concentrated in time and subject matter. Consult departmental listing for actual topics to be offered. Prereq: As posted. May be repeated.

4050 Developmental Biology (4) Experimental morphogenesis, fertilization, cellular interactions, hormonal effects and related topics with examples drawn primarily from invertebrates and vertebrates. Prereq: 3050, Cell Biology and General Ecology. 2 hrs and 2 labs.

4120 Undergraduate Research Participation (2) Experiential research projects under supervision of staff members. Prereq: Consent of Instructor.

4190 Mammalogy (4) Classification, evolution, distribution, reproduction, populations, and behavior. 2 hrs and 2 lab or field periods.

4200 Ichthyology (5) Classification, collection and identification, distribution, life histories, and economic importance of fishes. Prereq: General Ecology or consent of instructor. 2 hrs and 2 lab or field periods.

4210 Cell Physiology (5) Development of modern concepts in cell physiology from point of view of information and control which examines kinetics and integration of cellular activities. Prereq: Cell Biology or any physiology, and Organic Chemistry. Recommended: Biochemistry. 3 hrs and 1 lab.

4240 Animal Ecology (4) Environmental factors determining the distribution and numbers of animals; interspecific relations; problems and methods. Prereq: General Ecology. 2 hrs and 2 labs.

4250 Comparative Animal Physiology I (3) Environmental physiology. Survey of physiological mechanisms and their relation to ability of animals to survive in diverse physical environments. Prereq: Cell Biology, General Ecology and 2 yrs chemistry.

4259 Comparative Animal Physiology Laboratory I (1) Coreq: 4250.

4260 Comparative Animal Physiology II (3) Sensory, effector, and integrative physiology. Prereq: Principles of Animal Physiology.


4270 Advanced Immunology (2) (Same as Microbiology 4270.)

4280 Comparative Endocrinology (5) Comparative analysis of the physiology and morphology of endocrine glands in vertebrates and invertebrates. Their role and interaction in maintenance of the organism and species. Prereq: Principles of Animal Physiology or 4270 and Endocrine Function. 3 hrs and 1-3-hr lab.

4290 Herpetology (4) Classification, distribution, life histories, collection and identification of amphibians and reptiles, notably of local species. 2 hrs and 2 labs or field periods.

4300 Ornithology (4) Morphology, physiology, behavior, reproduction, populations, evolution, field identification. 2 hrs and 2 labs or field periods.

4310 Nuclear Cytology (4) Chromosome structure and behavior in mitosis and meiosis. 1 hr and 3 labs. Prereq: General Genetics.

4320 Microtechnique (4) Prereq: 3320 recommended. 2 hrs and 2 labs.

4330 General Cytology (4) Study of cellular organelles at the light and electron microscope levels and the functioning of these organelles. Prereq: Cell Biology.

4369 General Genetics Laboratory (2) Experiments designed to illustrate basic principles of inheritance. Prereq: General Genetics. 2 labs.


4410 General Parasitology (4) Morphology, taxonomy and ecology of parasitic worms and protozoa, with emphasis on host-parasite relationships. 3 hrs and 1 lab.

4430 Medical Entomology (4) Distinctive morphological features, distribution, life histories, and control of arthropods that parasitize man or serve as vectors of human pathogens. Recommended prereq: Agricultural Biology 3210 or General Ecology. (Not open to students with credit for 3430.)

4450 Protozoology (4) Morphology, taxonomy, and physiology of protozoa in relation to fundamental biological concepts. 2 hrs and 2 labs. Recommended prereq: Cell Biology.

4610-20 Comparative Animal Pathology (2, 2) Abnormal morphological changes and their causes. 4610—Cell and tissue changes. 4620—Organ, organ system, and organism changes. Recommended: 3060, 3060, 3320.

4619-29 Comparative Animal Pathology Laboratory (2, 2) 4619—Animal and tissue changes. 4629—Organ, organ system, and organism changes. Coreqs: 4610-20.

4660-70 Limnology (4, 4) 4660—Effects of origin, age, and location of lakes on their physical and chemical nature. 4670—Lake communities, productivity and pollution. Prereq: General Chemistry, General Ecology. Recommended: General Botany and Introductory Physics. 2 hrs and 2 labs (4660); 3 hrs and 1 lab (4670). Must be taken in sequence, except with consent of instructor. Not open to students with credit for former 3640 or 4660.

4700 Arachnology (4) Biology of spiders, mites, scorpions, and relatives. Prereq: 3110, or 3150. 2 hrs and 2 labs.

4720 Comparative Animal Behavior (4) Methods and principles. (Same as Psychology 4720.)

4729 Comparative Animal Behavior Laboratory (4) Laboratory and field studies. Coreq: 4720. (Same as Psychology 4729.)

4810-20-30 Insect Morphology and Taxonomy (4, 4, 4) 4810—Internal morphology of both general and arthropod forms. 4820—Taxonomy of major orders. 4830—Taxonomy of minor orders and immature forms. Prereq: 3110 or consent of instructor for 4820-30. 2 hrs and 2 labs.
5000 Thesis

5500 Graduate Research Participation (5) Advanced research techniques are studied under the supervision of a staff research director whose interest and background matches the interests of the student. Open to all graduate students in good standing. Prereq: Consent of department and research director. Course may be repeated with consent of the department. S/NC only.

5110-20-30 Special Problems (2, 2, 2)

5150 Zoological Bibliography (1) Study and practice in methods of locating and using zoological literature, bibliographies, and abstracts, and of preparing bibliographies and scientific papers.

5180 Fresh Water Invertebrate Zoology (4) Ecology and taxonomy of fresh water invertebrates exclusive of insects. Laboratory and field study. Prereq: 3150.

5210 Plant Parasitic Nematodes (4) (Same as Agriculture 5210.)


5270 Advanced Neurophysiological Physiology (5) Cellular and molecular aspects of phenomena associated with conduction of excitement and muscular contraction. Prereq: 4250. 3 hrs and 2 labs.

5280 Insect Physiology (4) Functions and interrelationships among the systems relative to metabolism, growth, coordination, movement, and reproduction. Prereq: 4810, 1 yr General Zoology or consent of instructor. 2 hrs and 2 labs.

5290 Quaternary Problems (4) (Same as Geology 5290.)

5310-20 Seminar in the Teaching of College Zoology (2, 2) Current concepts and principles in the teaching of zoology; modern techniques and instrumentation; supervised application of teaching principles and methods. Must be taken in sequence. Prereq: Consent of instructor. S/NC only.

5350 Biometry (3) Statistical methods used in analysis of quantitative biological data. Prereq: 1 quarter statistics or consent of instructor.

5410 Advanced Parasitology (4) Life cycles, techniques of collection, preservation, and identification of parasitic worms and protozoa. Prereq: Consent of instructor.

5430 Advanced Medical Entomology (3) Prereq: 4330.

5550 Advanced Ornithology (4) Classification, distribution, and anatomy of birds. Prereq: 4300.

5570 Animal Populations (3) Characteristics and methods of study of animal populations.

5610-20 Foundations of Radiation Biology (4, 4) Physiological and biological mechanisms involved in the actions of different kinds of radiations on the living cell and its components. Recommended prerequisite: 1 yr biological science, General Physics; Biochemistry; Calculus. 3 hrs and 1 lab.

5620 Methods of Experimentation with Laboratory Mammals (3) Designed to give competence in handling selected mammalian species. Techniques of anesthesia, drug administration, radiography and surgery will be included. Prereq: 4650, or 4410, or consent of instructor.


5700 Cellular Immunology (4) Laboratory course with emphasis on immunological phenomena at the cellular level. Includes preparation and use of immunofluorescent reagents, macrophage migration inhibition, skin allograft reactions, diffusion chamber cultures, and antibody formation at the cellular level. Recommended prerequisite: Immunology. 4 hrs and 2 labs.

5760 General Vertebrate Neuroanatomy (3) (Same as Psychology 5760.)

5780 Radiobiology (4) Effects of different kinds of radiations on the functions of cells, tissues, and organ systems of animals. Recommended prerequisite: 5610.

5790 Transport of Ions Across Epithelia (4) A laboratory course designed to teach the operational principles and methods needed to study the electrical and kinetic properties of epithelia and electrically excitable tissues. Emphasis will be on quantitative methods of measuring ion fluxes and flux ratios. Prereq: Two upper-division physiology courses, graduate standing, or consent of instructor. Recommended prerequisite: Chemistry 3810.

5820 Methods of Taxonomy (4) Methods employed in classification of animals; rules of nomenclature; preparation of keys, descriptions, and figures. Prereq: Consent of instructor.

5840 Aquatic Insects (4) Taxonomy and biology of aquatic insects, with emphasis on immature forms. Offered spring quarter. 2 hrs and 2 labs.

5860 Geographic Distribution of Animals (4) Distribution patterns of vertebrate and invertebrate animals in all major habitats. Prereq: Consent of instructor.

5870 Insect Systemecology (4) Ecology of insect communities.

6000 Doctoral Research and Dissertation

6110 Seminar in Cellular Biology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6140 Seminar in Immunobiology (2) Prereq: Consent of instructor. May be repeated. Maximum 6 hrs.

6210 Seminar in Physiology (2) Prereq: Two physiology courses or consent of instructor. May be repeated. Maximum 6 hrs.

6310 Seminar in Cytology (2) Prereq: 4310. May be repeated. Maximum 6 hrs.

6320 Seminar in Developmental Biology (2) Prereq: 4320, 4330; Biochemistry 4110-20. 4 hrs.

6410 Seminar in Parasitology (2) Prereq: 5410. May be repeated. Maximum 6 hrs.

6510 Seminar in Genetics (2) Prereq: General Genetics. May be repeated. Maximum 6 hrs.

6610 Seminar in Ornithology (2) Prereq: 4300. May be repeated. Maximum 6 hrs.

6850 Seminar in Aquatic Biology (2) Prereq: At least one of Zoology 5610, 5620 or 5770 or 5780, or Zoology 5350 or Plant and Soil Science 3610, 4 Chemistry 3810, 5 Biochemistry 4110-20 or 5510-20-30. (At least one-half of the student's program must be at the 5000 level.) A thesis is required of all students.

Interdepartmental Program in Radiation Biology

MAJOR

DEGREES

Radiation Biology

M.S., Ph.D.

Daniel Billen, Director

A graduate major in the field of Radiation Biology is offered through the Institute of Radiation Biology. This is a program crossing both departmental and institutional lines. Included on the Institute staff are certain scientists from the Departments of Biochemistry, Botany, Chemistry, Microbiology, Physics, Zoology and the Memorial Research Center and the Comparative Animal Research Laboratory of The University of Tennessee, the Biology and Environmental Sciences Divisions of the Oak Ridge National Laboratory, and the Medical Division of Oak Ridge Associated Universities.

Formal courses in this program are offered mainly on the Knoxville campus. Thesis research may be carried on either at the University or, by special permission, at one of the Oak Ridge laboratories. Problems selected for thesis research shall involve the interaction of radiations or long-lived fission products with biological systems, at the molecular, cellular, organismal, or ecological level of complexity. Areas of radiation specialization include biochemistry, biophysics, cytology, ecology, electron microscopy, genetic and epigenetic problems, immunology, genetics, hematology, immunology, microbiology, molecular biology, oncology, parasitology, pathology, physiology, and tissue culture.

ADMISSION REQUIREMENTS

The minimum academic requirements for admission to the Institute are: (1) A Bachelor's degree from an accredited college or university, (2) biological science, chemistry, physics: 30 quarter hours in one and 12 in each of the others, (3) college mathematics: potential candidates for the Master's degree, 9 quarter hours; potential candidates for the Doctoral degree, differential and integral calculus, (4) for the Ph.D. program, Graduate Record Examination scores.

THE MASTER'S PROGRAM

Course requirements shall include: (1) Zoology 5610, 5620 or 5770 or 5780, (2) Zoology 5350 or Plant and Soil Science 3610, 4 Chemistry 3810, 5 Biochemistry 4110-20 or 5510-20-30. (At least one-half of the student's program must be at the 5000 level.) A thesis is required of all students.
THE DOCTORAL PROGRAM

(1) Courses: In addition to those required for the Master's degree, Chemistry 4910-20-30 or 3410-20-30, Physics 3710-20-30; (Chemistry 3810 may be substituted for Physics 3730); Zoology 5620. Additional course requirements are determined by the student's faculty committee. The student's special field of interest and plans for a career determine these requirements. The more important courses from which selection may be made are advanced courses in biochemistry, botany, chemistry, electrical engineering, mathematics, microbiology, physics, and zoology. Courses are available in the University of Tennessee Graduate School of Biomedical Sciences at Oak Ridge. (2) The preliminary examination will consist of oral and written portions in radiation biology and in allied fields in which the candidate has received training. (3) Candidates will be required to pass, before the preliminary examination is taken, the official reading examination of the University in only one foreign language, or must earn a B average or at least a B in the last quarter of an appropriate language sequence, but the student's faculty committee may require other levels of training or proficiency in an additional foreign language. (4) The final examination will be an oral examination covering the candidate's dissertation and such other fields as the candidate's faculty committee may specify.

Regular attendance at the weekly Radiation Biology Seminar or an appropriate Departmental Seminar is expected of all students.

General Information

FOREIGN STUDY COURSES

Foreign study courses offered in some departments of the College provide an opportunity to undertake independent study outside the United States. Prior to departure the student must have a plan of study approved by the department head and a supervising faculty member of the department concerned. Credit will be given only upon fulfilling all requirements set by the department and may vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

INDEPENDENT STUDY

Certain educational goals may best be met through independent study done by an individual under the direction of a faculty member. Students who wish to do such independent work should obtain the approval of the faculty members and the departments concerned prior to embarking upon their study. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

OFF-CAMPUS STUDY

Recognizing that learning is not restricted to formal classroom situations, the College provides for students to earn credit toward graduation for approved off-campus study. Such study may be undertaken only with prior approval of the faculty member and the department concerned. It may include certain kinds of work experiences, community involvement, working in political campaigns, etc. Credit per quarter will vary from 1-12 hours. The maximum credit which may be applied toward a degree in the College is established in each individual case by the department in which the student is working.

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MAJOR DEGREE

The College of Nursing offers a five-quarter program of study leading to the Master of Science in Nursing degree. The general purpose of the program is to prepare at the graduate level nurses who are qualified to function as practitioners, clinicians, educators, and administrators in all segments of the health care delivery system.

Upon successful completion of the program, graduates will be able to:

1. Provide advanced high quality, comprehensive nursing care to individuals and groups in a variety of settings;
2. Collaborate with other health professionals in systematic implementation and evaluation of health care delivery to large groups in agency and community settings;
3. Utilize appropriate advanced teaching, administrative and clinical practice skills in the discharge of one's professional responsibilities;
4. Utilize appropriate research findings in the implementation and evaluation of nursing care;
5. Participate in clinical research activities by means of data collection, tabulation, and analysis, and by generating research topics for referral to nurse researchers.

GENERAL REQUIREMENTS FOR ADMISSION

1. Meet requirements for admission to the Graduate School.
2. Hold a Bachelor's degree in Nursing. If the Bachelor's degree is not in Nursing the applicant must demonstrate successful completion of the equivalent of an upper division major in Nursing.
3. If the number of qualified applicants exceeds the number that can be accommodated, preference will be given to applicants:
   a. whose undergraduate GPA is 3.0 or higher;
   b. who have had at least two years of full-time clinical practice experience following completion of a baccalaureate nursing program;
   c. who are Tennessee residents;
   d. who are currently employed in underserved health service areas and who can demonstrate their commitment to return to those areas following completion of the program; or
   e. who are currently employed as nurse educators in programs preparing registered nurses; or
   f. who are currently employed as directors of nursing service.
4. Ordinarily one year of full-time clinical practice experience should be completed prior to applying for admission to the program.

DEGREE REQUIREMENTS

1. Students must complete 60 quarter hours of graduate level course work with a cumulative grade point average of 3.0 or better.
2. The 60 credit hours must include the following components:
   a. Core requirement: 14 hrs
   b. Clinical concentration option: 26 hrs
   c. Functional concentration option: 11 hrs
   d. Electives: 9 hrs
3. A Master's thesis is not required, but those students who wish to complete a thesis as a part of their program may substitute the thesis for the 9 elective hours.
4. Those students who do not choose the thesis option must successfully complete a comprehensive final examination.
5. Students may choose either primary or secondary care as a clinical concentration option. Students selecting the primary care nursing clinical option must complete the following courses: 4770, 5220, 5240, 5260, 5550, 5650. Students selecting the secondary care nursing clinical option must complete the following courses: 5120, 5130, 5160, 5310, 5330.
6. The core requirement which must be completed by all students regardless of clinical option includes 5010, 5020, 5210, and a 4-hour graduate level statistics course which must be approved in advance by the student's faculty advisor.
7. Students may select a functional concentration option in teaching, management or advanced clinical practice. Students selecting the teaching option must complete 6 hours of graduate level courses in education and 5630. Students selecting the management option must complete 6 hours of graduate level courses in administration and 5730. Students selecting the advanced clinical practice option must complete 5560 and 5660 if their clinical option is primary care or 5320 and 5340 if their clinical option is secondary care. All courses taken in other colleges must be approved in advance by the student's faculty advisor.
5210 Nursing Research Methods (4) Utilization of the research process to identify and solve common nursing problems; methods of data collection and analysis; effective use of the literature; approaches to presentation and publication of findings. Prereq: Graduate level course in behavioral or biomedical statistics.

5220 Principles of Health Maintenance (3) Health and its meaning to various community groups; health screening, counseling, and education as approaches to health maintenance, health promotion, and its relationship to the quality of life; the economics of health maintenance. Prereq: 5010.

5240 Management of Common Health Problems (4) Indications for treatment and referral; use of protocols and treatment plans; pharmacological agents in common use; intervention in emergencies. Prereq: 5010, 5220. 2 hrs and 2 labs.

5250 Chronic Health Problems (4) Identification and in-depth exploration of health problems of a long term or life long nature which are common to people in various age groups over the life continuum; nursing and health care management of individuals and groups who must deal with one or more chronic health problems throughout most or all of their lives. Prereq: 5220. 2 hrs and 2 labs.

5260 Advanced Family Health Care (4) Nursing and health care management of families in the child-bearing and child-rearing stages of development; advanced developmental theory, changing family dynamics, management of women during pregnancy, labor and delivery, and post partum period, assessment of newborns. Prereq: 5220. 2 hrs and 2 labs.

5310 Secondary Care Nursing Field Work I (8) Advanced clinical practice in acute care hospital settings with opportunities to apply newly acquired nursing knowledge to more complex clinical nursing situations. Prereq: 5120-30 or 5140-50.

5320 Secondary Care Nursing Field Work II (9) A continuation of 5310 with emphasis on further acquisition and refinement of nursing skills needed to provide high quality nursing care to acutely ill patients. Prereq: 5310.

5330 Secondary Care Nursing Seminar I (2) A weekly on-campus seminar taken concurrently with 5310; seminar topics will focus on a discussion of nursing problems commonly encountered in acute care settings.

5340 Secondary Care Nursing Seminar II (2) A continuation of 5330 to be taken concurrently with 5320.

5410 Principles of Community Mental Health I (3) The epidemiology of mental health; sociocultural, religious, and economic variables affecting the mental health status of individuals, families, and communities, function and status of community mental health centers.

5420 Principles of Community Mental Health II (3) A continuation of 5410 with emphasis on recognized and developing approaches to mental health promotion and maintenance.

5430 The Adult and Mental Health (3) Coping and adjustment problems commonly experienced from post adolescence through middle adulthood; nursing approaches to the alleviation of mental health problems of both institutionalized and noninstitutionalized adults will be explored and analyzed.

5550 Nurse Practitioner Fieldwork I (6) Placement in selected off-campus primary health care delivery site for purposes of applying newly acquired knowledge and developing clinical skills necessary to function as a nurse practitioner. Prereq: 5240-50-60.
Graduate School of Biomedical Sciences

W. E. Barnett, Director
R. J. Preston, Associate Director

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 Doctor of Philosophy degrees. The National Laboratory, one of three installations operated at Oak Ridge by Union Carbide Corporation for the Department of Energy, 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.

The school is not departmentalized, and, apart from certain basic requirements, 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 research areas available for Master’s and Ph.D. dissertation work are biochemistry, biophysics, carcinogenesis, cell biology, genetics, and physiology. Included are such subjects as microbiology, immunology, protein and enzyme chemistry, nucleic acid chemistry, cytology, radiation biology, virology, developmental biology, experimental pathology, microbial and mammalian genetics, mutagenesis, and problems of aging.

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 previous training in biology, calculus, physics, organic and physical chemistry. However, a course in physical chemistry is offered by the school in order to meet this requirement. It is recommended that deficiencies in meeting entrance requirements should be eliminated prior to entrance.

Requests for application forms, information on admission, financial support, and housing should be sent to: Director, University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, Biology Division, ORNL, Box Y, Oak Ridge, Tennessee 37830.

SPECIAL MASTER OF SCIENCE DEGREE PROGRAM

2. Three quarters of Biomedical Sciences Laboratory 5310-20-30-40.
3. Participation in Biomedical Sciences Seminar (5350-60-70) for one year.
4. Participation in at least one of the seminar courses (6110-70) during each quarter of residence after the first year is strongly recommended.
5. 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.
6. Pass both written and oral examinations.
7. A dissertation reporting the results of original and significant scientific research. A minimum of 36 quarter hours of course 6000 is required.
8. A final oral examination on the dissertation.
9. A formal seminar presentation of the dissertation research.

THE DOCTORAL PROGRAM
Requirements for the Ph.D. degree are:

1. Satisfactory (B grade or better) completion of the following core courses or their equivalent: Biochemistry (5110-20); Biophysics (5140); Genetics (5160); Molecular Genetics (5170); Cell Biology (5180-90); Mammalian Physiology (5200) and Statistics for Biologists (5740).

2. Three quarters of Biomedical Sciences Laboratory 5310-20-30-40.
3. Participation in Biomedical Sciences Seminar (5350-60-70) for one year.
4. Participation in at least one of the seminar courses (6110-70) during each quarter of residence after the first year is strongly recommended.
5. 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.
6. Pass both written and oral examinations.
7. A dissertation reporting the results of original and significant scientific research. A minimum of 36 quarter hours of course 6000 is required.
8. A final oral examination on the dissertation.
9. A formal seminar presentation of the dissertation research.

Specific 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 as space is available.

Requirements for the M.S. degree are:
1. Graduate credit or a proficiency in the following core courses: Biochemistry (5110-20); Cell Biology I (5180); Cell Biology II (5190); plus any three of the following four courses: Biophysics (5140); Genetics (5160); Molecular Genetics (5170); and Mammalian Physiology (5200). Additional credits may be obtained (6 to 15 credit hours) with electives. The student will need previous training in biology, calculus, physics, organic and physical chemistry.
2. Forty-five credit hours of approved graduate courses including a minimum of 9 quarter hours for thesis (maximum 18 quarter hours of credit for course 5000).

3. For admission to candidacy:
   - Completion of 20 graduate courses including a minimum of 9 quarter hours for thesis (maximum 15 quarter hours of credit for course 5000).
   - A B average admission to candidacy forms must be filed at least one full quarter 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. Pass a final oral (or oral and written) examination as determined by the student's committee.

Full-Time Faculty

Professors:
- D. Biller, Ph.D. Tennessee; D. E. Olin, Ph.D. Rockefeller.

Associate Professors:
- F. H. Gaertner, Ph.D. Purdue; F. D. Hamilton, Ph.D. Pittsburgh.

Assistant Professors:
- N. W. Revis, Ph.D. Glasgow, Scotland.

Research Assistant Professor:
- C. T. Hadden, Ph.D. Washington.

Shared Faculty

Not all faculty listed are necessarily available in teaching and/or research roles in the graduate school.

- L. B. Russell, Ph.D. Chicago; W. L. Russell, Ph.D. Chicago; G. A. Segal, Ph.D. Louisiana State; J. K. Rittenberg, Ph.D. Syracuse.
- F. L. Snyder, Ph.D. North Dakota; A. L. Stevens, Ph.D. Western Reserve; J. B. Storer, M.D. Chicago; J. Studier, Ph.D. Minnesota; D. C. Swartzwender, Ph.D. Iowa; P. A. Swenson, Ph.D. Stanford.
- R. A. Wallace, Ph.D. Columbia.
- L. C. Waters, Ph.D. Georgia; C. H. Wei, Ph.D. Wisconsin; R. W. Tennant, Ph.D. Tennessee Medical Units; W. K. Yang, Ph.D. Tulane.

* Staff of Oak Ridge Associated Universities

Courses

The courses below are not necessarily taught every year.

5000 Thesis

5070-80 Physical Chemistry for the Life Sciences (3, 3) Thermodynamics, phase equilibria; chemical equilibria; electrolyte solutions; surface chemistry, electrolyte solutions, kinetics, conductance, viscosity, diffusion.


5140 Biophysics (3) Energy levels and excited states of large molecules; optical instrumentation; adaptations to system perturbations; properties of macromolecules; solutions; molecular conformation; inter- and intramolecular forces; physical principles of microscopie. Prereq: 5070-80.

5160 Genetics (5) Mendelian genetics, mitosis and meiosis. Genetics of phage, bacterial and eukaryotic organisms. Mapping and linkage; mutagenesis; cytoplasmic inheritance; mechanism of recombination; chromosome structure, replication, and segregation.

5170 Molecular Genetics (3) Molecular biology of genetic processes. Gene regulation; coding; protein synthesis; mechanisms of micro, sense and nonsense mutations; mutagen mechanisms; complementation; recombination. Prereq: 5110-20, 5160.

5180 Cell Biology I (3) Structure and composition of major macromolecular and organelles of eukaryotic cells. Pertinent instruments and techniques; meiosis and mitosis; cell cycle; chromosome structure; nuclear RNA metabolism; nucleoli and ribosome biogenesis; survey of specialized cells. Structure of genetic transcription and translation in bacteria. Coreq: 5110.

5190 Cell Biology II (3) Comparative biochemical approach to cell structure and function. Membrane systems and metabolism; development and function of mitochondria, chloroplasts, peroxisomes and other organelles as related to metabolism and regulation of transport phenotypes; cell cycle. Coreq: 5110, 5180. Coreq: 5120.

5200 Mammalian Physiology (4) Survey of mammalian organ systems and their functions. Nervous, muscular, endocrine, digestive, respiratory, circulatory, reproductive, and excretory systems will be included; interrelationships of these systems will be stressed. Prereq: 5070-80. Coreq: 5100.

5230 Biochemical Concepts in Medical Sciences (3) Biochemical mechanisms involved in physiological conditions and pathological processes of human body. Dynamic functions of organ systems; biomedical and pharmacological hormone actions; neurophysiology. Emphasis is placed on current biochemical advances in basic and clinical medicine. Prereq: 5200, 5110-20.

5310-20-30-40 Biomedical Sciences Laboratory (3, 3, 3, 3) Laboratory courses designed to acquaint students with both the approaches and technologies in various areas of modern biology. Students will spend a quarter in each of three or four laboratories conducting research in different areas of modern biological science. Required of all first-year students.

5530-60 Biomedical Sciences Seminar (1, 1) Critical analyses of current journal publications in a selected area of modern biology. Written evaluation of papers and weekly oral presentations by each student. Required of all first-year students.

5570 Biomedical Sciences Seminar (1) Basic principles of scientific writing. Research articles, grant and thesis proposals, abstracts, review articles, progress reports. Required of all first-year students.

5940-50 Graduate Research Participation (3, 3) Special problems, projects, and experiments designed to cover an area not related to dissertation research. Topics chosen with consent of instructor. May be repeated.

5950-60-70 Special Topics in Biomedical Sciences (3, 3, 3) Given either as tutorials or as formal lectures. Potential topics for such courses include X-ray diffraction and crystallography, excited-state biophysics, physical chemistry of macromolecules; computer science; pathology; cytology and cyogenetics; mammalian genetics; cancer research; plant physiology; radiation biology; aging research. Additional courses can be developed on any subject of mutual interest to individual students and staff members. May be repeated.

5700 Developmental Biology (3) Principles of early embryogenesis and tissue interactions that initiate cellular differentiation. Emphasis on mechanisms of differential gene action and regulation that are pertinent to cellular differentiation. Prereq: 5200, 5170, 5200.

5740 Statistics for Biologists (3) Application and interpretation of statistical methods in biological research. Random samples and populations; binomial, and Poisson distributions, statistical presentation of data; estimation, variance, correlation, and association; least squares, correlation and association; linear regression. Prereq: Introductory Statistics or consent of instructor.

5750 Experimental Design in Biomedical Research (3) Requirements for a valid experiment; designs for the reduction of error, including paired comparisons, randomized blocks, and Latin squares; use of supplementary observations to reduce errors; randomization; investigating several variables simultaneously by factorial and fractional factorial experiments; determining the number of observations. Prereq: 5740.


5840 Bioorganic Reaction Mechanisms (3) Nature of the chemical bond, nucleophile and electrophile reactions, molecular rearrangements, oxidation-reduction, solvolysis, protein and nucleic acid modification reagents, reactions involving proteins and nucleic acids on polymer supports.
5860 Cryobiology (3) Physical and chemical responses of cells at low temperatures and ice formation. Relation of these responses to permeability, structure of semipermeable membranes, conformation of macromolecules, and the nature and state of water in cells; and how they bear on other fields of biology and medicine—including electron microscopy, photobiology, cell physiology, exobiology, and cryosurgery. Prereq: 5070-80 or equivalent, and 5130.

5920 Mammalian Genetics (3) Orderly presentation of known genetic variants affecting each of the organ systems of experimental mammals, especially the laboratory mouse. Prereq: 5170.

5948 Classic Experiments in Genetics (3) Original papers presenting new and lasting concepts in genetics will be read and discussed. Prereq: 5170.

6000 Doctoral Research and Dissertation.

6110 Seminar in Plant Physiology (1) May be repeated. Maximum 12 hrs. S/NC only.

6120 Seminar in Cellular and Developmental Biology (1) May be repeated. Maximum 12 hrs. S/NC only.

6130 Seminar in Genetics (1) May be repeated. Maximum 12 hrs. S/NC only.

6140 Seminar in Mammalian Research (1) May be repeated. Maximum 12 hrs. S/NC only.

6150 Seminar in Immunology (1) May be repeated. Maximum 12 hrs. S/NC only.

6160 Seminar in Biophysics (1) May be repeated. Maximum 12 hrs. S/NC only.

6170 Seminar in Biochemistry (2) May be repeated. Maximum 24 hrs. S/NC only.

6180 Advanced Seminar in Biomedical Sciences (1-3) Presentation, evaluation and discussion of current research in the various areas of the biomedical sciences, including cell biology, genetics, biophysics, and biochemistry. Prereq: Consent of instructor. May be repeated. S/NG only.

6190 Seminar in Animal Virology (1) Discussion of experimental data and in-depth surveys of active research problems in virology through use of literature. May be repeated. Maximum 12 hours. S/NC only. Prereq: Microbiology 4521 or equivalent and consent of instructor.

6200 Nucleic Acid Chemistry (3) Chemistry of nucleotide-derived materials covering topics including alkylation, solvolysis, oxidation-reduction, polymerization, synthesis, denaturation and other structure perturbants. The reaction of nucleic acids in the above systems will be examined with emphasis on the relationship of structure and reactivity. Prereq: 5110-20. Coreq: 5080.

6210 Protein Chemistry and Enzyme Mechanisms (3) Theoretical and practical aspects of protein chemistry including chemical and physical characterization of proteins, chemical modification of proteins, and structure-function relationships. The latter will emphasize enzymes and will include approximation of substrates, covalent catalysis, general acid-base catalysis, and strain and distortion of substrates. Prereq: 5110-20.


6240 Chemistry and Metabolism of Lipids (3) Nomenclature, chromatographic isolation, chemistry, physical properties, and enzymology of lipids. Hormonal action of prostaglandins and the role of lipids in membranes, enzymatic expression, and nervous tissue. The main emphasis is on lipid biochemistry of mammals, although comparative aspects, particularly the lipid pathways in bacteria and yeast are also described. Prereq: 5110-20.


6260 Advances in Animal Virus Research (3) Mechanisms of infection, replication, and mutation; alternations of host cell structure and function; host immunological responses; oncogenesis; pathogenesis; genetics; interferon. Prereq: 5110-20, 5180-90.

6270 Viral Carcinogenesis (3) History of viral oncolgy and descriptive catalog of tumor viruses. The biology of normal and transformed cells. DNA tumor viruses: replication cycle; transformation; genetics; natural history. RNA tumor viruses: endogenous and exogenous states; genetics; induction; transformation; natural history.


6290 Cancer Biology and Biochemistry (3) Pathology and nomenclature of cancer. Tumor immunology and immunotherapy. Biochemistry of tumor cells; enzymology, metabolism; membranes; DNA repair; regulation; strategies in chemotherapcy.

6300 Mutagenesis (3) Course will include basic mechanisms in chemical and radiation mutagenesis and dosimetry in a variety of systems including bacteria, fungi, Drosophila, and mice.

6510-20-30-40 Advanced Topics in Biomedical Sciences (3, 3, 3, 3) Emphasis on current and future research developments. Offered on the topics listed under the Special Topics Courses and can be taken either as tutorials or as literature survey courses requiring substantial student participation. May be repeated.
Graduate School of Library and Information Science

Gary R. Purcell, Director

MAJOR
Library Science

DEGREE
M.S.L.S.

The Graduate School of Library and Information Science provides a library education program leading to the preparation of librarians for work in all types of libraries. The programs of study of this School include the graduate curriculum leading to the degree of Master of Science in Library Science.

MAJOR OF SCIENCE
IN LIBRARY SCIENCE

The objective of the program is to prepare responsible and competent individuals to assume a professional role in libraries and information centers in society and the processes by which knowledge is communicated through the medium of the graphic record. Students acquire a familiarity with the bibliography and the literature of various subject fields. They are expected to develop the ability to evaluate and use various types of print and non-print materials. Students are also introduced to current concepts of the management of library operations and services.

PROGRAMS OF INSTRUCTION

The program leading to the degree of Master of Science in Library Science involves a total of 51 quarter hours of graduate courses, 21 hours of which form a core curriculum required of all students. Either a thesis or a non-thesis program is available, with 9 hours allowed for thesis credit. At least 36 hours must be taken in the GSLIS, allowing up to 15 hours outside the school. Upon completion of the program, all students are subject to an examination. For students who elect the thesis option, the examination will be a defense of the thesis. Students who elect the non-thesis option will be given a written comprehensive examination. Programs are designed for persons interested in school libraries, public libraries, academic libraries, information science/technical information service, and library management.

ADMISSION REQUIREMENTS

The minimum grade point average for admission to the Graduate School is 2.5. Candidates who have at least a 3.0 average in the junior and senior years will receive first consideration. Applicants are required to take the aptitude test of the Graduate Record Examination. The test should be taken at least one quarter in advance of application for admission to the Graduate School.

Foreign applicants are required to take the Test of English as a Foreign Language.

APPLICATION PROCEDURE

Admission to the programs in the Graduate School of Library and Information Science should be made in advance of the quarter for which admission is requested. Applicants should submit the "Application for Admission" form (printed as the first page of the Graduate School Catalog) and should request the registrars of all colleges and universities attended to send two official transcripts to the Graduate School. In addition, each applicant should make arrangements to take the GRE and TOEFL exams, if applicable. A personal data sheet and three recommendations (obtained from the Graduate School of Library and Information Science) should be returned to the Director of the School.

FINANCIAL ASSISTANCE OPPORTUNITIES

Arrangements made with the University of Tennessee Libraries provide a work-study plan for selected students who wish to obtain experience in academic librarianship while pursuing the degree. Such students are expected to work at least 20 hours each week and to extend the period required for the degree to approximately two years.

Similar arrangements exist with some of the other libraries in the Knoxville area. A limited number of graduate assistantships are available through the School for the degree. Assistantships of this type carry a waiver of tuition and fees as well as a stipend, and require that recipients work 10 hours per week in the School.

Information on financial assistance is available from the Director of the Graduate School of Library and Information Science.

Faculty

Professors:
J. Knightly, Ph.D. Illinois; G. R. Purcell (Director), Ph.D. Case Western Reserve.

Associate Professors:

Assistant Professors:
J. Pemberton, Ph.D. Tennessee; G. M. Sinkenbae, Ph.D.

Pittsburgh; P. Wilson, Ph.D. Michigan.

Courses

4140 Libraries and Librarianship (3) Librarianship as an occupation: its organization, responsibilities, problems and prospects.

4150 School Library Administration (3) Objectives, functions, and place of the school library; relationship to local and state services; cooperative planning for quarters and materials; evaluation. (Same as Curriculum and Instruction 4150.)

4270 Organization of Library Collections I (6) Acquisitions, cataloging and maintenance of library collections.

4330 Introduction to Reference Materials (3) Basic information sources and services for all libraries.

4750 Utilization of Instructional Media (3) (Same as Curriculum and Instruction 4750.)
5000 Thesis

5022 Non-Thesis Graduation Completion (3-15)
Required for the non-thesis student not otherwise registered during any quarter when such a student uses university facilities and/or faculty time before degree is completed. May not be used to fulfill degree requirements. May be repeated. S/NC only.

5110-20-30 Problems in Library Science (3, 3, 3) May be repeated with consent of the school.

5140 Research Methods in Library Science (3)
Research methods applicable to librarianship. Emphasis on the process and conduct of research; includes analysis of published research.

5200 Subject Reference and Bibliography (3)
General patterns of bibliographical organization and basic information sources in subject fields, including non-English materials; experiences in bibliographic methods and search techniques. Prereq: 4390.

5210 Sources and Services for the Social Sciences (3)
Study and use of English and non-English literature and bibliographical sources in education, economics, political science, history, geography, anthropology, psychology, and sociology; emphasis on organization of collections for optimum use. Prereq: 5200.

5220 Sources and Services for the Natural Sciences (3)
Use of English and non-English literature and bibliographical sources in mathematics, physics, astronomy, chemistry, geology, biology, and medicine; emphasis on organization of collections for optimum use. Prereq: 5200.

5230 Sources and Services for the Humanities (3)
Use of English and non-English literature and bibliographical sources in literature and language, fine arts, music, philosophy and religion; emphasis on organization of collections for optimum use. Prereq: 5200.

5240 Organization of Library Collections II (3)
Construction and maintenance of the Library of Congress system, and problems in reclassification. Prereq: 4270.

5250 Government Publications I (3)
The acquisition, organization, and utilization of federal, state, and local government publications, publications of Congress, executive branch agencies and the Federal courts as well as government research and development report literature.

5260 Government Publications II (3)
Acquisition, organization and utilization of the publications of foreign governments and international organizations such as the United Nations, UNESCO, and others.

5270 Legal Bibliography (3)
Introduction to the literature of Anglo-American jurisprudence. Emphasis on use of reports, statutes, administrative regulations and decisions, treatises, periodicals, and indexes as bibliographic tools.

5300 Library Management (3)
A basic overview of management and organization concepts applicable to libraries and librarians.

5310 Library Systems and Services (3)
National, state, and regional systems of library service with attention to organization and planning, staff utilization, service standards and evaluation, and problems of jurisdictional relationships brought about by organizational patterns in multunit public library service systems.

5320 Library and Information Networks (3)
National and regional information systems will be examined. Primary attention will be given to the design and analysis of existing systems within the academic or special library sphere.

5330 Academic Libraries (3)
Discussion of persistent and current problems. Topics vary depending upon needs and interests of the group.

5350 School Libraries (3)
Discussion of persistent and current problems. Topics vary depending upon needs and interests of the group.

5360 Technical Libraries and Information Centers (3)
Purpose, functions and organizational characteristics of those libraries and information centers, private and public, which offer scientific and technical information services. Problems related to the acquisition, organization and servicing of technical information collections.

5370 The Library in the Community (3)
The role of the public library as a social agency; its role in the education and communication systems of the community.

5380 Seminar: Academic, Public, School or Special Libraries (3) Prereq: Consent of instructor.

5400 Library Facilities (3)
Problems inherent in the planning and construction of libraries. Examination of the interrelationship of staff, materials and user space requirements.

5500 Principles of Materials Selection (3)
Philosophy and practice of building library collections in the light of library objectives.

5510 Multimedia Resources of Libraries (3)
Selection, acquisition, processing, storing, and servicing nonbook materials, with special attention to films, recordings, microforms, photocopying.

5520 History of Books and Printing (3)
development of the book in its various forms. History of the alphabet and writing; early writing materials; book in manuscript; history and technique of printing; book illustration and binding; standards of modern fine printing.

5530 Contemporary Publishing (3)
Creation, production, marketing, and distribution of materials acquired by libraries, with special attention to various types of publishers.

5540 Special Collections—Archives and Rare Books (3)
Problems involved in the acquisition, selection, processing, preserving and utilization of rare books and archival materials.

5550 Reading Guidance for Children and Young People (3)
Organization to meet needs, interests, abilities of different age and socio-economic groups. Prereq: 5640 or consent of instructor.

5560 Mass Communications and the Library (3)
Mass media of communication in terms of their relation to modern library service, considered as forces that influence what people read, see, and hear.

5562 Traditional Literature and Oral Narration (3) Fundamental principles of the art of storytelling including techniques of adaptation and presentation for various age groups; instruction and practice in oral techniques.

5563 Critical History of Children's Literature I (3)
Development of literature for children noting influence of changing social and cultural factors; attention to emerging genres through primary sources. Fifteenth century to 1920.

5564 Critical History of Children's Literature II (3)
Development of literature for children noting influence of changing social and cultural factors; attention to emerging genres through primary sources. 1920 to present.

5591 Advanced Production of Audiovisual Software (3) (Same as Curriculum and Instructional Media 5591.)

5700 Automation of Library Processes (3)
Analysis of the application of data processing methods to basic library operations such as bibliographic control, technical processes, circulation control, and management functions.

5710 Introduction to Information Science (3)
Survey of the content and method of information science with emphasis on the application of research findings to general library practice.

5720 Information Systems Analysis and Design (3) Elements involved in the design and operation of information retrieval systems, including acquisition, indexing, vocabularies, information representation, file organization, search procedures, and system evaluation.

5730 Information Retrieval Systems Laboratory (3) Comparative capabilities of various types of information retrieval systems; analyzing the performance of systems to arrive at generalizations with respect to the theory, design and operation of IR systems.

5999 Practicum (6 or 9 or 12) An opportunity to translate library theory into practice under the guidance of qualified librarians. Prereq: Completion of the 21-hr core curriculum plus approval of the director.
The Graduate School of Planning offers a two-year graduate course leading to a degree of Master of Science in Planning. The purpose of study is the education of professional planners, competent to handle positions of increasing technical and administrative responsibility. Graduates are candidates for professional service in regional, city, county, and metropolitan area planning agencies, in local, state, and federal agencies concerned with physical, economic and administrative planning, in private businesses and organizations dealing with urban problems, and in private consulting practices.

The curriculum is organized on a basis of six quarters, or 72 credit hours, and provides the student with core courses in planning theory, methods, and techniques, and also takes advantage of offerings at The University of Tennessee in related fields such as government, economics, geography, sociology, and civil engineering, and economics. Students in the latter quarters of the first year, and in the second year, are permitted to pursue particular interests through the choice of electives approved by the Graduate School of Planning. Practice in research and analysis on a particular planning problem or topic is obtained through the preparation of a thesis or major study option.

Core planning courses are taught by the faculty of the Graduate School of Planning. Related courses are taught by other specialists drawn from the University faculty. In addition, the services of experienced professional planners in TVA and other public and private organizations are called upon to broaden the scope of the students' understanding. A variety of outside speakers and seminar leaders provide insight into particular problems of significance to planners.

ADMISSION PROCEDURES

All applicants should submit two letters of recommendation with their applications. Both letters should be from teachers familiar with the applicant's undergraduate or, where applicable, graduate academic record. In the event the applicant has had planning experience, a third letter is required from a supervisor or other person familiar with the planning work of the applicant. All applicants who wish to be considered for financial assistance from the University or the Graduate School of Planning should also submit recent Graduate Record Examination scores for the Aptitude (verbal and quantitative) portion of that test. Applicants are also requested to submit a statement of career goals in support of their application.

Applications will be acknowledged upon receipt. The applications will then be held by and reviewed in the Graduate School of Planning. The applicant should not anticipate an immediate response in regard to admissibility. Applications will be held until mid-April. Recommendations will then be made to the Graduate Office regarding the applicant's admission status. The Graduate School will then notify the applicants whether they have been admitted to the University and under what conditions the admission has been made.

All inquiries concerning admission should be addressed to: Director, Graduate School of Planning. The University of Tennessee, Knoxville, Tennessee 37916.

DEGREE REQUIREMENTS

Each student will be required to complete a minimum of 72 hours credit including at least 36 hours at the 5000 level or above.

Each student will be required to demonstrate competence in individual research. This may take either of two forms.

Plan I—Complete a thesis for 9 hours credit.

Plan II—Complete a major study with acceptable documentation. In order to be eligible for the major study the student must have earned a grade of B+ or higher in Research Methods II, have a 3.5 cumulative grade point at the time of approval of the major study proposal, and have completed at least 24 hours of graduate study. The student meeting these criteria may present a proposal for a
major study which will include at least 9 hours of elective course work in an area of concentration. The proposal shall justify the area of study, the approach to the study, and the method of final documentation. Approval of the documentation, which must include written documentation, is a prerequisite for graduation.

Students in the Graduate School of Planning will be given a comprehensive written examination after approximately four quarters of course work. In addition to testing the knowledge of the student, the information thus obtained will be taken into account in advising students concerning the study program they should undertake during the balance of their academic program to remove any indicated deficiencies.

Each student will be encouraged, but not required, to complete a work internship equivalent to at least two and one-half months of full-time work in a planning agency at approximately the mid-point in course work.

Faculty

Professors:

Associate Professors:
J. A. Spencer, M.C.P. Ohio State; R. L. Wilson, M.P.R. North Carolina.
Assistant Professors:

Courses

4100 Introduction to Planning (3) History of planning, familiarization with the operations of contemporary planning, the concept of systems, current trends and issues. Emphasis on the relationship between planning and the society in which it occurs.

4200 Planning Communications (1) Graphic, oral and written communication of information and recommendations.

5000 Thesis

5002 Non-Thesis Graduation Completion (3-15) Required for the non-thesis student. Not otherwise registered during any quarter when such a 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.

5100 Theory of Planning (4) Analysis of the means and objectives of the planning process. Emphasis on the role of the planner and the planning function in public decision making. Prereq: 4100.

5130 Planning Research Methods I (3) Research techniques in subject areas associated with city and regional planning. Research tools, data collection, analysis and projection as a basis for planning and decision making. Coreq: 4100 or consent of instructor. (Same as Water Resources Development 5130.)

5135 Planning Research Methods II (3) Application of rigorous investigation techniques in solving planning problems, including the use of statistical analysis and mathematical models. Urban and regional information systems as a resource and tool in problem identification and solution. Prereq: 5130.

5160 Planning and Utilities (3) (Same as Environmental Engineering 5180.)

5230 Urban and Site Design (2) Principles of design of small areas such as residential subdivisions, shopping centers, institutional complexes, central business districts. Brief examination of the problems of reviewing alternative designs against each other or written regulations. Extensive laboratory experience. Fees. Prereq: 5270.

5270 Planning and Transportation (3) (Same as Civil Engineering 5270.)

5280 Planning Methods (5) Tooling up studies; methods for preparation of land use and public facility elements of comprehensive development plans, including visual aspects. Prereq: 5130.

5300 Regional Planning (3) Making the planning process operative in an intergovernmental context. Theories of development and analysis of metro planning, area planning, regional planning by states, single-purpose agency planning, and the TVA. Prereq: 5100.

5310 State Planning (3) Evolution of the planning function in state government, with emphasis on the institutional environment in which planning occurs. Context and scope of state planning, and the relationships with other branches and levels of government. Prereq: 5100.


5350 Urban Spatial Structure (3) An examination of past, present, and possible future patterns of urban spatial structure as determined by changing technology, interaction patterns, and socioeconomic environment, drawing on contemporary theories, models, empirical research. Prereq: Consent of instructor.

5360 New Towns (2) Historical development of planned new towns and implications for a national urbanization policy in the United States; the process by which new towns are being created, from the establishment of objectives to administration of the development process and the provision of public services; organizational alternatives for new town planning, development and management in the context of past experience and future objectives. Prereq: 4100, and consent of instructor.

5380 Housing (2) The nature and the demand for housing in the U.S. and abroad with emphasis on the U.S. experience. The private market processes and public influences. The problems of change in the housing supply, impact of new technology, and governmental programs designed to improve the supply and quality of housing are emphasized. Coreq: 4100 or consent of instructor.

5410-20-30 Special Topics in Planning (1-3, 1-3, 1-3) Lecture, group discussion, and individual research and study on specialized topics in planning not covered in depth in other courses. These courses may be repeated for credit. Prereq: Consent of instructor.


5450 Urban Renewal (2) The use of urban renewal as a device for rebuilding the central city. Programming in relation to the general plan and budget. Familiarization with techniques and procedures insofar as is necessary to gain insight into major problem areas. Prereq: 4100.

5500 Synthesis (9) Problem-oriented experience designed to integrate knowledge from previous courses. Interrelationships will be stressed and the student will be required to use judgment in evaluation and creation of plans and policies addressed to real world situations. Extensive laboratory experience. Fees. Prereq: 5340.

5670 Social Planning (3) Theory, philosophy, and implications of programs for planned social change. Consideration of major social planning issues in diverse fields of service (aging, corrections, education, health, manpower, mental health, social services, etc.). Prereq: Consent of instructor. (Same as Social Work 5670.)
Graduate School of Social Work

Ben P. Granger, Dean
Betty J. Cleckley, Assistant Dean
Ronald K. Green, Director, Continuing
Social Work Education
David P. Fauri, Branch Director,
Nashville
Roger M. Nooe, Branch Director,
Knoxville
Kate Mullins, Branch Director,
Memphis

MAJOR
Social Work

The University of Tennessee School
of Social Work is a fully accredited
two-year graduate professional school,
with a program (thesis or non-thesis
option) leading to the degree of
Master of Science in Social Work.
The full two-year curriculum is offered
in all three branch locations.

GRADUATE PROFESSIONAL EDUCATION

The goal of graduate professional social
work education is the education and
training of personnel for leadership roles
in the social welfare community and in
the social work profession. Leadership
roles include those in social welfare
management and administration, social
planning, social policy development, and
research. Social treatment leadership
roles include treatment team leaders,
consultants, supervisors, and expert
practitioners.

In order to help reduce and eliminate
such basic social problems as poverty,
 racsim, crime, social injustice, and ill
health, both educational and social
welfare service organizations must focus
on preventive as well as restorative
objectives and functions.

The School of Social Work's curriculum
provides a core program and two areas of
specialization: social work treatment, and
social welfare administration and
planning. The two-year or six-quarter
program courses are designed to provide
the student with the basic components of
professional competence through a
progression of course work and supervised
practice experience.

At the core of professional practice is
the individual's capacity for self-awareness
and self-discipline and a commitment to
the values and goals of the profession.
The student must be able to think
independently and analytically in order
to use the skills and knowledge for
purposeful and effective intervention at
all societal levels.

THE PROFESSIONAL CURRICULUM

The curriculum offered during the first
two quarters of the first year, the Core
Curriculum, is required for all students.
This Core Curriculum is designed to
provide students with knowledge and
skills that are common to social work
practice at the treatment and at
the administration and planning levels
of intervention. The Core Curriculum also
provides students in social work treatment
with knowledge and skill about administra-
tion and planning and vice versa. The Core
Curriculum is composed of the following
units: (1) human behavior and social
environment, (2) social welfare policy
and services, (3) research, (4) social
work practice, (5) field instruction.

Human behavior and social environment
courses focus on community structure
and process, systems theory, culture and
ethnicity, role theory, small group theory,
personality theory, the family, and social
deviance. The social welfare policy and
services courses focus on the social
work profession's interest in the analysis
and formulation of contemporary social
policy, and the analysis of organizations
that implement policy and deliver
services. The research courses focus on
methodology as applied to problems in
social welfare. Social work practice
courses, which may include a skills
laboratory, focus on interviewing,
formulating objectives, observing and
reporting behavior, managing group
discussion, and other practice skills.

Field instruction is a practicum that
provides students with experience in a
social welfare agency or program.

At the beginning of the third quarter of
the first year, the student selects a
specialization—social work treatment or
social welfare administration and planning.
Students are required to take 12 credit-
hours in their specialization. Students may
take electives in the other specialization.
The first-year curriculum is on a concurrent
class and field plan, with students
participating in the classroom study
program two or three days per week and
spending two days in field instruction in
a social welfare agency.

In the second year, students are
involved full-time in classroom courses
during the fall quarter, and in a block field
placement in the winter and spring
quarters with at least one concurrent
classroom course per quarter.

The availability of second-year field
placements in social agencies in principal
cities in Tennessee and in areas im-
mmediately adjacent to the state enables
the student to have some choice as to
field instruction assignments.

The School of Social Work recognizes
and accepts the cultural pluralism of
society and seeks to prepare the student
for practice through the planned inclusion
of significant and pertinent racial and
ethnic content throughout the curriculum.
Such knowledge and its application should
provide the student with the educational
background to take a creative and
objective role in the efforts of the social
work profession toward the elimination
of racism, poverty, and other social ills.

A special bulletin describing the facili-
ties, admission, fees, and degree require-
ments is obtainable from The School of
Social Work, 2014 Lake Ave., Knoxville,
Tennessee 37916.
ACCELERATED PROGRAM

The University of Tennessee School of Social Work has a special accelerated program which enables eligible candidates to complete the M.S.S.W. degree in twelve consecutive months. This Accelerated Program is approved by the Council on Social Work Education.

Students who qualify for the Accelerated Program must:
1. Have maintained a 3.0 or above grade point average (on a 4.0 scale) in undergraduate work.
2. Have an undergraduate major in social work which included a supervised field practice component, or have two years full-time practice in the field of social work.
3. Pass a qualifying examination administered by the School of Social Work faculty.
4. Enroll during the last two years of undergraduate work.
5. Meet the University's admission requirements for the graduate program.

The twelve-month program begins in June in the Nashville Branch only with an intensive ten-week term from which students proceed in the fall into the regular second-year curriculum. Application for admission to the Accelerated Program is through the regular admissions process. Applications should be filed no later than January 31 for the year in which admission is desired.

ADMISSION REQUIREMENTS

Admission to the professional curriculum is based on the following requirements:
1. A Bachelor's degree from an accredited college or university with some preparation in the social sciences. At least three-fourths of the applicant's undergraduate work should be in the social sciences, humanities, physical sciences, and other liberal arts subjects. Those with other academic backgrounds may request consultation regarding ways in which they might be admitted.
2. A grade point average of 2.5 on a 4.0 scale, with those falling below the average to be admitted on a satisfactory basis. This requirement is based on the following requirements:
   1. A Bachelor's degree from an accredited college or university with some preparation in the social sciences.
   2. A grade point average of 2.5 on a 4.0 scale, with those falling below the average to be admitted on a satisfactory basis.
   3. Personal qualifications acceptable for entrance into the professional practice of social work.

Preference is given to applicants with a B average in undergraduate work and substantial preparation in the social sciences. Applications should be filed no later than March 1 for the year in which admission is desired.

DEGREE REQUIREMENTS

1. Satisfactory completion of the curriculum.
2. All courses taken as part of the degree programs, whether taken within the School of Social Work or outside, must be acceptable for graduate credit, relevant to social work and to the student's career objectives, and have the approval of the student's faculty advisor.
3. Achievement of a B average on all work presented for the Master's degree.
4. Students who elect a thesis must pass an oral examination conducted by a faculty committee.
5. Students who elect a non-thesis option must pass a written comprehensive examination.
6. Credits to be counted toward the degree must be earned within six years from the beginning date of the earliest course applied toward the degree, except in cases where permission to update courses has been granted.
7. The minimum number of credit hours required for a degree shall be 72 hours including a maximum of 36 S/NC hours.

PART-TIME STUDENTS

Courses in the regular curriculum of the School are open to persons who meet the admission requirements for full-time study and who are planning to complete the work for the degree within the next two or three years. Application should be made to the School in the regular way, but the applicant should inform the Director of Admissions of the wish to begin part-time study on a planned basis.

TRANSFER CREDITS

Courses completed in another accredited school of social work and usually accepted for The University of Tennessee School of Social Work degree requirement providing the applicants meet the admission requirements of the Graduate School and The University of Tennessee School of Social Work, and if previous courses are equivalent to required or elective courses offered here. The University of Tennessee School of Social Work allows a maximum of 45 credit hours of graduate course work taken at another accredited institution to be transferred into the student's program. Such work must have been taken for graduate resident credit and passed with a B or better. In addition, it must be part of an otherwise satisfactory graduate program (B average) and be approved by the branch director and the dean. This course work must be completed within the six-year period prior to the receipt of the degree. In addition, S/NC credit earned for field practicum is also accepted.

Graduate students majoring in fields other than social work are admitted to certain social work courses with the approval of the School of Social Work and the student's major professor.

The Core Curriculum

The core curriculum is essentially the same for all students.

Credit Hours

Fall Quarter, First Year
5070 Social Work Research I 3
5110 Social Welfare Policy and Services I 3
5210 Human Behavior and Social Environment I 3
5410 Social Work Practice I 3
5910 Field Practice 3
TOTAL QUARTER HOURS 15

Winter Quarter, First Year
5080 Social Work Research II 2
5120 Social Welfare Policy and Services II 3
5220 Human Behavior and Social Environment II 3
5420 Social Work Practice II 3
5920 Field Practice 4
TOTAL QUARTER HOURS 15

The Specialization

The curriculum outlined below for the spring quarter, first year, and for the second year shows typical programs for students after they have completed the Core Curriculum. A student may earn 9 hours of elective credit through completion of a Master's thesis.

Spring Quarter, First Year
5930 Field Practice 4
Specialization Courses and Electives 10
TOTAL QUARTER HOURS 14

Fall Quarter, Second Year
5940 Field Practice 8
Specialization Courses or Electives 2 or 3
TOTAL QUARTER HOURS 10 or 11

Winter Quarter, Second Year
5950 Field Practice 8
5961 Integrative Seminar 2
One Elective 2 or 3
TOTAL QUARTER HOURS 12 or 13

AREAS OF SPECIALIZATION

A specialization is a focus within the student's program involving intensive study, through class and field instruction. The University of Tennessee School of Social Work offers specializations in the following areas:

Social Work Treatment

Social work treatment deals with those individuals, family, and group methods utilized to enhance the social functioning of individuals and effectively ameliorate problems of social dysfunction. The specialization attempts to develop a thorough knowledge of the theory and methodology basic to social work, and the methods applicable in the treatment of diverse client problems.

Social Welfare Administration and Planning

Social welfare administration and planning deals with the design, implementation, and continued operation of effective programs for client service. Specifically, the methods deal with assessment of client characteristics, development of environmental resources, design of effective organizational structures, management, staff development, program evaluation, social planning, neighborhood and community development, financing, and coordination of services.

Preparation for Fields of Practice

Within the curricular specializations described above, the School offers opportunities for preparation for careers in fields of social work practice such as the following: corrections, including work with children and adults in courts, correctional institutions, and in probation and parole; family and child welfare services in public and voluntary agencies; group services in neighborhood and community centers; health services, including work with individuals and groups.
in programs of health and medical care in public health departments, hospitals, and clinical mental health services. All students in groups in mental health programs including
comprehensive mental health clinics, traditionally-oriented psychiatric clinics, and hospitals; rehabilitation services in a variety of settings to individuals with medical, psychiatric, and social disabilities; school social work and children and their families concerning school-related problems; social gerontology, individual and group services to the aging in a variety of settings.

Faculty
Professors:

Associate Professors:

Courses
5000 Thesis
5002 Non-Thesis Graduation Completion (3-15)
Required for the non-thesis student not otherwise registered during any quarter when such a 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.

5070 Social Work Research I (3) Examination of research methodology as applied to problems in social welfare. Consideration is given to problem formulation; development of research design; instrument construction; data collection, analysis, and presentation; and report writing.

5080 Social Work Research II (2) A continuation of Social Work Research I.

5081 Evaluative Research in Social Work (2-3) An advanced research course. Topics will include the scientific organizational context of evaluative research, research design and methodology appropriate to evaluative research, and the utilization of research findings. Prereq: Completion of core or consent of instructor.

5082 Practicum in Social Work Research (3-9) Supervision of students in the application of research methods and tools to a social welfare problem. Program may be generated by faculty, students, agencies, or organization. Prereq: Completion of core or consent of instructor. S/NC only.

5083 Directed Readings in Research (2-4) May be repeated with approval of instructor. Maximum 4 hrs.

5090 Special Problems in Social Work (2-9) Individual study or research on problems of special significance to students of contemporary problems. Prereq: Core completion under supervision of the major professor. May be repeated.

5110 Social Welfare Policy and Services I (3) The focus is on the interests of the social work profession in the formulation of contemporary social policy at the local, state, national, and international levels of organization. Examination of the contribution of social work professionals to the formal policy-making process through which macro-social change is effected and through which aggregate social welfare services are proposed, authorized, financed, and programmed. Policy lab may be used to focus on beginning skill development.

5120 Social Welfare Policy and Services II (3) An examination of theories of complex organizations as applied to social welfare services over time and settings. The transformation of collective social welfare resources into visible and invisible social welfare benefits through organized instrumental action of a professional nature.

5130 Social Policy Analysis (2-3) "Policy science" techniques are considered for their appropriateness in assessing the social, political, and economic implications of social policy proposals. Prereq: Completion of core or consent of instructor.

5161 Social Welfare Seminar (2-3) A problem area or a field of practice seminar focusing on substantive knowledge about a social problem or condition and the interrelationships among problem definition, social policy, social welfare program, and social work practice. Fields such as health, mental health, child and family welfare, mental retardation, education, corrections, housing, labor force development, income maintenance, and aging may be examined. Maximum 4 hrs. Prereq: Completion of core or consent of instructor.

5210-20 Human Behavior and Social Environment I and II (3, 3) Examination of theories pertaining to the individual, family, and small group within the context of their functions, structures, roles and processes. Behavior of these systems are conceptualized along a functional-dysfunctional and normal-deviant continuum. Organizing themes are stress, development and maturation, adaptive and defensive mechanisms. An open system approach is used to understand the interrelationships of biological, psychological, and social variables with emphasis on the implications of culture and ethnicity.

5290 Special Accelerated Program in Social Work (3, 6, 9, 12) Designed to provide qualified students with an intensive academic and field practice experience that qualifies them to enter the second year of graduate study upon successful completion of this term. S/NC only.

5310 Human Behavior and Social Environment (2-3) The program emphasizes the development of students' knowledge of the range of adaptive behavior; continuum of behavior from optimum social functioning through pathology. Prereq: Second-year status. Prereq: Completion of core or consent of instructor.

5311 Imaginative Perspectives on the Human Condition (2-3) Examination of the usefulness to social work students of prose, drama, and poetry, which may illuminate and expand the knowledge and appreciation of every person's humaneness. Adaptive and maladaptive responses to crisis situations, human behavior, and events, as portrayed by creative writers, are considered. The artistic representation of the interplay of creativity and spirit through the interaction of persons with one another and with society are analyzed. Prereq: Completion of core or consent of instructor.

5312 Psychopathology and Social Deviance (2-3) Prereq: Completion of core or consent of instructor. Taught at branches only. Available at UTK as Psychology 5411. S/NC only.

5315 Human Sexual Problems (2-3) Desensitization and desensitization of personal and social attitudes toward sexual behavior; clinical problems and approaches for making clients better able to deal with clients with sexual problems. Prereq: Completion of core or consent of instructor.

5316 Mental Health and Employment (2-3) Provides work as a major life task and value, attitudes toward work, patterns of employment, effect of changing technologies on individual and community, interdependence of individual and organization, meaning of work in assessing mental health. Prereq: Completion of core or consent of instructor.

5410 Social Work Practice I (3) Basic theory, values and beginning skills development generic to social work intervention at various system levels. Combines classroom skills and laboratory experience.

5420 Social Work Practice II (3) Assessment, planning, methodology and skills development to enable students to develop social work skills and behavior. Prereq: Completion of core or consent of instructor.

5440 Family Therapy in Social Work Practice (3) Application of practice theory designed to assist in the acquisition of skills in the treatment of the family as a unit. Prereq: Completion of core or consent of instructor.

5441 Transactional Analysis (2-3) The philosophical, theoretical and therapeutic technique of transactional analysis. Learning, discussion, and experiential methods facilitate acquisition of the knowledge and skills to use transactional analysis as a treatment modality. Prereq: Completion of core or consent of instructor.

5442 Short-term Treatment (2-3) Prereq: Completion of core or consent of instructor. Taught at branches only. Available at UTK as Psychology 5411. S/NC only.

5443 Seminar on Behavioral Theory (2-3) Prereq: Completion of core or consent of instructor. Taught at branches only. Available at UTK as Psychology 5412. S/NC only.
assess treatment interventions, skill in evaluating data on effectiveness of treatment interventions, and awareness of ethical considerations. Prereq: Completion of core or consent of instructor.

5444 Social Work Practice with the Poor (2-3) Focuses on the use of group processes, interpersonal skills, and dilemmas of practice in social services with the poor and considers the development of social workers as leaders. Prereq: Completion of core or consent of instructor.

5460 Social Work Treatment with Individuals and Families (5) Draws primarily on social work theories to examine detailed social casework as a method of social work practice and as a form of interpersonal treatment. Prereq: Completion of core or consent of instructor.

5470 Contemporary Treatment Modalities: Individual and Family (2-3) Well-established and developing treatment modalities are examined in terms of their essential concepts. Emphasis on differential facets and theory-based linkages. Prereq: Completion of core or consent of instructor.

5560 Social Work Treatment with Groups (3) Focuses on the development of knowledge and skill in the use of group methods in social work practice with emphasis on organizing and forming the group, structuring group tasks and experiences, understanding and intervening in the problems, issues, and dilemmas of group work, and the group's process. Prereq: Completion of core or consent of instructor.

5561 Interpersonal Skill Development (2-3) A training group is employed to enhance interpersonal competence in the application of human relations skills in social work practice. Prereq: Completion of core or consent of instructor.

5570 Comparative Methods of Group Treatment (2-3) Comparative analysis and critical review of the theory and methodology of some of the major group treatment modalities with emphasis on theory-based, leadership, techni- 
cues and procedures, and research. Prereq: Completion of core or consent of instructor.

5560 Social Work Treatment with Individuals and Families (5) Focuses on the use of group processes, interpersonal skills, and dilemmas of practice in social services with the poor and considers the development of social workers as leaders. Prereq: Completion of core or consent of instructor.

5610 Social Work in Rural Communities (2-3) Focuses on characteristics of rural populations and the delivery of social services. Prereq: Completion of core or consent of instructor.

5661 Community Organization (2-3) Methods of applying social welfare organization knowledge about communities and organizations to assist in the development of resources to meet human needs. Prereq: Completion of core or consent of instructor.

5670 Social Planning (3) (Same as Planning 5670.)

5671 Planning and Management of Change in Social Welfare (2-3) Theories and models of change, such as planned change, conflict, and evolutionary change, are applied to the problems of change and to the evaluation of the effectiveness of such change processes. Prereq: Completion of core or consent of instructor.

5701 Administration in Social Work (2-3) An introduction to the practice of social work administration and its historical development. Prereq: Completion of core or consent of instructor.

5702 Organizational Design of Social Welfare Agencies (2-3) Critical problems of adapting organizational structure and operational patterns to new tasks, objectives, and mandates. Planning and design techniques for new programs and for modification and expansion of existing programs are presented. Prereq: Completion of core or consent of instructor.

5741 Supervision in Social Work (2-3) Dual roles of the supervisor in various settings, and supervision distinguished from consultation and from direct practice. Responsibility and accountability to client, system, and supervisory level are considered, together with problems of the middle management position of the supervisor. Differences and similarities in supervision of varying levels of personnel will be identified and analyzed. Goals, tasks, techniques, and processes in relation to individual and group supervision and field instruction. Prereq: Second-year status or consent of instructor.

5742 Consultation in Social Work (2-3) Consultation of roles, relationships, and behaviors required for consultation and consultation as distinguished from supervision, administration, and direct practice. Types of consultation consultation, understandingings and levels of responsibility. Processes and prac- 
tices of consultation and the dilemmas and pitfalls of the consultation role. Prereq: Completion of core or consent of instructor.

5743 Management of Human Resources in Social Welfare (2-3) Examination of the personnel function in administration of human services programs. Topics include personnel recruitment, selection, appointment, and supervision; staff development, training, and performance evaluation; wage and benefit systems; employer-employee relations; and fair employment practices. Prereq: Completion of core or consent of instructor.

5744 Education and Training in Social Welfare (2-3) Examines philosophies and practices of teaching and learning as they relate to adults in social work and social welfare. Topics include: distinctions between teaching and learning; training and education; unique aspects of adult learning; measurement issues; models and approaches to adult education. Prereq: Completion of core or consent of instructor.

5745 Professional Leadership in Social Work (2-3) Examination of leadership in social wel- fare. Topics include: the meaning of leadership; the complexity of leadership; function, effectiveness, and satisfactions of leaders; leadership styles, values, motivations, and morale; and leadership development and training. Prereq: Completion of core or consent of instructor.

5761 Social Welfare Administration and Planning (3) An initial sequence course in social welfare administration and planning which examines topics significant to managerial-planner role such as decision making, budgeting, planning, and programming. Prereq: Completion of core or consent of instructor.

5762 Seminar in Social Welfare Administra- 
tion and Planning (2-3) The seminar is designed to assist students in acquiring specific administrative and planning techniques appropriate for social welfare delivery and administrative decision making. Prereq: Completion of core or consent of instructor.

5771 Information Systems and Decision Making (2-3) Studies the information systems used by social workers in the development of social welfare systems. Technical aids to budgetary control, evaluation and forecasting. Prereq: Completion of core or consent of instructor.

5772 Financial Management for Social Wel- fare (2-3) Focuses on central- ized and decentralized decision making in the distribution of scarce resources in social services or- ganizations. Technical aids to budgetary control of the organization for management. Prereq: Completion of core or consent of instructor.

5910 Field Practice (3, 4) Instruction and supervised practice in methods of social work with individuals, groups, and communities. Prereq: Admission to the school; 5410 concurrently or prior to 5910; 5420 concurrently or prior to 5920; 5910 is a prerequisite for 5920. Required course. S/NC only.

5930-50 Field Practice (4, 8, 8) Specialized instruction and supervised practice in methods of social work treatment, administration, and planning in community health and welfare pro- grams and agencies. Prereq: Admission to the school. To be taken in sequence. S/NC only.

5961 Integrative Seminar (2) Required seminar facilitates integration of the two-year M.S.W. program in terms of current issues in the profession and to pressing social problems. Prereq: Participation in symposia, dis- cussions, simulations, and gaming situations.

5728 Social Work Practice with the Poor (2-3) Focuses on the use of group processes, interpersonal skills, and dilemmas of practice in social services with the poor and considers the development of social workers as leaders. Prereq: Completion of core or consent of instructor.
prepares the graduating student to assume positions of responsibility and leadership within the profession. The graduating student is helped to plan toward continuing his/her education and professional development. S/NC only.

5970 Outcomes in Social Work Practice (2-3) Application of substantive knowledge to comprehensive problem-solving within existing service and community systems. Critical appraisal of functional relationships between problem, policy, planning, practice, and outcomes. Examination of problems from practice to determine key elements of optimal services and implications for policy decisions. S/NC only.

5980 Practicum in Governmental Social Welfare Policy Making (2-3) Practical introduction to the process of legislative and/or administrative policy making at the state or local governmental level, through assignment of students to the offices of elected or appointed proximate policy makers. Limited social welfare policy research activities. Seminar used to present normative and descriptive theory about the policy-making process, and models of policy analysis. May be repeated. Prereq: Social Work 5110 and consent of instructor.